КНИГА-ПОБЕДИТЕЛЬ

конкурса рукописей учебников

по направлениям

подготовки в МЭИ

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ

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Основной целью учебного издания является формирование компетенций, необходимых для профессионального общения. В процессе обучения развиваются навыки изучающего чтения научных текстов, письменного и устного переводов, отрабатываются характерные для технического перевода грамматические явления, словарный запас пополняется часто используемыми общенаучными словами и терминами, формируется монологическая и диалогическая речь на темы, связанные с разными направлениями подготовки в техническом вузе.

Для занятий в группах бакалавров, начинающих изучать основы перевода научно-технических текстов.

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ПРЕДИСЛОВИЕ

Учебник предназначен для студентов бакалавриата и магистратуры технических и инженерных ВУЗов, инженеров и научных работников, изучающих английский язык, а также для широкого круга читателей, интересующихся основами перевода технических текстов.

Цель учебника – развитие навыков коммуникативной деятельности и перевода технических текстов в будущей профессиональной сфере. В процессе обучения формируются основы понимания оригинальной научно-технической литературы средней трудности, построенной в основном на общетехнической лексике, навыки поиска профессионально значимой информации, а также устной речи на английском языке.

Основной акцент делается на углубленное изучение характерных для научного стиля изложения грамматических тем, таких как страдательный залог, неличные формы глагола, модальные глаголы и их эквиваленты, безличные и неопределенно-личные предложения и др.

Все тексты подобраны из оригинальных англоязычных источников без последующей адаптации. Тематика текстов носит общетехнический характер, однако, соответствует заявленной теме модуля и позволяет интегрировать языковую и профильную подготовку. Тематика модулей разнообразна, что помогает с лексической точки зрения охватить широкий круг областей техники и науки.

Учебник состоит из восьми модулей, каждый из которых объединяет 2–3 урока, подчиненных одной лексической теме, что даёт возможность четко структурировать информацию, систематизировать процесс обучения и сделать его логически завершенным. Все уроки составлены идентичным образом и включают в себя такие части, как грамматический раздел, лексический, работу с текстом, словообразование, трудности перевода лексических единиц, характерных для технических текстов, а также блок заданий, нацеленных на формирование навыков монологической и диалогической речи. Уроки открываются кратким представлением

грамматической темы в табличном формате, способствующем наглядности излагаемого материала. Первые упражнения посвящены отработке изучаемого грамматического явления. Они носят разноплановый характер и строятся на общенаучной лексике. Грамматические упражнения также помогают развивать навыки двустороннего перевода.

Каждый урок снабжен активным словарем, построенным главным образом на лексике текста урока, с переводом и транскрипцией наиболее сложных случаев произношения и примерами использования слова в контексте. В первых уроках даются упражнения на перевод интернациональных слов, характерных для технических текстов. В дальнейшем лексика отрабатывается на послетекстовых упражнениях, что способствует её наилучшему закреплению. В специально выделенном разделе на трудности перевода предлагаются упражнения на многозначность и многофункциональность слов и словосочетаний. В каждом уроке присутствует тема словообразование, в которой рассматриваются различные способы формирования слов, включая аффиксацию, конверсию, сокращения и другое.

Второй основной составной частью урока, после изучения грамматического правила, является работа с текстом с целью развития у обучающихся навыков понимания и перевода технической и научной литературы. Все тексты сопровождаются вопросами и другими послетекстовыми упражнениями, помогающими провести анализ прочитанного.

Для развития устной речи в каждом уроке предусмотрен ряд заданий, направленных на составление докладов и презентаций, позволяющих развивать творческие способности обучающихся и реализовать индивидуальный подход в образовательном процессе. В этом же блоке есть упражнения на чтение и написание деловых писем, чтение, перевод и воспроизведение диалогов, что способствует формированию у обучаемого готовность к участию в обсуждении профессиональных вопросов на английском языке.

Общий объем материала упражнений рассчитан на работу с одним уроком, включая домашние задания, от двух до четырех

часов в аудитории. В целом данный учебник может быть использован в течение 2–3 семестров обучения при двух аудиторных часах в неделю.

Основной раздел учебника сопровождается приложениями, в которые вынесены лексико-грамматические тесты с тренировочными и обзорными упражнениями к каждому модулю и ключи к ним. Тесты дают возможность провести самопроверку и подготовиться к сдаче промежуточных контрольных мероприятий. Грамматический справочник содержит подробное изложение грамматических тем всех уроков, а также вопросы для проверки понимания темы. Вниманию обучающихся предлагаются рекомендации по составлению презентаций на заданную тему и ведению деловой переписки. Последнее приложение содержит таблицу наиболее часто встречающихся в технических текстах сокращений.

Данное учебное издание является результатом долгой методической работы сотрудников кафедры иностранных языков НИУ «МЭИ», а также их личного педагогического опыта в обучении студентов навыкам технического перевода. Авторы надеются, что учебник будет полезен не только во время практических занятий, но и в процессе самостоятельного изучения основ перевода научно-технических текстов.

МЕТОДИЧЕСКИЕ РЕКОМЕНДАЦИИ

В основу учебника положен модульный подход к подаче информации. Каждый модуль посвящен одной, достаточно крупной, области знаний, и все тексты уроков сопряжены с данной областью.

Урок открывается грамматическим разделом, для более детальной проработки которого рекомендуется, в качестве самостоятельной подготовки, предварительно изучить материал данной темы, вынесенный в приложение. Все грамматические упражнения выполняются на уроке, упражнение на перевод на иностранный язык выполняется как домашнее задание для проверки понимания пройденной темы. Грамматический раздел обращает внимание обучающихся на наиболее часто встречающиеся трудности технического перевода.

Для снятия лексических трудностей, перед прочтением текста рекомендуется проработать лексику, вынесенную в словарь, а также примеры её использования. При работе с лексическим материалом используется методика соотнесения лексической единицы и её толкования на иностранном языке. При прочтении текстов на последних уроках следует работать с просмотровым чтением и постепенно добиваться беспереводного понимания содержания, для чего после каждого текста представлены упражнения с вопросами, а также задания на поиск конкретной информации. На начальных этапах тексты читаются вслух с целью развития техники чтения и контроля ритмико-интонационных навыков. Проработка лексических особенностей текста продолжается в после текстовых упражнениях, ряд из которых может быть выполнен в качестве домашнего задания.

Многочисленные диалоги направлены на развитие продуктивной устной речи в профессиональной сфере, приводятся часто используемые клише, предлагаются задания на воспроизводство собственных диалогов. В последнем разделе урока есть задания на поиск информации на профессиональные темы в сторонних источниках, что будет наилучшим образом формировать монологическую речь.

АВТОРЫ

Module 1. Power Engineering

Unit 1

Grammar. Tense System. Active Voice
Text. Basic Concepts of Electricity
Word building. Conversion. Verb Suffixes

GRAMMAR

Tense System. Active Voice.

	Simple	Continuous	Perfect	Perfect Continuous
Present	V (V_s)	am / is / are + V_{ing}	have/has + V_{ed}	have/has + been + V_{ing}
	I work.	*I am working.*	*I have worked.*	*I have been working.*
Past	V_{ed}	was / were + V_{ing}	had + V_{ed}	had + been + V_{ing}
	I worked.	*I was working.*	*I had worked.*	*I had been working.*
Future	will + V	will + be + V_{ing}	will + have + V_{ed}	will + have + been + V_{ing}
	I'll work.	*I'll be working.*	*I'll have worked.*	*I'll have been working.*
Future-in-the Past	should/would + V *My friend said that the professor would deliver the lecture next Monday.*			

See Grammar Module

Ex. 1 Translate the following sentences.

1. We have already come to certain conclusions on the subject. 2. Mendeleyev was sure that new elements would be discovered and find their proper place in his table. 3. The English teacher said that the only suitable course for such a student would be a corrective course. 4. He did not in fact believe that such a model was possible. 5. Have you found a quiet place where you will study? 6. You will have completed your preparation for the exam by the end of the term. 7. The teacher asked the student whether he would be able to translate the text. 8. The more you try to make yourself concentrate, the more difficult you find it. 9. She said that she would have studied English before graduating from the university. 10. Even though he has prepared for the discussion, he doesn't want to take part in it. 11. At the beginning of your study ask yourself: What do I want to achieve? 12. Did the test really find out whether the students had understood the main idea of the text? 13. We did not believe that she had been working long enough to take the qualification test. 14. They have been talking only about their future speciality. 15. I knew that he would have been working all day long.

Ex. 2 Use the words in brackets and form new sentences making all necessary changes to the verbs.

Example: I finished school last year. (this year) – I have finished school this year.

1. The students have translated the text. (the whole evening yesterday)
2. I have English classes on Wednesday. (from 11.00 to 12.30 yesterday)
3. Mike said he was preparing his report. (the whole morning tomorrow)
4. We went to the library. (when we met him)
5. He has written the essay. (by last Friday)
6. Olga studies English. (since she was 5)
7. How many exams will you take? (by the end of the year)
8. When I came home, my brother was playing computer games. (tomorrow evening)

9. He asked if somebody helped me. (next time)
10. We worked on the problem and we realized that we wasted time. (for some years)

Ex. 3 Complete the sentences with the correct form of the verbs in brackets.

1. What (to be) the basic concepts of electricity? 2. We (to look) for the diagram the whole day and finally discovered it under the notebook. 3. The researchers hope that the new material (not to attract) dust. 4. People (to know) for centuries that certain black, heavy stones have the property of attracting iron. 5. Nowadays any company (to try) to find the most effective ways for the production of goods and services. 6. In fact, nobody (to associate) him with that experiment until he published his famous paper. 7. The student switched on the computer and (to demonstrate) the new program to his friends. 8. We already (to pass) two exams and we (to take) an exam in English in two weeks. 9. How they (to come) to such a conclusion? 10. We (to make) an experiment when somebody switched the light off. 11. I (to work) at my report all morning next Sunday. 12. We will have a test in two weeks. By that day, we (to study) two more units. 13. How many texts the students (to translate) by the end of the last term? 14. The experiment (to go on) still when the teacher asked us to stop it. 15. I (to enter) the university this year and my friend (to enter) it next year.

VOCABULARY

1. **Basic** *(adj.)* – основной

At school, we studied the **basic** laws of physics.

2. **Concept** *(n.)* – понятие

The student should know the basic **concept**s of modern physics.

3. **Electricity** *(n.)* – электричество

Many engineers have been working in the field of **electricity**.

4. **Mysteriously** *(adv.)* – таинственно; загадочным образом

The object had gone as m**ysteriously** as it had come.

5. **Experience** *(v.)* – знать по опыту

He has never **experienced** such an effect before.

6. **Repel** *(v.)* – отталкивать
The new technology will help **repel** water.
7. **Attract** *(v.)* – притягивать
Magnets can **attract** and repel each other.
8. **Property** *(n.)* – свойство
The engineers used this **property** of the material to build a new device.
9. **Distinct** *(adj.)* – отдельный, различный
This book explains many **distinct** types of the phenomenon.
10. **Phenomenon** (*n., pl.* **P**henomena) – явление, феномен
Some theories have been proposed to explain the **phenomenon**.
11. **Definitely** *(adv.)* – точно, определенно
It is **definitely** the right way.
12. **Fluid** *(n.)* – жидкость
Before the twentieth century, hydrodynamics was synonymous with **fluid** dynamics.
13. **Object** *(n.)* – объект
The temperature of the **object** was high.
14. **Certain** *(adj.)* – определенный; некоторый
I'm going to explain **certain** things to you and ask you some questions.
15. **Force** *(n.)* – сила
The push or pull that makes an object move is a **force.**
16. **Evident** *(adj.)* – очевидный; несомненный
It is **evident** that the problem of ecology has become the most important one for mankind.
17. **Charge** *(n.)* – заряд
Electric **charge** is a basic physical property.
18. **Researcher** *(n.)* – исследователь, учёный
Benjamin **F**ranklin was a famous **A**merican **researcher**.
19. **Transfer** *(n.)* – перенос, перемещение
They will use a new computer system for fast electronic data **transfer**.
20. **Come to** a **conclusion** – прийти к заключению, сделать вывод
You will certainly **come to** the proper **conclusion**.
21. **Exchange** *(v.)* – обменивать(ся)
Let's **exchange** our information.

22. **Excess** *(n.)* – избыток, излишнее количество
There is an **excess** of electrons at point A.
23. **Deficiency** [dɪ'fɪʃ(ə)nsɪ] *(n.)* – недостаток, дефицит
The excess electrons will flow towards the point of **deficiency.**
24. **Associate with** *(v.)* – ассоциировать, связывать с (кем-л. / чем-л.)
Many people **associate** computers with the world of science and mathematics.
25. **Negative** *(adj.)* – отрицательный
Negative charges repel each other.
26. **Positive** *(adj.)* – положительный
The proton is a part of an atom that has a **positive** charge.

READING

Basic Concepts of Electricity

They discovered centuries ago that certain types of materials mysteriously attracted one another when someone rubbed them together. For example, when we rub a piece of silk against a piece of glass, the silk and glass tend to stick together. Glass and silk aren't the only materials that behave like this. Anyone who has ever brushed up against a balloon has experienced this same phenomenon. This phenomenon became even more interesting when people discovered that identical materials rubbed with the respective cloths, always repelled each other. Scientists also noted that when a piece of glass rubbed with silk was exposed to a piece of wax rubbed with wool; the two materials attracted one another. Furthermore, they found that any material which demonstrated properties of attraction or repulsion they could class into one of two distinct categories: attracted to glass and repelled by wax, or repelled by glass and attracted to wax. It was either one or the other: there were no materials that attracted or repelled both glass and wax.

The same phenomenon held when they used pieces of wool to rub the wax. After all, none of these objects visibly changed by the rubbing, yet they behaved differently than before. Whatever change took place to make these materials attract or repel one another was invisible.

Some experimenters thought that invisible "fluids" were flowing from one object to another during the process of rubbing and that these "fluids" were able to effect a physical force over a distance. Charles Dufay [ˊʧa:lz duˊfe] (1698 –1739) was one of the early experimenters who demonstrated that there were two different types of changes effected by rubbing certain pairs of objects together. Indeed, the fact that there was more than one type of change manifested in these materials was evident by the fact that there were two types of forces produced: attraction and repulsion. The hypothetical fluid transfer became known as a charge.

An American researcher, Benjamin Franklin ['bendʒəmin 'fræŋklɪn] (1706 –1790), came to the conclusion that there was only one fluid which rubbed objects exchanged and that the two different "charges" were nothing more than either an excess or a deficiency of that one fluid. Following Franklin's ideas that the wool rubbed something off the wax, the type of charge that he associated with rubbed wax became known as "negative" (because he supposed that wax had a deficiency of fluid), while the type of charge that he associated with the rubbing wool became known as "positive" (because he supposed excess of fluid). He could not imagine that his ideas would cause much confusion for students of electricity in the future!

Notes to the Text

to brush up against – сталкиваться, столкнуться (с чем-либо)
respective – соответствующий
to be exposed (to) – подвергаться (чему-либо)
to hold – оставаться (в силе) *(зд.)*
visibly – явно, заметно
to effect a physical force – совершать физическое воздействие
to manifest – проявить(ся), проявлять(ся)

Ex. 4 Answer the questions.

1. How long have people known about the attractive properties of certain types of materials? 2. What materials can we use to show their

attractive properties? 3. What happens when we rub a piece of silk against a piece of glass? 4. Into what categories can we class materials which demonstrate properties of attraction or repulsion? 5. What phenomenon did Charles Dufay demonstrate? 6. What did they call the hypothetical fluid transfer? 7. Who came to the conclusion that it was only one fluid which the rubbed objects exchanged? 8. What century did B. Franklin live in? 9. What do we call the type of charge that B. Franklin associated with rubbed wax? 10. Why do B. Franklin's ideas cause much confusion for students of electricity?

Ex. 5 Translate the following sentences paying attention to the vocabulary of the unit.

1. The damage only became evident the following morning. 2. We need a few small metallic objects for our experiment. 3. They exchanged a few words before the meeting began. 4. This is a new method to obtain a good current transfer. 5. We just need some basic information. 6. Atoms with a deficiency of electrons are positively charged. 7. The electron has a negative charge and the proton has a positive charge. 8. Underground cables carry electricity to all parts of the city. 9. New electricity companies often experience some difficulties in their first few years. 10. One of the important properties of copper is that it conducts heat and electricity very well. 11. The force of gravity keeps all of the planets in orbit around the Sun. 12. This book is very useful for young researchers. 13. Did you come to any conclusions at the meeting yesterday? 14. We have certain reasons for our decision. 15. We know that magnets attract iron objects.

Ex. 6

a. Translate the following international words used in the unit.

Idea, experiment, atom, identical, electron, basic, category, to demonstrate, concept, device, engineer, magnet, material, positive, proton, modern, fact, hypothetical, student, object, temperature, process, type, negative, virus, phenomenon.

b. Match the words with their definitions.

1) electricity	a) a push or pull that acts upon an object
2) property	b) more of something than is usual or needed
3) fluid	c) the ways in which an object behaves in certain conditions
4) phenomenon	d) a liquid, gas, or other material that continually flows under certain conditions
5) excess	e) a set of physical phenomena associated with electric charges
6) force	f) a fact or event which can be observed

c. Combine the following words.

1)	a positive	a)	transfer
2)	a negative	b)	effect
3)	the only	c)	materials
4)	an interesting	d)	experimenter
5)	identical	e)	fact
6)	distinct	f)	change
7)	an invisible	g)	charge
8)	the early	h)	electricity
9)	fluid	i)	phenomenon
10)	students of	j)	categories

d. Match the words with the same meaning.

1)	for example	a)	embarrassment
2)	whatever	b)	one of the two
3)	deficiency	c)	for instance
4)	confusion	d)	lack or shortage
5)	in the future	e)	any
6)	indeed	f)	moreover
7)	after all	g)	in the end
8)	furthermore	h)	no more than
9)	nothing more than	i)	in fact
10)	either one or the other	j)	from this time forth

LANGUAGE STUDY

Word Building

I. Conversion. Явление, при котором новое слово образуется путем перехода основы в другую часть речи, при этом сохраняется и форма, и произношение, называется *конверсией*. Определить, к какой части речи относится слово можно по артиклю, частице *to*, по контексту и т.д. Например, *an answer* (ответ) – *to answer* (отвечать, ответить).

II. Verb Formation from Nouns or Adjectives.

суффикс	значение	пример
(существительное или прилагательное +) **–ize(–ise)/ –en**	становиться, происходить	*crystal – to crystal**ize*** *wide – to wid**en***

Ex. 7

a. Translate the pairs of nouns and verbs.

Charge – to charge; exchange – to exchange; force – to force; type – to type; effect – to effect; manifest – to manifest; transfer – to transfer; change – to change; class – to class; cause – to cause; research – to research.

b. Form verbs from the following nouns or adjectives.

Length, advert, black, national, broad, character, crystal, maximum, sharp, sympathy, dark, material, light, wide, social, red, minimum, deep, organ, symbol.

Ex. 8

a. Complete the following sentences with nouns or verbs derived from the words in brackets.

1. This is a device which (change) mechanical energy into electrical energy. 2. We need the (change) of information between people or organizations, so that they understand each other and work well together. 3. Unemployment has (force) more than 500,000 people to leave the country in the last two years. 4. In gases and liquids another pro-

cess of heat (transfer) is very effective. 5. Next time when you buy something in online stores, you (type) in your name and other information. 6. Climate change has multiple (cause) – some natural and others result from human action.

b. Complete the following sentences with the verbs derived from the word in brackets (nouns or adjectives). Make all necessary changes.

1. Click in the corner of the screen and (maximum) the window. 2. The sky (light) and there were breaks in the clouds. 3. I need (sharp) that pencil. 4. He (advert) his business on the Internet last week. 5. Nowadays the economic crisis is (deep). 6. The government decided (national) the railways. 7. In his book the author (character) the whole era as a period of deep changes. 8. When a liquid (crystal), it turns into crystals. 9. A few minutes later the sky (dark) and heavy rain began to fall. 10. We are usually too tired to (social) during the week.

Translation Difficulties

Ex. 9 Translate the sentences. Pay attention to the construction <u>the… the</u>.

1. The more civilization is developing, the greater the ecological problems are becoming. 2. The sooner you start, the sooner you finish. 3. The younger you are, the easier it is to learn. 4. The more computers and robots we use in industry, the quicker technological progress will be. 5. The harder the test will be, the lower my score will be. 6. The more powerful the car was, the more dangerous it was to drive. 7. The higher the level of technology, the more difficult problems electrical engineers have to solve. 8. The more we study nature, the more we know about it. 9. The more automobiles appear in the streets, the worse the air in the cities is. 10. The lower the temperature is, the slower the molecules of the gas move. 11. The bigger the city, the worse the ecology in that city. 12. The more effective is the technology, the quicker is the development of this country. 13. The larger the water pipe, the more water passes through it. 14. The more electrons are in the body, the more negative the body is. 15. The greater the number of free electrons in a substance, the better that substance conducts electricity.

SPEAKING

Discuss the basic concepts of electricity with your partner. Say what you think and find out if your partner agrees or disagrees with you.

Talk about:

– materials which can attract or repel each other after rubbing;
– the work of Charles Dufay;
– the work of Benjamin Franklin.

Helpful phrases:

To begin with, I would suggest…	Don't you also think ...?
Would you go along with that?	That's absolutely right.
No, I rather think that…	May I just break in there?
Well, you certainly have a point, but…	What about… ?

Ex. 10 Read and act out the following dialogue with your partner.

Vera: Good morning, and welcome to our programme. Today I'm interviewing **O**lga Ivanova, a young engineer who works for *Rosenergoatom*. We'll be talking about her, and about her career. Good morning, **O**lga. And you are very young, aren't you? **H**ow old are you, exactly?

Olga: Good morning, **V**era. Well, since you ask, I'm 24. Is that too young to be an engineer?

Olga: No, no, not at all. The younger, the better. And how long have you worked for *Rosenergoatom*?

Vera: I've been here for about four years now.

Olga: I see. So what's your job title? Inventor?

Vera: No, no. I'm a design engineer. I work in a team of designers and inventors.

Olga: And how many things have you invented?

Vera: I think, with the team, I've designed or invented five, no, six new products since I joined *Rosenergoatom*.

Olga: That's fantastic. So, what qualifications do you have?

Vera: I have an engineering degree from the Moscow **P**ower Engineering Institute.

Olga: Great. So, **O**lga, let's talk a little about your future intentions. Are you planning to invent anything else in the near future?

Vera: Yes, I am. In fact, I'll be working on a new type of sensors for power stations.

Olga: I see. And after that? What are your long-term plans for your career?

Vera: Ah, who knows? I'll continue working here for several years, I hope. Then I may start my own design company.

Olga: Well Olga, it's been very interesting talking to you. And good luck with your career.

Vera: Thanks very much.

Unit 2

Grammar. Tense System. Passive Voice
Text. Electric Fields
Word building. Verb Suffixes

GRAMMAR

Tense System. Passive Voice

	Simple	Continuous	Perfect
Present	am / is / are + V_{ed}	am / is / are + being + V_{ed}	have/has + + been + V_{ed}
	It is published.	*It is being published.*	*It has been published.*
Past	was / were + V_{ed}	was / were + being + V_{ed}	had + been + V_{ed}
	It was published.	*It was being published.*	*It had been published.*

Future	will + be + V_{ed} *It will be published.*	—	will +have + + been + V_{ed} *It will have been published.*
Future-in-the Past	should/would + be + V_{ed} *It was said that the lecture on Physics would be delivered next Monday.*		

See Grammar Module

Ex. 1 Translate the following sentences.

1. It was found that a large force was required to start the motion. 2. This scientist will be much spoken about. 3. Many difficulties are often met with when you begin a new scientific project. 4. This device could not be relied on because it was not accurate enough. 5. Gold has been known since earliest times and has always been valuable. 6. Through training, you will be taught many special subjects. 7. The growth of industry in the Urals is paid much attention to. 8. For a long time, Mars has been studied by astronomers. 9. If a given amount of energy is put into a machine, that very amount will be developed. 10. The electron was discovered more than 100 years ago but has never been seen. 11. The properties of iron are greatly affected by other substances. 12. We were sure that the new method would give good results. 13. In the seventeenth century, Europeans began to study Greek and Islamic texts which had been forgotten about. 14. The results of the experiments will be published. 15. New experimental equipment is being used in our laboratory.

Ex. 2 Express the same idea in passive.

1. The students are carrying out a very interesting experiment. 2. Our teacher has not given us a new task yet. 3. The students of our group will take an exam in English next week. 4. Nobody will give

him such a book. 5. By the end of the year, the scientists had already obtained much information about the new material. 6. The teacher has found many mistakes in my report. 7. This professor is delivering a lecture to first-year students at the moment. 8. They were demonstrating a new device at that time yesterday. 9. The teacher sent for a laboratory assistant. 10. Did you know what data the teacher had given the students? 11. They have not discussed all the tasks yet. 12. Did they offer him a good job? 13. They are building a station not far from our university. 14. I am sure the students of our group will pass the exam with excellent marks. 15. Do students attend all lectures on Mathematics?

Ex. 3 Complete the sentences with the correct form of the verbs in brackets.

1. Atoms (make up, are made up) of many fundamental particles. 2. The new phenomenon (has much written, has been much written) about lately. 3. The new material (will make, will be made) this device very small but quite reliable. 4. Further human progress (directly connects, is directly connected) with scientific and technological progress. 5. At present scientists (are working, are being worked) on the theory of interaction of all the global atmospheric and oceanic processes. 6. Before Newton no one could explain why the planets (were moved, moved) around the Sun. 7. By that time, space flight (will become, will have become) quite usual. 8. These devices (had brought, had been brought) to the laboratory before I returned from St. Petersburg. 9. In spite of many experiments no good results (have been obtained, were obtained) yet. 10. A course of lectures (will deliver, will be delivered) on the subject next year. 11. His experiment (is still discussing, is still being discussed). 12. The engineer (was made, made) us test the device before the experiment.

VOCABULARY

1. **Require** [rɪ'kwaɪə] *(v.)* – требовать, нуждаться

Nuclear power **require**s low-enriched uranium as fuel.

2. **Separate** *(v.)* – отделять, разделять

They have just **separate**d these two liquids.

3. **Conductor** *(n.)* – проводник
Silver is the best **conductor**.
4. **Electric field** – электрическое поле
Electrically charged particles form an **electric field.**
5. **Voltage** *(n.)* – напряжение
The **voltage** must be controlled before the experiment.
6. **Current** *(n.)* – ток
Where is the **current** used?
7. **Resistance** *(n.)* – сопротивление
What metal has the least **resistance**?
8. **Path** *(n.)* – путь, ветвь
The current always follows the **path** (or **paths**) of the least resistance.
9. **Circuit** ['sɜ:kɪt] *(n.)* – цепь, контур электрической цепи.
An electric **circuit** is a path through which an electric current flows.
10. **Particle** *(n.)* – частица
The electron is an elementary **particle** with a negative electric charge.
11. **Matter** *(n.)* – материя
All **matter** is made up of very small particles called molecules.
12. **Relative** *(adj.)* – относительный
Einstein certainly did not say that everything is **relative**.
13. **Substance** *(n.)* – вещество
Many useful **substances** are produced from coal.
14. **In terms of** – с точки зрения
There is little change **in terms of** results.
15. **Lines of the field** – силовые линии
Lines of the field were thought out by Michael Faraday.
16. **Indicate** *(v.)* – указывать
The parameters of the device are **indicated** in the book.
17. **Amount** (of) *(n.)* – величина, количество (чего-либо)
A large **amount** of work was done by the students.
18. **Quantity** *(n.)* – количество
Huge **quantities** of oil were found in the sea.

19. **Motio**n *(n.)* – движение
Newton published his laws of m**otio**n in 1687.
20. **O**ppo**se** *(v.)* – оказывать сопротивление
What force **oppose**s the motion of an object?
21. **Equa**l *(adj.)* – равный
Let's divide the sheet of paper into two **equa**l parts.
22. **Co**nn**ect** *(v.)* – соединять; связывать; объединять
Heat and temperature are closely **co**nn**ecte**d.
23. **Continuous current** – постоянный ток
The name of Volta is closely connected with the term "**continuous current**".
24. **A**dd *(v.)* – добавить
Your own information can be easily ad**de**d.
25. **Directly proportio**nal [d(a)ɪ'rektlɪ] – прямо пропорциональный
In a circuit with constant resistance, the current will be d**irectly proportio**nal to the voltage.

READING

Electric Fields

Whenever an electric voltage exists between two separated conductors, an electric field is present within the space between those conductors. In physics, we study the interactions of voltage, current, and resistance as they refer to circuits, which are conductive paths through which electrons may travel. It is thought that the concept of a "field" is somewhat abstract. **A**t least with electric current, it isn't too difficult to envision tiny particles called electrons moving between the nuclei of atoms within a conductor, but a "field" doesn't even have mass, and need not exist within matter at all.

Despite its abstract nature, almost every one of us has practical experience with fields, at least in the form of magnets. Have you ever played with a pair of magnets and noticed how they attract or repel each other on the basis of their relative orientation? Undoubtedly, there is a force between a pair of magnets. It has no mass, no colour, no

odour, and if not for the physical force exerted on the magnets themselves, it would be absolutely insensible to our bodies. Physicists describe the interaction of magnets in terms of magnetic fields in the space between them. If iron filings are placed near a magnet, they orient themselves along the lines of the field, visually indicating its presence.

Fields have two measures: a field force and a field flux. The field force is the amount of "push" that a field exerts over a certain distance. The field flux is the total quantity, or effect, of the field through space. Field force and flux are roughly analogous to voltage ("push") and current (flow) through a conductor, respectively, although field flux can exist in totally empty space (without the motion of particles such as electrons) whereas current can only take place where there are free electrons. Field flux can be opposed in space, just as the flow of electrons can be opposed by resistance. The amount of field flux that will develop in space is proportional to the amount of applied field force, divided by the amount of opposition to flux. Just as the type of conducting material dictates that the conductor's specific resistance to electric current, the type of insulating material which separates two conductors dictates the specific opposition to field flux.

Normally, electrons cannot enter a conductor unless there is a path for an equal amount of electrons ready to leave this path. This is why conductors must be connected together in a circuit and form a continuous current. However extra electrons can be "added" to a conductor without any path if an electric field is allowed to develop in space relative to another conductor. The number of extra free electrons which are added to the conductor (or free electrons which are taken away) is directly proportional to the amount of field flux between the two conductors.

Notes to the Text

basic electronics – основы электроники
to envision – представлять себе
to exert – влиять, оказывать влияние
insensible – незаметный, неощутимый
filings – металлические опилки
visually – наглядно

field force – сила (напряженность) поля
field flux – поток вектора напряжённости поля
the amount of "push" – величина толчка или тяги
to exit – выходить, покидать
extra electrons – избыточные электроны

Ex. 4 Answer the questions.

1. What interactions referring to circuits are studied in physics? 2. What is an electric circuit? 3. Why do they say that the concept of a "field" is somewhat abstract? 4. What types of fields do you know? 5. What makes the physical force exerted on the magnets themselves sensible to our bodies? 6. In what way does a pair of magnets act on each other? 7. Where do the magnetic fields of a pair of magnets interact? 8. How do iron filings behave when they are placed near a magnet? 9. Give a definition of the *field force*. 10. What terms are analogous to "*push*" and "*flow*"? 11. What is the flow of electrons opposed by? 12. How are the amount of field flux that develops in space and the amount of applied field force related? 13. What is directly proportional to the amount of field flux between the two conductors?

Ex. 5 Translate the following sentences paying attention to the vocabulary of the unit.

1. It is known that water is a good conductor of electricity. 2. Most batteries which are used in households have a voltage of 1.5 volts. 3. All substances differ greatly in the ease with which the current can pass through them. 4. The longer is the conductor, the greater is its resistance to the current flow. 5. An electric circuit is a closed path in which electrons move and produce an electric current. 6. When the parts of the atom are examined, there can be found tiny particles with positive and negative electrical charges. 7. Wood, water, iron, and paper are some examples of matter. 8. Matter produces no electrical effects when it has equal amounts of both charges. 9. The proton is a relatively heavy positive particle. It has exactly the same quantity of electrical charge as the electron although its sign is opposite. 10. The negative particles are relatively light in weight and in constant motion.

11. The continuous current is an electric current in which the electrons flow in one direction, but may vary with time. 12. In the circuit, all electrical devices were connected so that the current flowed from one device to another.

Ex. 6

a. Match the words with their definitions.

1) interaction	a) a kind of action that occurs as two or more objects have an effect upon one another
2) force field (in physics)	b) a map of a force over a specific space
3) particle	c) a very small piece of something
4) amount	d) a quantity of something such as time, money, or a substance
5) circuit	e) a closed circle that an electric current travels
6) conductor	f) something that allows electricity or heat to travel along it or through it

b. Translate the following international words used in the unit.

Electric, conductor, concept, abstract *(adj.)*, electron, atom, mass, in the form of, magnet, a pair of, orientation, physical, absolutely, to orient, line, analogous, proportional, opposition, material, to dictate, type *(n.)*, normally, extra, molecule, parameter, instruction, temperature, constant *(adj.)*, practical, structure.

c. Match the words or expressions with their translation.

1)	just as	a)	всякий раз
2)	whereas	b)	если бы не
3)	respectively	c)	именно поэтому
4)	at all	d)	несмотря на то, что
5)	at least	e)	однако
6)	however	f)	по крайней мере
7)	despite	g)	совсем, совершенно
8)	this is why	h)	соответственно
9)	if not for	i)	тогда как
10)	whenever	j)	точно так же, как

Ex. 7 Combine the following words.

1)	basic	a)	force
2)	conductive	b)	nature
3)	tiny	c)	space
4)	abstract	d)	path
5)	physical	e)	insensible
6)	absolutely	f)	quantity
7)	total	g)	particle
8)	empty	h)	amount
9)	conducting	i)	material
10)	equal	j)	electronics

Ex. 8 Match the words with the same meaning.

1)	amount	a)	additional
2)	tiny	b)	branch
3)	insensible	c)	couple
4)	space	d)	evidently
5)	motion	e)	very small
6)	despite	f)	movement
7)	undoubtedly	g)	quantity
8)	pair	h)	in spite of
9)	path (in physics)	i)	very slight
10)	extra	j)	room

LANGUAGE STUDY

Verb Formation from Nouns or Adjectives

суффикс	**значение**	пример
(существительное или прилагательное +) **–ify/–fy/–(i)ate**	превращать в то, на что указывает основа	*mode – to modify* *local – to locate* *vaccine – to vaccinate*

Ex. 9 Form verbs from the following nouns or adjectives.
Origin, beauty, mode, simple, class, different, false, décor, active, regular, pure, clarity, motive.

Ex. 10 Complete the following sentences with the verbs derived from the word in brackets (nouns or adjectives). Make all necessary changes.
1. All files are marked with the date and time they were last (mode). 2. It has been found that houseplants help (pure) the air. 3. A computer system (regular) production. 4. This business will not only employ a great many people but it also (beauty) the town. 5. We are going (decor) the hall next week. 6. He tried (simple) the story for younger people. 7. This device is used (regular) the speed at which the machine operates. 8. The process (active) by sunlight. 9. The method (origin) by an Italian engineer. 10. The report aims (clarity) how these conclusions were reached. 11. What (different) these two periods of history? 12. The file was changed (false) the data. 13. A good teacher has to be able (motive) her students. 14. When we moved in, the house already (decor).

Translation Difficulties

Ex. 11 Translate the sentences. Pay attention to the construction <u>both… and</u>.
1. Many changes have been caused by electricity both inside and outside our homes. 2. Both Lomonosov and professor Rihman studied atmospheric electricity. 3. Electricity is used both in industry and in everyday life. 4. When a magnet is divided into two parts, each of the two new magnets has both a north pole and a south pole. 5. The students of our group speak both English and German. 6. Many Russian scientists carry out experimental work both in physics and chemistry. 7. We will both read and translate the text. 8. There are differences between the two materials both in their technology and in their physical properties. 9. Heat produces effects

both in plant and in animal life. 10. Faraday discovered a way both to make electricity and to make use of it. 11. People have greatly affected nature, both positively and negatively. 12. Both Newton and Einstein believed that light was made of particles. 13. They bought a car both comfortable and economical. 14. Programs on both radio and television are classified into several different categories. 15. The device can both receive and send a message.

SPEAKING

Discuss with your partner what an electric field is, what its basic properties are. Remember to use some of your own ideas, to explain things clearly, to consider your partner's opinion. Say what you think and find out if your partner agrees or disagrees with you.

Talk about:

- practical experience people may have with fields;
- a field force and a field flux;
- conducting and insulating materials.

Helpful phrases:

To begin with, I would suggest…	Don't you also think ...?
Would you go along with that?	That's absolutely right.
No, I rather think that…	May I just break in there?
Well, you certainly have a point, but…	What about… ?

Ex. 12 Read the following dialogue. Try to act out a similar dialogue with your partner.

Teacher: I know you are all science students – some of you are studying Informatics, others are studying Physics or Maths, so you might be surprised when I tell you today we are going to discuss ancient philosophers.

Student: Why? Did they contribute to science?

Teacher: Yes, they definitely did. **A** few thousand years ago, philosophers were also scientists, and scientists were also philoso-

phers! Let's look at the Greeks, for example. Has anyone here heard of Thales?

Student: I have. Wasn't he the first ever western philosopher?

Teacher: That's right, he was. He was one of the Seven Wise Men of Greece. He believed that everything in nature was composed of one basic substance, water. Now, we all know this isn't true, but do you know why Thales' idea was so important?

Student: No.

Teacher: Well, before Thales, ancient people had used mythology to explain the world around them. For example, they thought that Zeus – the father of the gods – was responsible for thunder because they didn't know about electricity. So, Thales' idea was very important because of his scientific approach – he tried to explain the world in scientific terms, and not by relying on mythology.

Student: Didn't one of the Greek thinkers come up with an idea that was similar to the conservation of mass?

Teacher: Yes. That was Anaxagoras. The Greeks were very interested in 'substances' and what things were made of. Thales, as I said, believed everything was composed of water. Anaxagoras stated that there were many different elements, which he called 'seeds', and each had unique qualities. He also said that these particles had existed forever and that everything was a mix of these pre-existing particles, so that nothing could come into being, and nothing could be destroyed – it just changed form.

Student: And he came up with this idea two and a half thousand years ago?

Teacher: Yes, he did.

Unit 3

Grammar. Modal verbs and their equivalents
Passive Infinitive
Text. Capacitors
Word building. Noun Suffixes

GRAMMAR

Modal verbs

Модальный глагол	Значение	Пример
must	необходимость, обязанность	*We must stop at a red traffic light.* – Необходимо остановиться на красный свет светофора.
	высокая вероятность / уверенность	*You must be very tired. You didn't sleep well.* – Вы, должно быть, устали: вы плохо спали.
must not	запрет	*You must not smoke here.* – Здесь нельзя (запрещено) курить.
can	способность что-либо делать	*I can swim.* – Я умею (могу) плавать.
	возможность	*It can be difficult.* – Это может быть трудно.
can't	отказ, запрет	*You can't play computer games for as long as you like.* – Вы не можете играть в компьютерные игры столько, сколько хотите.
could	способность что-либо делать в прошлом	*It was so noisy that we could not hear the speaker.* – Было так шумно, что мы не слышали (не могли слышать) оратора.
	вежливая просьба	*Excuse me, could you help me?* – Простите, не могли бы Вы мне помочь?

	возможность	*It could snow soon!* – Скоро может пойти снег.
may	разрешение	*May I make a suggestion?* – Можно высказать предположение?
	возможность, вероятность	*The door may be closed.* – Дверь может быть закрыта.
might	вежливая просьба	*Might I borrow your pen, please?* – Можно взять Вашу ручку?
	неуверенное предположение, небольшая вероятность	*We might leave for London next month.* – Возможно, мы поедем в Лондон в следующем месяце.
should	(следует) рекомендация	*You should study more.* – Вам следует больше заниматься.

Equivalents of Modal Verbs

Модальный глагол	Эквивалент	Значение	Present	Past	Future
can	be able (to)	способность что-либо делать	can, am/is/are able (to)	could was/were able (to)	will be able (to)
may	be allowed (to)	разрешение	may, am/is/are allowed (to)	was/were allowed (to)	will be allowed(to)
must	have to	быть должным (вынужденным)	have/has (to)	had (to)	will have (to)
	be to	быть должным (по плану)	am/is/are (to)	was/were (to)	–

See Grammar Module

Ex. 1

a. Translate the following sentences with modal verbs.

1. The sound might come from an unknown source. 2. The students could observe how the volume of a given mass of gas decreased as the

temperature decreased. 3. Students shouldn't be allowed to use phones in the classroom. 4. Some people may have strong shocks from the electric wires in their houses. 5. You should always check the oil in your car before you go on a long trip. 6. The oceans can slowly release heat for many months or years. 7. We must establish new methods that will be practical and more reliable. 8. The flow of electricity through a wire may be compared to the flow of water through a pipe. 9. "Should I apologize to him?" "Yes, I think you should." 10. You needn't worry. I'm not going to tell it to anyone. 11. We must work hard to reduce the weight of the device.

b. Translate the following sentences with equivalents of modal verbs.

1. He **had to** work hard to maintain his company's reputation. 2. We think we will **be able to** maintain prices at this level for several months more. 3. It's already 3 o'clock. We will **have to** hurry up! 4. New equipment will **be able to** store and release heat at temperatures below zero. 5. The laboratory head **is to** provide proper conditions for experimentation. 6. The students will not **be allowed to** enter the laboratory without a special uniform. 7. They hoped that they would **be able to** pass the exam successfully. 8. You **are not allowed to** carry on any experiments without a laboratory assistant. 9. The method will be used to deal with the problem which **is to** be solved. 10. You **have to** establish a plan for future research.

Ex. 2 Change the following sentences into Future Simple using equivalents of modal verbs if necessary.

Example: I must do it as soon as possible. – I will have to do it as soon as possible.

1. You may see your friend at the hospital in a few days. 2. People must establish long-term peace and stability. 3. We could not attach a small microphone to the device. 4. We must maintain high standards. 5. May I enter the laboratory? 6. You can't carry out the experiment without a good conductor. 7. You may use a dictionary at your English exam. 8. We can store the data on a hard or a flash disk. 9. No one is allowed to smoke in any part of the building. 10. A reader may borrow up to six books at any one time.

Ex. 3 Choose the proper modal verb or its equivalent.

1. необходимо получить – (must, be allowed, may) be obtained;
2. должен будет включать – (is to, can, may) include;
3. быть в состоянии начать – (have to, be able to, be allowed to) start;
4. нельзя охлаждать – (can't, needn't, be not able to) be cooled down;
5. можно использовать этот метод – this method (must, can, may) be used;
6. должны встретиться в 12 – (have to, may, be to) meet at 12;
7. следует оценить – (should, may, need) estimate;
8. не нужно производить – (may not, needn't, should not) produce;
9. быть в состоянии работать в таких условиях – (have to, be able to, be allowed to) work under such conditions;
10. обязан выполнить вовремя – (have to, is to, is able to) fulfil in time.

Ex. 4 Express the same idea in the passive.

1. Government should reduce unemployment in the country. 2. In this device, we must use almost colorless glass. 3. You must improve the method. 4. Sometimes heat is a waste of useful energy, so one must cut it down. 5. You can open the garage door only with the help of this device. 6. You may start work at once. 7. The committee might choose Petrov's plan. 8. Now we can decrease the temperature to –20 °C. 9. You should make the gap between the two details smaller. 10. You must return books to the library on time.

VOCABULARY

1. **Capacitor** [kə'pæsɪtə]*(n.)* – конденсатор

The **capacitor** is a device that collects and stores electricity.

2. **Plate** *(n.)* – пластина, анод

The **plates** (glass or copper) must be carefully designed to minimize temperature.

3. **Circular** ['sɜ:kjulə] *(adj.)* – круглый, круговой

The house looks **circular**, but it isn't a perfect circle.

4. **Flexible** *(adj.)* – гибкий
Rubber is a **flexible** substance.
5. **Value** *(n.)* – величина, значение
The **value** must be less than 3600 **second**s.
6. **Gap** *(n.)* – зазор, промежуток
Mi**nd** the **gap**, **p**lease.
7. **Wire** *(n.)* – провод, проводник
When large currents **p**ass through a **wire**, it becomes hot.
8. **Attach to** *(v.)* – прикреплять к чему-либо
You must **attach** this label to your suitcase.
9. **Develop** *(v.)* – разрабатывать, развивать
Franklin **developed** a new theory of electricity.
10. **Establish** *(v.)* – установить(ся), основывать
Can you **establish** the connection?
11. **Represent** *(v.)* – представлять
He **represented** our research grou**p** at the sym**p**osium.
12. **Store** *(v.)* – хранить, сохранять
A com**p**uter can **store** information.
13. **Accumulate** *(v.)* – накапливать
Such batteries can **accumulate** a large amount of energy.
14. **Resistor** *(n.)* – резистор, сопротивление
We know that the **resistor** is a **d**evice with high resistance.
15. **Potential difference** – разность потенциалов
In a battery, the **potential difference** is maintaine**d** by chemical action.
16. **Increase** *(v.)* – увеличивать(ся)
The **p**o**p**ulation **increased** greatly in the first half of the century.
17. **Decrease** *(v.)* – снижать(ся), уменьшать(ся)
We will have to **decrease** the number of charges.
18. **Supply***(v.)* – подавать, поставлять
To make an electric current flow continuously along a wire, a continuous **supply** of electrons must be available.
19. **Source** *(n.)* – источник
The sun is **p**er**h**a**p**s the cheapest energy **source** which we have.
20. **Result in** *(v.)* – приводить к чему-либо, иметь что-либо в результате
Icy roads that **d**ay **resulted** in a lot of car acci**d**ents.

READING

Capacitors

The capacitor is a device that collects and stores electricity. There are many different styles of capacitor construction and each construction suits particular purposes. For very small capacitors, two circular plates with insulating material between them will be sufficient. For larger capacitors, the "plates" may be strips of metal foil, placed around a flexible insulating medium and rolled up for compactness.

The schematic symbol for a capacitor is quite simple, it represents short, parallel lines separated by a gap. Wires are attached to the respective plates for connection to other components. When a voltage is applied across the two plates of a capacitor, a concentrated field flux is created between them and a significant difference of free electrons (a charge) is allowed to develop between the two plates.

As the electric field is established by the applied voltage, extra free electrons are forced to collect on the negative conductor, while free electrons are taken from the positive conductor. This differential charge equals to a storage of energy in the capacitor and represents the potential charge of the electrons between the two plates. The greater the difference of electrons on opposing plates of a capacitor, the greater the field flux, and the greater the "charge" of energy the capacitor will store.

Because capacitors store the potential energy of accumulated electrons in the form of an electric field, they behave quite differrently than in a circuit. A capacitor's ability to store energy as a function of voltage (potential difference between the two contacts) results in a tendency that tries to maintain voltage at a constant level. In other words, capacitors tend to resist changes in voltage. When the voltage across a capacitor is increased or decreased, the capacitor is drawing current from or supplying current to the source of the voltage change, in opposition to the change.

If it is necessary to store more energy in a capacitor, the voltage across it must be increased. This means that more electrons must be added to the (—) plate and more taken away from the (+) plate, and a current flows in that direction. Conversely, to release energy from a capacitor, the voltage across it must be decreased. This means some of the excess electrons on the (—) plate must be returned to the (+) plate, and a current flows in the other direction.

When the voltage across a capacitor is increased, it draws current from the rest of the circuit and acts as a power load. In this condition, the capacitor is charging because its electric field is storing an increasing amount of energy.

Notes to the Text

foil – фольга
insulating medium (pl. media) – изолирующая среда
strip – полоска
power load – силовая (электрическая) нагрузка

Ex. 5 Answer the questions.

1. What is the function of the capacitor? 2. How many styles of capacitor construction are there? 3. How many plates can be sufficient for very small capacitors? 4. What may the "plates" for larger capacitors look like? 5. What does the schematic symbol for a capacitor look like? 6. What happens when a voltage is applied across the two plates of a capacitor? 7. When are electrons forced to collect on the negative conductor? 8. What is the relationship between the difference of electrons on opposing plates of a capacitor and the capacity of a capacitor? 9. What happens when the voltage across a capacitor is increased or decreased? 10. What must you do if you are to release energy from a capacitor?

Ex. 6 Translate the following sentences paying attention to the vocabulary of the unit.

1. The 101^{st} element of the periodic table of elements is mendelevium which was named after Mendeleyev. 2. Experiments showed that some

metals increased in weight when they were burned. 3. Who established the relation between current and resistance? 4. Soon a new compact source of electricity will be developed. 5. Use this cable if you must connect the printer to the computer. 6. It is difficult and unreliable to supply electricity in mountainous areas of the country. 7. Two parallel plates are placed at a distance of 2 mm apart. 8. As information was accumulated, it became possible to plan experiments. 9. The wire has to be flexible enough to go around the corners of the room. 10. By 1881, the population of Ireland had decreased to 5.2 million. 11. The potential difference causes electricity to flow from one point to the other. 12. The client software can be stored on one central computer that is connected to the network. 13. Nanotechnology may result in great changes in many economic sectors from medicine to energy. 14. The ability of a capacitor to store energy in the form of an electric field is called capacitance. 15. If K equals 3, what is the value of X?

Ex. 7

a. Match the words with their definitions.

1) in other words	a) to explain something more clearly
2) conversely	b) in opposite way
3) to take advantage (of)	c) to use the good things in a situation
4) under such condition	d) the physical situation that someone or something is in and affected by something
5) directly proportional	e) a relationship when one value directly influences another
6) in opposition (to)	f) in a way that is against someone or something

b. Translate the following international words used in the unit.

Extra, electron, proportional, component, phenomenon (*pl.* phenomena), style, construction, metal (*adj.*), compactness, schematic, symbol, parallel, line, energy, potential, to accumulate, form (*n.*), resistor, function, contact, tendency, level, opposition, electric.

Ex. 8 Make up the pairs of words.

1)	directly	a)	voltage
2)	field	b)	symbol
3)	metal	c)	purpose
4)	capacitor	d)	proportional
5)	particular	e)	plate
6)	potential	f)	flux
7)	excess	g)	field
8)	schematic	h)	electron
9)	applied	i)	difference
10)	electric	j)	construction

Ex. 9 Match the words with the opposite meaning.

1)	directly	a)	negligible
2)	free (electrons)	b)	normal, usual
3)	conductive	c)	positive
4)	close (*adj*)	d)	decrease
5)	particular	e)	bound
6)	across	f)	inversely
7)	significant	g)	insulating
8)	negative	h)	remote, distant
9)	ability	i)	along
10)	increase	j)	inability

LANGUAGE STUDY

Noun Formation from Verbs

суффикс	значение	пример
(глагол+) **–tion/– sion**	действие, состояние или результат	*to revolve – a revolu**tion*** *to compress – compres**sion***
(глагол+) **– er/–or/–ent/ –ant**	лицо или механизм, производящий действие	*to drive – a driv**er*** *to act – an act**or*** *to study – a stud**ent*** *to account – an account**ant***

Ex. 10

a. Form the nouns from the following verbs and translate them.

To construct, to research, to expose, to attract, to alter, to define, to demonstrate, to rub, to manifest, to exchange, to associate, to suppose, to imagine, to confuse, to study.

b. Form the verbs from the following nouns and translate them.

Correspondent, translator, examination, speaker, consultant, specialization, organization, dictator, assistant, conclusion, walker, presentation, celebration.

Ex. 11 Form the nouns from the words in brackets to complete the sentences. Make all necessary changes.

1. My final (to exam) will take place in June. 2. This report came directly from our New York (to correspond). 3. You should buy new (to speak) for your stereo system. 4. Unlike acid rain, global warming has no visible (to manifest). 5. We have two bright (to study) in our group, but the rest are average. 6. Some (to alter) to our original plans might be necessary. 7. Our laboratory (to assist) will show you around the factory. 8. You might know about his close (to associate) with the Green Party. 9. The pyramids are a living monument to the skill of their (to build). 10. The messages from our (to account) were about our premiums.

Translation Difficulties

Ex. 12 Translate the sentences. Pay attention to the nouns <u>the former, the latter</u>.

1. Of the two possibilities, the former is more preferable. 2. Both the values seemed correct, but I preferred to choose the latter. 3. Electric cars are easier to start than gasoline-powered ones. But the latter are still faster. 4. If you heat ice, water can be produced. The latter could be divided into hydrogen and oxygen. 5. Atomic energy is replacing the present sources of energy, the latter will find various new applications. 6. Among fuels one can mention coal and uranium, the latter is used in nuclear reactors. 7. The unit of heat is

called a joule or a calorie, the latter may come from the Latin word which means heat. 8. There are two kinds of current: dynamic current and static current. The former changes its direction, the latter does not. 9. We were given a book on Russian history and a book on Physics. The former is an old one and the latter is rather new. 10. We have to present a report on English grammar and a report on Mechanics. The former must be in English and the latter – in Russian.

SPEAKING

Discuss with your partner what a capacitor is. Remember to use some of your own ideas, to explain things clearly, to consider your partner's opinion. Say what you think and find out if your partner agrees or disagrees with you.

Talk about:

- the application of capacitors;
- the styles of capacitor construction;
- the schematic symbol for a capacitor, etc.

Helpful phrases:

To begin with, I would suggest…	Don't you also think ...?
Would you go along with that?	That's absolutely right.
No, I rather think that…	May I just break in there?
Well, you certainly have a point, but…	What about… ?

Ex. 13 Read the following dialogue. Try to act out a similar dialogue with your partner.

Student: Could you help me with the photoelectric effect, please? I can't seem to grasp it.

Teacher: Yes, it can be confusing. Well, experiments have shown that when light shines on a metal surface, the surface releases electrons.

Student: Yes. That's the easy part!

Teacher: OK ...What could be the reason for that?

Student: I'm afraid I don't know.

Teacher: Well, let me ask you this: What is light made up of?

Student: I'm not sure. Waves? Particles?

Teacher: All right, we'll go back to that later, but for now let's say light is made up of waves... and those waves have energy. So when a wave of light hits an electron in an atom in the metal, that energy can knock the electron out of its atom. Is that clear?

Student: Yes, but what about particles?

Teacher: The truth is we don't really know for sure one way or the other. Isaac Newton thought of light as a particle. Then in 1805, an experiment was conducted which indicated that light was a wave. However, in the early 20th century, some physicists, including Einstein, began to think again of light as a particle.

Student: Particle ... wave ... particle ... no wonder I'm confused!

Teacher: Hold on, there's more. Einstein believed that experiments with the photoelectric effect could prove whether light consists of particles or waves.

Student: But whether light is made up of waves or particles, wouldn't the photoelectric effect still happen? I mean, the light would still have the energy to knock electrons out, whether that energy came from particles or waves.

Teacher: That's true, but science is about finding out the truth in the world, so it did matter which of the two it was. And someone did do the experiment Einstein suggested.

Student: What happened?

Teacher: It was found that all of the results agreed exactly with Einstein's predictions, not with the wave theory. In fact, did you know Einstein won the Nobel Prize for the photoelectric effect, not for his more famous theory of relativity?

Student: Wow! I didn't know that. So, light is made up of particles.

Module 2. Electrical Engineering

Unit 4

Grammar. Participle I: Forms and Functions
Text. Ohm's Law – How Voltage, Current, and Resistance Relate
Word building. Noun Suffixes

GRAMMAR

Present Indefinite and Perfect Participle

	Participle I	Perfect Participle
	simultaneousness (одновременность)	priority (предшествование)
Active	writing	having written
Passive	being written	having been written

See Grammar Module

Ex. 1 Translate the following sentences with Participle I.

1. The article written will be sent to the supervisor in a few days. 2. The electric current is the charge flowing through the cross-section of the wire per second. 3. I'm having some difficulties connecting to Wi-Fi here. 4. Having been weighed inaccurately, the substance could not be used in the analysis. 5. Now everything depends on the proportion of the substances being investigated. 6. You can see a graph showing the dependence of pressure on temperature. 7. Phenomena occurring during thunderstorms are thoroughly investigated. 8. Being invited too late, Smirnov could not go to the conference. 9. Having carried out the measurements, the students made all necessary calculations. 10. Having been heated for half an hour, the liquid began to boil. 11. Having finished his report, the young scientist waited for questions.

12. They are having a very important meeting at the conference hall. 13. The quantity of the flowing electricity is directly proportional to the amount of material transformed at the electrodes. 14. The investigators were watching the moving particles. 15. We are going to study mechanisms based on photosynthesis.

Ex. 2 Choose the proper form of Participle I.

1. The students took a (having conducted, conducting) wire and made a coil of several turns out from it. 2. (Having been tested, being tested) at the manufacturing plant, the turbine will be sent to the power station. 3. The speaker (having mentioned, mentioned) the problem has been already working on it for some years. 4. Different forms of the magnetic circuits can be employed (depending, having depended) on the characteristics of the material used. 5. (Having lost, losing) some of its electrons, the atom becomes positively charged. 6. Many electrical devices (having served, being served) mankind for so many years now. 7. (Increasing, having increased) the voltage across a resistor, we increase the current which flows through the resistor. 8. The properties of the substances (using, being used) are not clearly understood yet. 9. (Having been invited, having invited) to the conference, the young engineer went to Kazan. 10. Friction (having reduced, reducing) the efficiency of machines is often undesirable.

Ex. 3 Join pairs of sentences to make sentences with Participle I. Use a joining word if necessary.

1. The engineer was trying to improve the efficiency of the machine. He was studying the properties of the fuel. 2. Radio and television have already made great progress. They continue to find wider and wider applications. 3. The students are carrying on their laboratory experiments. They are studying the properties of different substances. 4. Rubber is a good insulator. It is often used in cables. 5. Pierre and Marie Curie were experimenting in their laboratory. And they discovered a new element – radium. 6. When you use a transformer you can increase or decrease the voltage of the alternating current. 7. Resistance can be high or low. It depends on the type of circuit and the material employed. 8. The scientists made a discovery. At that

time, he was studying the gas near absolute zero. 9. First, the operator examined the engine. Then he switched it on. 10. The scientists had finished the research. Then they began to analyse the collected data.

VOCABULARY

1. **Relate** *(v.)* – иметь отношение, быть связанным

You should **relate** events to probable causes.

2. **After the name of** *smb.* – по имени кого-либо

Later, the continent was called America, **after the name of** the explorer Amerigo Vespucci.

3. **Refer (to)** *(v.)* – иметь отношение, касаться

These figures **refer to** the latest results of our experiment.

4. **Pipe** *(n.)* – труба

Passing water through **pipes** in the radiator in the room, we heat it.

5. **Measure** *(n., v.)* – 1) мера; 2) измерять

An inch is a **measure** of length. We can **measure** the energy that food provides in calories.

6. **Exist** *(v.)* – существовать, иметься в природе

Do you think the phenomenon really **exists**?

7. **Particular** *(adj.)* – особенный, особый

Most students choose one **particular** area for research.

8. **Meaning** *(n.)* – значение, смысл

The same word may have several different **meanings**.

9. **Degree** *(n.)* – степень, уровень; градус

Each part of the system is able to operate with a certain **degree** of freedom. Heat the oven up to 425 **degrees**.

10. **Friction** *(n.)* – трение (процесс), сила трения

Putting oil on both surfaces, we can reduce **friction**.

11. **Properly** *(adv.)* – должным образом, как следует, правильно

Make sure the door is **properly** closed.

12. **For this reason** – поэтому, по этой причине

The bridge is unsafe and it is closed **for this reason**.

13. **Meaningful** *(adj.)* – значительный, значимый, важный

Without new data, we cannot make a **meaningful** comparison of the two systems.

14. **Quantify** *(v.)* – определять количество, измерять
It's difficult **to quantify** how long it will take to finish the project.
15. In **the form of** – в виде
Information is given into the computer **in the form of** instructions.
16. **Equation** *(n.)* – уравнение
In the **equation** below, what is *x*?
17. **Common** *(adj.)* – общепринятый, общий
Nowadays personal computers are as **common** in our homes as TV-sets.
18. **Recognize** *(v.)* – признавать
It is important **to recognize** how little we know about this disease.
19. **Electromotive force** – электродвижущая сила
Electromotive force (e.m.f.) is the voltage at the terminals of the source when there is no current in the circuit.
20. **Express** *(v.)* – изображать, символизировать
Resistance **is expressed** using the capital letter **R**.

READING

Ohm's Law – How Voltage, Current, and Resistance Relate

The first, and perhaps most important, relationship between current, voltage, and resistance is Ohm's **L**aw, called after the name of its discoverer. **G**eorg Simon Ohm published his discovery in 1827. **A**n electric circuit is formed when a conductive path allows electric charge to continuously move. This continuous movement of electric charge through the conductors of a circuit is called a current, and it is often referred to in terms of "flow," just like we call the movement of a flowing liquid through a pipe. The force making charge carriers "flow" in a circuit is called voltage. Voltage is a specific measure of potential energy that is always relative between two points.

Speaking of a certain amount of voltage in a circuit, we refer to the measurement of how much potential energy exists and moves charge carriers from one particular point in that circuit to another. Without reference to two particular points, the term *"voltage"* has no meaning.

Current tends to move through the conductors with some degree of friction, or opposition to motion more properly called resistance. The amount of current in a circuit depends on the amount of voltage and the amount of resistance in the circuit opposing current flow. Just like the voltage, resistance is a quantity relative between two points. For this reason, the quantities of voltage and resistance are often stated as being "between" two points in a circuit. Having described their quantities in the same way that we might quantify mass, temperature, volume, length, or any other kind of physical quantity we will be able to make meaningful statements about these quantities in circuits. For mass, we might use the units of "kilogram" or "gram."

Representing each quantity (electrical current, voltage, and resistance) in an algebraic equation, we usually use its "symbol" in the form of the standard alphabetical letter. Being standardized and internationally recognized, letters like these are common in the disciplines of physics and engineering. Each unit of measurement is named after a famous experimenter in electricity: *the amp* after the Frenchman Andre M. Ampere, *the volt* after the Italian Alessandro Volta, and *the ohm* after the German Georg Simon Ohm.

All of these symbols ("R" for resistance, "V" for voltage, "I" for current, "E" for "electromotive force") are expressed using capital letters and as well as DC and AC are stable over time.

Notes to the Text

capital letter – прописная буква
standardized – стандартизированный
to be symbolized with a capital letter – обозначаться прописной буквой

Ex. 4 Answer the questions.

1. Who discovered the relationship between current, voltage, and resistance? 2. When was the discovery published? 3. When is an electric circuit formed? 4. What can the flow of current be compared with? 5. Can you give the definition of the term *"voltage"*? 6. Why does the

term *"voltage"* have no meaning without reference to two particular points? 7. What is friction? 8. What does the amount of current in a circuit depend on? 9. What units are used to describe mass? 10. Whose names were used to name the units of resistance, voltage, and current?

Ex. 5 Translate the following sentences paying attention to the vocabulary of the unit.

1. Studies show a close relationship between magnetism and electricity. 2. The article makes no reference to known research on the subject. 3. An ammeter is a measuring device used to measure the electric current in a circuit. 4. The existence of water on the planet's surface is possible. 5. It is quite easy to quantify the cost of unemployment to the government. 6. He won public recognition for his work in the field of electrical engineering. 7. $x^2 + 4$ (X squared plus four) is an algebraic expression. 8. The avenue was named after Andrey Sakharov, a physicist and a Nobel Peace Prize winner. 9. I'm looking for a particular book on English grammar. 10. I don't know the meaning of the word combination "electromotive force." 11. They want to have a chance to do meaningful work. 12. Microchips are quite common these days – even in washing machines. 13. He asks whether the experiments were carried out properly. 14. Heat can be produced by chemical reactions or friction. 15. 20 degrees Celsius are equal to 70 degrees Fahrenheit.

Ex. 6

a. Match the words with their definitions.

1) degree	a) a unit for measuring temperature
2) recognition	b) the act of realizing and accepting that something is true or important
3) expression	
4) measurement	c) a sign or group of signs that represent a mathematical idea or quantity
5) relationship	
6) friction	d) the length, height, etc. of something

e) the way in which two or more things are connected and affect each other
f) the natural force that prevents one surface from sliding easily over another surface

b. Translate the following international words used in the text.

To form, electric, term, specific, potential, energy, to tend, opposition, physical, mass, temperature, kilogram, gram, symbol, standard, alphabetical, algebraic, disciplines, physics, experimenter, electricity, to symbolize.

Ex. 7 Combine the following words.

1)	electric	a)	the name of the discoverer
2)	degree of	b)	statement
3)	specific	c)	path
4)	unit of	d)	measurement
5)	algebraic	e)	carrier
6)	potential	f)	friction
7)	called after	g)	equation
8)	meaningful	h)	energy
9)	charge	i)	circuit
10)	conductive	j)	measure

Ex. 8 Match the words with the same meaning.

1)	discoverer	a)	1000 grams
2)	relationship	b)	amount
3)	movement	c)	character
4)	meaning	d)	interrelation
5)	opposition	e)	motion
6)	quantity	f)	pioneer
7)	symbol	g)	resistance
8)	kilogram	h)	significance
9)	discipline	i)	subject
10)	engineering	j)	technology

LANGUAGE STUDY

Noun Formation from Verbs

суффикс	значение	пример
(глагол+) –ment/–age/–(t)ure	действие, состояние, результат действия	*to punish – punish**ment*** *to post – post**age*** *to press – press**ure***
(глагол+) – al	процесс	*to arrive – arriv**al*** *to refuse – refus**al***

Ex. 9

a. Form the nouns from the following verbs and translate them.

To break, to advertise, to propose, to agree, to pass, to create, to arrange, to renew, to equip, to use, to remove, to pay, to mix, to disappoint, to close, to improve, to move, to pack, to fail, to develop.

b. Form the verbs from the following nouns and translate them.

Removal, advertisement, creature, bandage, improvement, marriage, renewal, shipment, enjoyment, departure.

Ex. 10 Complete the following sentences with the nouns derived from the verbs in brackets. Make all necessary changes.

1. I saw (to advertise) for the job on the Internet yesterday. 2. The earliest recorded (to use) of the word is in the twelfth century. 3. A special meeting was called to discuss the (to remove) of the director. 4. Their latest CD is (to mix) of new and old songs. 5. Have you read Steve's (to propose) for the new project? 6. Don't all living (to create) have certain rights? 7. He wound a small (to band) around her finger. 8. If you need more information about the online (to renew) process, visit our website. 9. The equipment was taken to the airport for (to ship) to Sochi. 10. His bedroom was on the right at the end of the (to pass).

Translation Difficulties

Ex. 11 Translate the sentences. Pay attention to the expressions on the one hand, on the other hand.

1. On the one hand, magnetism is produced by the current and on the other hand, the current is produced from magnetism. 2. On the one hand, atoms can serve people and on the other hand, they can destroy the world. 3. On the other hand, heat is used in engines which perform work in many ways. 4. On the one hand, studying at the university is hard, on the other hand, it is always exciting to learn something new. 5. My friend likes classical music – I, on the other hand, like any. 6. On the one hand, he wants to go on a nice holiday, but on the other hand, he doesn't have enough money. 7. It is, on the one hand, a good decision. 8. On the one hand, I'd like to go out tonight, but on the other hand, I must be at work very early tomorrow. 9. On the one hand, I really could help Oleg, but on the other hand, we don't get on very well. 10. On the one hand, the flat is very cheap, on the other hand, it is too far from the university.

SPEAKING

Discuss Ohm's Law with your partner. Remember to use some of your own ideas, to explain things clearly, to consider your partner's opinion. Say what you think and find out if your partner agrees or disagrees with you.

Talk about:

- the definitions of current, voltage, and resistance;
- the relationship between current, voltage, and resistance;
- the importance of Ohm's Law;
- the schematic symbols for current, voltage, resistance.

Helpful phrases:

To begin with, I would suggest…	Don't you also think ...?
Would you go along with that?	That's absolutely right.
No, I rather think that…	May I just break in there?
Well, you certainly have a point, but…	What about …?

Ex. 12 Read the following dialogue. Try to act out a similar dialogue with your partner.

Teacher: The words 'calculate', 'calculation', and 'calculator' are all derived from the name of the branch of mathematics known as 'calculus'.

Student: But where does that name come from, sir?

Teacher: Well, it is a Latin word. It stems from the birth of mathematics in ancient Greece. The Romans borrowed the Greek word 'calix' (pebble) and changed it to 'calculus', so the Latin word for pebble is where the term 'calculus' comes from, and the verb 'calculare' means 'to count'. But it wasn't the Greeks or the Romans who named the branch of mathematics.

Student: Who coined the term?

Teacher: One of the two most famous contributors to calculus. Can you guess who?

Student: Newton? Leibniz?

Teacher: Yes, they were the two, but it was Leibniz who named the discipline 'calculus'. Newton also gave it a name, but it's not the one we use now.

Student: What did Newton call it?

Teacher: Newton called it 'the science of fluxions'. Can anyone tell me why he did that? What does 'fluxion' or 'flux' mean?

Student: It means 'change', doesn't it?

Teacher: That's right. So how does 'flux' relate to calculus?

Student: Differential calculus deals with rates of change.

Teacher: Exactly. Very good. He called it 'the science of fluxions' because it was the way in which rates of change – or flux – could be studied.

Student: Why did they give different names to the same thing? Why didn't they just use the one term?

Teacher: Ah, well, as I think you know, Leibniz published his results before Newton but that doesn't mean he got his results before Newton. No, indeed not. What actually happened was that Newton had got his results first –

he just hadn't published them! When Newton saw Leibniz's publication, he was convinced that Leibniz had seen his notes and copied him.

Student: Had he?

Teacher: Actually, no, he hadn't. This was proved by the fact that they had arrived at their results in different ways – Leibniz began with integration and Newton began with differentiation, so Leibniz couldn't have copied because they worked independently and made equally important contributions, both Newton and Leibniz were recognised as the mathematicians who developed calculus.

Unit 5

Grammar. Participle II: Functions **Text. P**ermanent **M**agnets **Word building.** Noun Formation

GRAMMAR

Past Participle (Participle II)

	Active Voice	Passive Voice
Indefinite	–	asked written

See Grammar Module

Ex. 1 Translate the following sentences with Participle II.

1. The article written will be sent to the supervisor in a few days. 2. The example referred to in your article certainly needs clarification. 3. Each text is followed by a number of exercises. 4. The personnel employed worked in the new workshop. 5. The continued research helped the scientists make an interesting discovery. 6. The laser beam has almost unlimited industrial possibilities. 7. When continued, the research helped the scientists make an interesting discovery. 8. According to the data obtained, it was reported that the experiment

was successful. 9. Your instructions were followed exactly. 10. It is well-known that molecules of the heated material move faster. 11. If heated, an object can be detected by its radiation. 12. The scientist has finished the research and later an analysis of the collected data will be made. 13. Unless properly tested, the device cannot be put into operation. 14. The methods used in this research were rather effective. 15. The delegation arrived some days ago is having a meeting with the minister.

Ex. 2 Complete the following sentences with suitable forms of Participle II using the verbs in brackets.

1. The substances (to receive) required further investigation. 2. The article on the new method (to publish) in this journal was (to write) by Smith. 3. Mind the (to break) glass. 4. I have (to bring) a lot of interesting articles from the students' conference. 5. Someone had (to draw) a line under my name. 6. Nowadays petrol- (to drive) cars are mostly used. 7. As you drive as fast as this all the time, the brakes of your car have (to wear) out. 8. He said that the keys were (to keep) in his office. 9. The wind had (to rise) again and it was starting to rain. 10. Someone has (to forget) to switch off the lights in the laboratory.

Ex. 3 Complete the sentences with suitable forms of Participle I or Participle II from the words in brackets.

1. (Testing, tested, having tested) the device under different conditions, we started its production. 2. The journal deals with electronics but particular attention (is paying, is paid, having been paid) to microelectronics. 3. When (discovering, discovered, having discovered), radioactivity helped scientists make great progress in atomic physics. 4. The molecules themselves are minute magnets (having, had, having had) a north pole and a south pole. 5. (Repairing, repaired, having repaired) the device, they continued their work. 6. The materials (utilizing, utilized, having utilized) decreased the friction effect. 7. Under equal conditions, iron is (oxidizing, oxidized, having been oxidized) more rapidly than mercury or silver. 8. The plant (supplying, supplied, having supplied) with good raw materials will produce better goods.

9. **P**robably the first metals (using, used, having used) by man were gold, silver, and copper. 10. (Writing, written, having written) by hand, the letter is absolutely unreadable.

VOCABULARY

1. **Po**ss**e**ss [pə'zes] *(v.)* – иметь, обладать, располагать
Different workers p**o**ss**e**s**e**d different skills.
2. **Ir**o**n** *(n.)* – железо
Iro**n** is a metal found in very small quantities in food and blood.
3. **Réco**r**d** *(n.)* – запись
He spent a lot of time listening to **reco**r**d**s.
4. **T**e**n**d *(v.)* – иметь тенденцию (к чему-л.)
They **te**n**d** to carry out each experiment several times.
5. **Directio**n *(n.)* – направление
A piece of magnetite tends to orient itself in a north-south d**irectio**n.
6. **Su**sp**e**n**d** *(v.)* – подвешивать
The lights were s**u**sp**e**n**de**d on long wires.
7. **Reve**a**l** *(v.)* – открывать; обнаруживать
The committee made him **reve**a**l** more information.
8. **Un**l**ike** – 1) *(prep.)* в отличие от; 2) *(adj.)* непохожий, отличный от
Unl**ike** the other questions, that one was very interesting. **B**irds have two kinds of motion, which are quite **un**l**ike**.
9. **De**n**ote** *(v.)* – обозначать
Small circles on the map d**e**n**ote** villages.
10.**Observe** *(v.)* – наблюдать
Scientists have **observe**d a drop in ozone levels over the **A**ntarctic.
11. **Is**o**late** ['aɪs(ə)lət] *(v.)* – изолировать
A high wall **is**o**late**d the house from the rest of the village.
12.**Like** *(adj.)* – похожий, подобный
The houses here are **like** the ones in northern **R**ussia.
13.**Stre**n**gth** *(n.)* – сила
The s**tre**n**gth** of our plan lies in its simplicity.
14.**Ass**u**me** *(v.)* – допускать, предполагать
It is ass**u**m**e**d that the engineer will complete his work in a week.

15. **Theorize** ['θɪəraɪz] *(v.)* – теоретически предсказывать
Investigators **theorize**d that ice had built up on the wings of the plane.
16. **Uniformly** *(adv.)* – равномерно; однородно
The streets were **uniformly** grey under the white winter sky.
17. **Permanently** *(adv.)* – постоянно; неизменно
Smoking damages your health **permanently**.
18. **Sustain** *(v.)* – поддерживать; обеспечивать
This planet is unable **to sustain** human or plant life.
19. **Readily** *(adv.)* – легко; быстро
A large conductor will carry the current more **readily** than a thinner one.

READING

Permanent Magnets

Centuries ago, it was discovered that certain types of mineral rock possessed unusual properties of attraction to the iron. One particular mineral, called magnetite was mentioned in very old historical records (about 2500 years ago in Europe, and much earlier in the Far East). Later, it was employed to help navigation, as it was found that a piece of this unusual rock would tend to orient itself in a north-south direction if it was left free to rotate (suspended on a string or on a float in water).

A scientific study undertaken in 1269 by Peter Peregrinus revealed that steel could be similarly "charged" with this unusual property after being rubbed against one of the "poles" of a piece of magnetite. **U**nlike electric charges (such as the charges observed when amber is rubbed against cloth), magnetic objects possessed two poles producing opposite effect after their self-orientation to the earth, denoted "north" and "south". As Peregrinus found, it was impossible to isolate one of these poles when a piece of magnetite was cut in half and each resulting piece possessed its own pair of poles.

Like electric charges, there were only two types of poles: north and south (by analogy, positive and negative). Just as with electric charges, the same poles repel one another, while opposite poles attract.

This force, like that caused by static electricity, could even pass through objects such as paper and wood with little effect upon strength.

Modern theories of magnetism assume that a magnetic field is produced by an electric charge being in motion, and thus it is theorized that the magnetic field of so-called "permanent" magnets such as magnetite is the result of electrons within the atoms of iron spinning uniformly in the same direction. Only certain types of substances react with magnetic fields, and even fewer have the ability to permanently sustain a magnetic field.

Iron is one of those types of substances that readily magnetizes. If a piece of iron is brought near a permanent magnet, the electrons within the atoms in the iron orient their spins to match the magnetic field force produced by the permanent magnet. The previously unmagnetized iron becomes magnetized as it is brought closer to the permanent magnet. No matter what pole of the permanent magnet is oriented toward the iron, the iron will magnetize as if it is attracted toward the magnet.

Notes to the Text

free to rotate – для того, чтобы (он) мог свободно вращаться
on a string or on a float – на веревке или на поплавке
amber – янтарь
to spin – вращаться
spin – спин

Ex. 4 Answer the questions.

1. When was the ability to attract iron by rocks discovered? 2. What was the first mineral rock which could attract iron? 3. Where was magnetite used in ancient times? 4. Who revealed the fact that steel could magnetize after being rubbed? 5. What poles does an ordinary magnet have? 6. What pole is called the north one? The positive one? 7. Do opposite poles attract or repel each other? 8. What happens when a piece of iron is brought near a permanent magnet? 9. Can previously unmagnetized iron become magnetized again? 10. What pole of the permanent magnet must be oriented toward the iron if we want to magnetize the metal?

Ex. 5 Translate the following sentences paying attention to the vocabulary of the unit.

1. The teacher explained the movement of charges by analogy with the movement of water. 2. He possessed an unusual ability to learn languages quickly. 3. The iron and steel industry of this region exists because long ago iron ore was mined there. 4. Scientific records in this institute are secret. 5. The British traditionally tend not to display much emotion in public. 6. I couldn't find the station, so I asked someone if he could direct me. 7. The builders worked on special platforms suspended by ropes from the roof of the building. 8. She revealed the history of the discovery to the public because she thought it was important. 9. "Unlike poles" means opposite poles – one north and the other south. 10. The lecturer found it difficult to sustain the students' interest. 11. We assume that the rest of the system will operate well. 12. One student is performing the experiment, while his partner is observing. 13. The English word "family" is used to denote all the people in the house, including servants. 14. There was one telescope, however, that was permanently directed at the Earth. 15. These materials conduct electricity less readily than conductors but much better than insulators.

Ex. 6

a. Match the expressions with their definitions.

	a) completely different from a particular person or thing
	b) an expression used to compare two people or things when they are similar
1) just as	
2) no matter	c) an expression used to say that something is not important and will not affect a situation
3) unlike	
4) as if	d) an expression used to show that the situation is similar to another so that a comparison can be made
5) by analogy	
6) conversely	e) an expression used to say that something seems to be true or that something is happening
	f) an expression used when one situation is the opposite of another

b. Translate the following international words used in the unit.

Type, mineral (*adj.*), magnetite, historical, navigation, to orient, object, effect, orientation, to isolate, analogy, static electricity, theory, magnetism, result, electron, atom, magnetic.

Ex. 7 Combine the following words:

1) unusual	a) properties
2) particular	b) electricity
3) historical	c) study
4) north-south	d) magnet
5) scientific	e) mineral
6) magnetic	f) effect
7) opposite	g) direction
8) static	h) theories
9) modern	i) objects
10) permanent	j) records

Ex. 8 Match the words with the opposite meaning.

1) like	a) possible
2) particular	b) earlier
3) later	c) unlike
4) unusual	d) usual
5) modern	e) ancient
6) opposite	f) same
7) impossible	g) ordinary
8) positive	h) negative
9) static	i) dynamic

LANGUAGE STUDY

Noun Formation from Adjectives

суффикс	значение	пример
(прилагательное+) –ness/–y/–(i)ty/–(i)bility	состояние, качество, свойство	*happy – happi**ness*** *difficult – difficul**ty*** *active – activ**ity*** *possible – possib**ility***

Ex. 9

a. Form the nouns from the following adjectives and translate them.

Complex, kind, probable, soft, possible, great, responsible, busy, flexible, white, safe, dark, major, careful, stable, lazy, negative, clean, real, weak.

b. Form the adjectives from the following nouns and translate them.

Familiarity, narrowness, positivity, massiveness, convertibility, sensitiveness, conductivity, calmness, responsibility, usefulness, honesty, hardness, certainty, redness, ability.

Ex. 10 Form nouns from the adjectives in brackets to complete the sentences. Make all necessary changes.

1. At ordinary temperatures the (conductive) of the material is quite high. 2. In some cases (useful) of tests is limited. 3. It will be important to present an idea that has a high (probable) of success. 4. The lamp suddenly went out, leaving us in (dark). 5. It's important to do some kind of regular physical (active). 6. English grammar may present some (difficult) for learners. 7. A lot of university graduates want to go into (busy). 8. The exercises will help you improve your mental (able). 9. This device is used to determine the (hard) of metal and plastic. 10. It's your (responsible) to inform us of any changes in our class schedule.

Translation **Difficulties**

Ex. 11 Translate the sentences. Pay attention to the words very, the very, only, the only.

1. There are only a few units in the workshop. 2. We use only the best materials for the experiment. 3. The transfer takes place only when the data has been checked. 4. My new project allowed me not only to get a better job but it helped me to improve my English as well. 5. The only reason to use the new technology is to improve the product's quality. 6. That's not the only effect of air pollution. 7. You will not be able to solve the problem if this is the only data you have. 8. We weren't the only ones who had to work on Saturday. 9. Power engineering is very

important to the country's economy. 10. She was very much in demand as a speaker. 11. This meeting will be very important, so come on time. 12. At that very moment, the teacher entered the room. 13. The very fact that you are reading this book suggests that you want to improve your English. 14. Those were his very own words. 15. The student came in time and started his laboratory test from the very beginning. 16. This very term can also have some other meanings.

SPEAKING

Discuss with your partner what a permanent magnet is. Remember to use some of your own ideas, to explain things clearly, to consider your partner's opinion. Say what you think and find out if your partner agrees or disagrees with you.

Talk about:

- when and how magnetic properties of materials were discovered;
- what is Peter Peregrinus known for;
- old and modern theories of magnetism.

Helpful phrases:

To begin with, I would suggest…	Don't you also think ...?
Would you go along with that?	That's absolutely right.
No, I rather think that…	May I just break in there?
Well, you certainly have a point, but…	What about… ?

Ex. 12 Read the following dialogue. Try to act out a similar dialogue with your partner.

Student 1: How's your Chemistry class going? Are you enjoying it?

Student 2: I'm enjoying the lab work – the experiments are really good – but I'm having trouble understanding the theory and some of the terms. You did Chemistry last year. Can you help me?

Student 1: Sure. What's the problem?

Student 2: Well, let's start with chemical reactions. What exactly are they?

Student 1: A chemical reaction is a process that changes substances. The substance or substances that you start with are called reactants.

Student 2: ... and the substances that are produced are called products.

Student 1: Right. And during a chemical reaction, energy is released or absorbed, but there's no change in the total molecular weight – that remains the same. OK?

Student 2: Um ... I'm not sure. Can you give me an example?

Student 1: Yes. Let's look at salt, which chemical name is sodium chloride. Suppose we start with *x* weight of salt.

Student 2: OK.

Student 1: Now, let's take that salt and decompose it – that means 'break it down'. Its molecules, which consist of equal parts of sodium and chloride ions, are broken down. The sodium atoms then combine in pairs to form sodium molecules, and the chloride ions combine to form chlorine molecules. Now, instead of salt, you have two different elements.

Student 2: And those two elements' combined weight will be the same as the weight of the salt?

Student 1: Exactly. Also, in a chemical reaction, substances lose their characteristic properties. Salt, for example, is a solid in crystal form, right?

Student 2: Right...

Student 1: ... but in decomposing it, we have produced a metal and a gas...

Student 2: ... a metal and a gas?

Student 1: Yes. Sodium is a metal and chlorine is a gas.

Student 2: OK.

Student 1: ... so, from a crystal solid – salt – we have produced a metal and a gas.

Student 2: OK, I get it, I think. In a chemical reaction, substances combine to form new substances; molecular weight doesn't change, and the characteristic properties of substances can change.

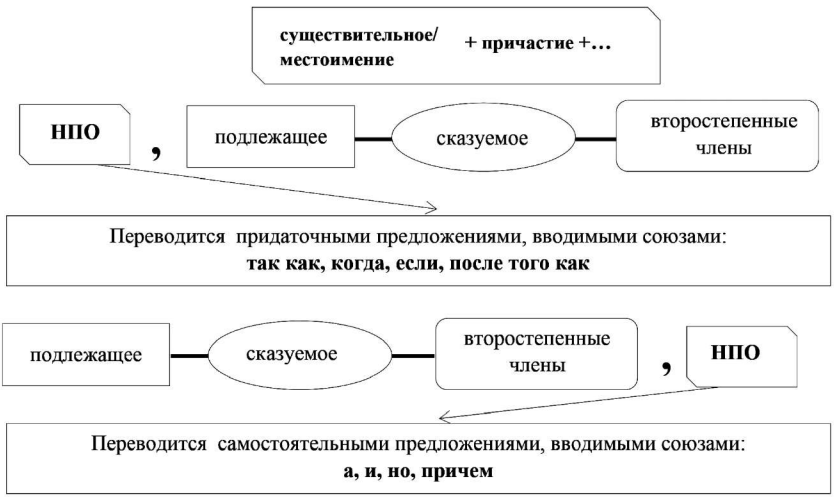
Student 1: Very good!

Unit 6

Grammar. Absolute Participle Construction
Text. Electromechanical Relays
Word building. Noun Formation

GRAMMAR

Absolute Participle Construction
Независимый причастный оборот (НПО)



See Grammar Module

Ex. 1 Translate the following sentences with Absolute Participle Construction at the beginning of the sentence.

1. The construction of the ice-breaker completed, the Russian fleet got the most powerful ice-breaker in the world. 2. The speed of the engine being increased, tractors could be used for road work. 3. Part of the energy being changed into heat, not all the chemical energy of the battery is transformed into electric energy. 4. The results of the experiment depending on the temperature of the liquid, the liquid observed

should be as hot as possible. 5. The new method having been studied in detail, the committee decided to introduce it to all the plants. 6. Small lasers having many useful properties, they are applied in many industries. 7. Air pollution being a large problem, the usage of fossil fuels should be decreased. 8. There being a small loss of energy caused by friction, the object continued its motion. 9. The signal given, the rocket starts immediately. 10. The sky having cleared, the astronomer went on with his observation. 11. Radioactivity discovered, we made great progress in atomic physics. 12. The speed of light being extremely great, we cannot measure it by ordinary methods. 13. The scientists having been given much information about the behavior of planets, their experiments were successful. 14. With the new equipment tested on time, the plant could begin the production. 15. The explanation given, we could make a proper decision.

Ex. 2 Translate the following sentences with Absolute Participle Construction at the end of the sentence.

1. Many scientists worked in the field of mechanics, perhaps the most outstanding being Newton and Galileo. 2. The limit of cold is reached at approximately -273.15°C, this temperature being known in physics as absolute zero. 3. This substance can be decomposed by means of an electric current, the process being known as electrolysis. 4. The molecules themselves are minute magnets, each of them having the positive pole and the negative pole. 5. The test was not difficult, many words having been learned before. 6. Any moving object is able to do work, the quantity of kinetic energy depending on its mass and velocity. 7. Scientists have developed a magnetic coating, the latter having a thickness of 0.4 mm. 8. The word "computer" comes from Latin, the term being widely used everywhere. 9. The electron is about as large as a nucleus, its diameter being about 10^{-12} cm. 10. It is frequently said that the atom is a sort of minute solar system, with its electrons orbiting about the nucleus as the planets orbit around the Sun. 11. The conductivity depends on the number of ions present, the substance being more ionized in solutions. 12. Acids react with oxides of all the metals, salt and water formed. 13. When we generate a current by magnetic

action, we make a wire pass through a magnetic field, the latter being set up either by a permanent magnet or an electromagnet. 14. Atoms of gas helium are heavier than hydrogen atoms, each of them weighing about four times as much as a hydrogen atom. 15. We continued our work, our laboratory assistants helping us.

Ex. 3 Join pairs of sentences to make sentences with the Absolute Participle Construction.

Example: The lecturer delivered a lecture. The students listened attentively. – *The lecturer delivering a lecture, the students listened attentively.*

1. An object loses its potential energy. That energy is turned into kinetic energy. 2. A book falls from the table. Its energy is changed from potential energy to kinetic one. 3. Electronic devices have found a wide application everywhere. The mobile phone is one of them. 4. There was a hydroelectric station at the river. The energy of the falling water is used to generate electricity. 5. The energy sources of the world are decreasing. We must look for new sources of energy. 6. There are different sources of energy. The sun is an unlimited source of energy. 7. Industrial application of energy increases. Now our households need much more energy. 8. The electrical equipment was properly insulated. There were no accidents at the power plant. 9. Power is the basis of civilization. Industry and transport are dependent upon some form of power. 10. There are two kinds of mechanical energy – potential and kinetic. Potential energy is the energy of position.

VOCABULARY

1. **Coil** *(n.)* – катушка

The axial magnetic field was created by two magnetic **coil**s.

2. **Orient** *(v.)* – ориентировать, задавать направление

The tourists stopped **to orient** themselves.

3. **Strength** *(n.)* – сила, интенсивность, мощность

The **strength** of the magnetic field in the coil is proportional to the amount of current.

4. **Inductor** *(n.)* – индуктор

An **inductor** is an electrical device which stores energy in a magnetic field.

5. **Core** *(n.)* – сердечник

A magnetic **core** is a piece of magnetic material used in electrical, electromechanical and magnetic devices.

6. **Exert** *(v.)* – прилагать (силу), оказывать действие

They did so **to exert** control over this organisation.

7. **Except that** *(prep.)* – за исключением того, что

She could think of nothing to say **except that** she was so sorry.

8. **Switch** *(n.)* – выключатель, переключатель

Where's the light s**witch**?

9. **Armature** ['ɑ:məʧə] *(n.)* – якорь

Each motor is designed with two separate **armature**s.

10. **Direct current (dc)** – постоянный ток

A battery is a source of d**irect current**.

11. **Alternating current (ac)** – переменный ток

The letters a.c. stand for **alternating current**.

12. **Energize** ['enəʤaɪz] *(v.)* – подать напряжение

The car electric motor is **energize**d by solar cells.

13. **Valve** *(n.)* – вентиль; клапан

The **valve** didn't open.

14. **Load** *(n.)* – нагрузка

The **load** of the power stations often varies.

15. **Set** *(n.)* – комплект, набор, ряд

We face a new **set** of problems.

16. **Relay** *(n.)* – реле

A **relay** is an electrically operated switch.

17. **Consume** [kən'sju:m] *(v.)* – потреблять

The car **consume**s a lot of petrol.

18. **Fraction** *(n.)* – часть; дробное число

How would you express 25% as a **fraction**?

19. **Power** *(n.)* – энергия, мощность

The simplest source of **power** for direct current is a battery.

20. **Spark** *(v.)* – искрить(ся); вызывать

In some cases, a damaged wire may sp**ark** an explosion.

READING

Electromechanical Relays

An electric current through a conductor will produce magnetic field lines, the latter encircling the conductor. If that conductor has a shape of a coil, the magnetic field produced will be oriented along the length of the coil. The greater the current, the greater the strength of the magnetic field, all other factors being equal. Inductors oppose the changes in the current because of the energy stored in this magnetic field. When we construct a transformer from two inductor coils around a common iron core, we use this field to transfer energy from one coil to the other. However, there are simpler and more direct uses for electromagnetic fields than the applications we have seen with inductors and transformers.

The magnetic field produced by a coil of wire carrying a current can be used to exert a mechanical force on any magnetic object, just as we can use a permanent magnet to attract magnetic objects, except that we can turn on or off this magnet (formed by the coil) when we switch the current on or off through the coil.

If we place a magnetic object near such a coil in order to move that object when we energize the coil with an electric current, we have a solenoid. The movable magnetic object is called an armature, and most armatures can be moved with either direct current (**DC**) or alternating current (AC) energizing the coil.

Solenoids can be used to electrically open doors, open or shut valves, move robotic parts, and even actuate electric switch mechanisms. However, if a solenoid is used to actuate a set of switch contacts, we have the relay.

Relays are extremely useful when we have a need to control a large amount of current and/or voltage with a small electrical signal. The relay coil which produces the magnetic field may only consume fractions of a watt of power, the contacts closed or opened by that magnetic field being able to conduct hundreds of times that amount of power to a load.

One relay may be used to actuate more than one set of contacts, those contacts being normally-open, normally-closed, or any combination of the two. As with switches, the "normal" state of a relay's contacts is that state when the coil is connected to any circuit. Relay contacts may have different forms just as with other types of switches. The choice of contacts in a relay depends on the same factors which dictate a contact choice in other types of switches. Open-air contacts are the best for high-current applications, but their tendency to destroy slowly and spark may cause problems in some industrial applications.

Notes to the Text

encircle – окружать
inductor coil – индукционная катушка
direct use – прямое использование (без преобразования)
solenoid – соленоид
robotic – роботизированный, автоматизированный
actuate – запускать, задействовать
relay coil – обмотка реле
normally-open – нормально разомкнутый
normally-closed – нормально замкнутый
as with – как в случае с
open-air contacts – контакты, предназначенные для работы на открытом воздухе
high-current application – предназначенный для эксплуатации при больших токах

Ex. 4 Answer the questions.

1. What will an electric current produce through a conductor? 2. In what way will the magnetic field be oriented if the conductor has a shape of a coil? 3. Why do inductors oppose the changes in the current? 4. What is the magnetic field used for when we construct a transformer from two inductor coils around a common iron core? 5. What can the magnetic field produced by a coil of wire carrying the current

be used for? 6. How do we form a solenoid? 7. How are solenoids used in everyday life and in the industry? 8. How many contacts can a relay actuate? 9. What is the "normal" state of a relay's contacts? 10. What does the choice of contacts in a relay depend on?

Ex. 5 Translate the following sentences paying attention to the vocabulary of the unit.

1. In the 1980s she became known for works made with new types of armature. 2. The man raised a heavy coil of wire to his shoulder. 3. After she came out of the station, she stopped and tried to orient herself. 4. The strength of an electromagnet is proportional to the number of its ampere-turns. 5. She will have to exert herself a lot if she wants to succeed in her studies. 6. The exam went well except that I made a mistake in the final answer. 7. All these machines operate at the click of a switch. 8. When the electrons flow in one direction only, the current is known as direct current. 9. Alternating current flows first in one direction and then in the opposite one. 10. The wind and rain caused several accidents. 11. The maximum load for this lift is eight persons. 12. The first set of questions was rather easy, but then they got really difficult. 13. This device monitors how much energy your appliances are consuming at any time. 14. ¼ and 0.25 are different ways to show the same fraction. 15. Damaged power lines caused fires in several parts of the region.

Ex. 6

a. Match the words with their definitions.

1)	armature	a)	an electric current that regularly changes the direction in which it moves
2)	solenoid	b)	a part of an electric motor
3)	alternating current	c)	an electric current that moves in one direction only
4)	fraction	d)	a number that results from dividing one whole number by another
5)	direct current		
6)	strength		

e) a device, consisting of a wire wrapped in the shape of a cylinder, that acts like a magnet when the electricity goes through it
f) the physical power and energy that makes someone strong

b. Translate the following international words used in the unit.

Conductor, magnetic, line, to orient, factor, inductor, energy, transformer, electromagnetic, permanent, to energize, solenoid, contact, relay, to control, signal, watt, combination.

Ex. 7 Combine the following words.

1) magnetic field	a) contacts
2) equal	b) object
3) iron	c) magnet
4) mechanical	d) lines
5) permanent	e) forms
6) relay	f) force
7) different	g) factors
8) contact	h) current
9) direct	i) core
10) movable	j) choice

Ex. 8 Match the words with the opposite meaning.

1) strength	a) weakness
2) equal	b) similar
3) simple	c) alternating
4) use	d) unequal
5) permanent	e) integer (whole number)
6) near	f) immovable
7) movable	g) far
8) fraction	h) temporary
9) different	i) complex
10) direct	j) disuse

LANGUAGE STUDY

Noun Formation from Nouns

суффикс	значение	пример
(существительное +) **–ship**	состояние, положение, отношение между людьми	friend – *friend**ship***
(существительное +) **– age**	содержание чего-либо (в единицах измерения)	per cent – *percent**age***
(существительное +) **– dom; – hood**	состояние, качество; территория	king – *king**dom*** brother – *brother**hood***
(существительное +) **– ics**	область знаний, науки	economy – *econom**ics***
(существительное +) **– ian; – an**	профессия, социальная, философская, религиозная или национальная группа	history – *histor**ian***
(существительное +) **– ist**	принадлежность к профессии, партийному, философскому или религиозному движению	art – *art**ist*** science – *scient**ist***
(существительное +) **– ism**	понятия, действия, процессы, их результаты, а также направления в искусстве, науке и т.д.	terror – *terror**ism***

Ex. 9

a. Make the nouns from the following nouns and translate them.

Leader, tour, member, capital *(n.)*, commune, library, music, Serbia, impression, brother, neighbour, Russia, economy, citizen, biology.

b. Define the basic form of the following nouns and translate them.

Christian, athletics, ecologist, communism, politician, dietician, kingdom, European, tonnage, childhood, impressionist, Italian, scholarship, criticism.

Ex. 10 Form the nouns derived from other nouns in brackets to complete the sentences. Make all necessary changes.

1. He spent most of his (child) in a small town in Siberia. 2. She was a queen of an ancient (king) in Egypt. 3. The new ship will

have a (ton). 4. (Impression) is a style of painting used especially in France in the 19th century. 5. He said that (Russia and Ukraine) were one people – a single whole. 6. He has lost his student (member) card. 7. He applied for American (citizen). 8. The most important application for our mobile manipulator is the robot- (library). 9. The practice of meditation is a very important part of (Buddha). 10. She won a (scholar) to study abroad.

Translation Difficulties

Ex. 11 Translate the sentences. Pay attention to the words as, since.

1. Don't worry, the box is big but it's light as a feather. 2. This really isn't our problem, as far as I can tell. 3. As it was getting late, I decided to stop the experiment. 4. He decided to go to the conference in Barcelona as he was in Spain at that time. 5. As it was getting dark, I switched on the lights. 6. I saw him as I was entering the University building. 7. Do exactly as I say. 8. The car was repaired as promised. 9. The production of motor cars in Great Britain was stopped since there were severe speed limits. 10. Since this cooling system is not very effective, a new one has to be developed. 11. Since petrol engines are usually lighter and smaller than diesel engines, they are cheaper. 12. The film must be very interesting since everyone has already seen it. 13. Since we have a few minutes left, let's have a cup of coffee. 14. The coach guided his team by telephone since half of them played in Italy, France or Spain. 15. Since she did not make enough money to live on her own, she had to go back to live with her parents. 16. Since you are already here, you might stay as well.

SPEAKING

Discuss with your partner what an electromechanical relay is. Remember to use some of your own ideas, to explain things clearly, to consider your partner's opinion. Say what you think and find out if your partner agrees or disagrees with you.

Talk about:

- what a relay consists of;
- some advantages of using relays;
- relay contacts, their forms and types;
- application of relays, etc.

Helpful phrases:

To begin with, I would suggest.	Don't you also think ...?
Would you go along with that?	That's absolutely right.
No, I rather think that...	May I just break in there?
Well, you certainly have a point, but...	What about... ?

Ex. 12 Read the following dialogue. Try to act out a similar dialogue with your partner.

Teacher: Many years ago – in fact, billions of years ago – uranium began to enter the Earth's crust.

Student: Where did it come from?

Teacher: It had been released from an exploding star, and floated around the universe. Uranium is the heaviest of all the naturally occurring elements. It has an atomic number of 92.

Student: Does that mean there are 92 protons in the atom's nucleus?

Teacher: Yes, it does. That is a huge amount. Just to compare it to lighter elements, can anyone tell me how many protons there are in, for example, hydrogen or oxygen?

Student: There's just one in hydrogen, and there are eight in oxygen.

Teacher: That's right. Uranium is also radioactive. What does that mean?

Student: It means that it is an atom that can release huge amounts of energy.

Teacher: Correct. We can use uranium – that is, nuclear power – to produce energy, such as electricity. But before this happens, the uranium must be mined and refined into very small pieces about the size of a piece of chewing gum. These pieces are then put into small tubes and are used in nuclear reactors as fuel.

Student: How much energy can it produce?

Teacher: Well, because it contains more energy than any other element, a small amount – about a handful in fact – can provide as much energy as 390 barrels of oil.

Student: It's dangerous though, isn't it?

Teacher: Yes, it can be extremely dangerous, and accidents occurred in the past.

Student: Why is it used then?

Teacher: Because it is cleaner than other forms of energy that we use to produce the huge amounts of electricity that we need. At the moment, if we didn't have any nuclear power, an extra two billion tonnes of carbon dioxide would be poured into the atmosphere by other forms of energy, such as coal.

Module 3. Thermal Power Engineering

Unit 7

Grammar. Gerund: Forms and Functions. Verbal Noun
Text. Thermoelectric power generator
Word Building. The Most Common Suffixes of Adjectives
Formation of Adjectives from Nouns
Formation of Adjectives from Verbs

GRAMMAR

Gerund: Forms (Герундий: формы)

	Active	Passive
Indefinite *одновременность*	V+-ing *heating*	being + V3 *being heated*
Perfect *предшествование*	having + V3 *having heated*	having been + V3 *having been heated*

Gerund: Functions (Герундий: функции)

Functions	Examples
Подлежащее	*Measuring heat is necessary for this kind of experiment.*
Часть составного именного сказуемого	*The best way to solve this problem is experimenting.*
Часть составного глагольного сказуемого	*She began working at this research last month.*
Прямое дополнение	*She admits having missed this aspect.*
Косвенное (предложное) дополнение	*The students succeeded in testing this chemical reaction.*
Определение (с предл. *of* или *for*)	*She had no hope of reconstructing the substance.* *The barometer is an instrument for measuring pressure.*
Обстоятельство (всегда после предлога)	*On splitting atoms in the reactor heat is developed.*

Verbal Noun (Отглагольное существительное, ОС)
V + -ing

Distinctive Features	Examples
1. Перед ОС может стоять артикль или указательное местоимение	***The*** *meeting starts at 10 a.m.*
2. ОС может иметь форму множественного числа	*All these repairings are useless.*
3. После ОС может стоять только косвенное дополнение с предлогом *of*	*The constructing* ***of the tool*** *didn't take long.*
4. ОС может определяться прилагательным	***Heat*** *engineering is of great importance in the modern world.*

See Grammar Module

Ex. 1 Use the following verbs to form:

a) Passive Indefinite Gerund.

measure, achieve, demonstrate, find, design, prove, solve, write.

b) Active/Passive Perfect Gerund.

reflect, build, improve, combine, fulfil, succeed, produce, perform, obtain.

Ex. 2 Name Gerund forms and explain their meaning.

having decided, being invented, having been solved, changing, being received, having been equipped, washing.

Ex. 3 Translate the following sentences paying attention to Gerund functions.

1. A boiler is a device for generating steam. 2. Our aim is solving this complex problem. 3. John Parsons had the idea of reducing the steam pressure and speed by causing the whole expansion of the steam to take place in stages. 4. The functions of heating, ventilation, and air-conditioning are interrelated when we need to provide thermal comfort. 5. Gustaf Patrik de Laval connected an electric generator to his turbine after he had succeeded in reducing the speed of rotation to 300 r.p.m. 6. Proving the existence of radio waves in space was one of the greatest scientific achievements. 7. It is most important to remember that electricity is only a means of distributing energy, carrying it from the place where it is produced to the places where it is used. 8. Using the new method makes possible the increase of accuracy and speed of computational results. 9. By raising the voltage, it is possible to transmit a certain amount of energy. 10. The cooling water is pumped to a cooling tower after passing through the condenser. 11. The Society for testing materials had adopted a test procedure for determining the ignition temperature of liquid combustibles. 12. Investigating the possibility of recovering waste heat is an important engineering task. 13. If steam is required for industrial processing, a turbine may be modified by creating steam flows from various stages of the turbine.

14. Being out in the open field during a thunderstorm is dangerous. 15. Using state-of-the-art equipment and more complex cycles gives better theoretical efficiencies. 16. Proper calculating of the circulation loop provides reliable natural circulation in a drum boiler. 17. Better theoretical efficiencies are possible by using upgraded equipment in more complex cycles. 18. In condensing the steam gives up heat to the cooling water.

Ex. 4 Use the verb in brackets as a Gerund with an appropriate preposition:

after (1), of (3), without (2), by (2), on (1), in (3), for (2).

Define the functions of the Gerund and translate the sentences into Russian.

Model: By pressing (press) the key, the operator can put the machine into work.

1. Automobiles, trams, airplanes are moved (change) heat energy to other forms of energy. 2. Comparing the data obtained by different tests is the only means (to solve) many problems. 3. Ongoing research is aimed (improve) the quality and availability of the measurements. 4. After two years (experiment), in 1802, William Murdock persuaded his employer, Watt, to let him illuminate the Soho factory by gaslight. 5. This method (to store) flue gases became criticized. 6. (Achieve) negative results they stopped the research. 7. (Transmit) error-correction codes an adaptive system can resist interference. 8. They managed to make an experiment (increase) the power of the circuit. 9. I will work at a thermal power plant as an engineer (to graduate) from the University. 10. Appliances (convert) energy from one form to another are called engines. 11. The tubular air heater is constructed (to expand) vertical tubes into parallel tube sheets. 12. They succeeded (to obtain) good results using this computer. 13. (To develop) the new method, they couldn't achieve good results. 14. Thousands of scientists, using the most modern equipment, are engaged (to study) this phenomenon.

Ex. 5 Write out the numbers of the sentences with a Gerund (G.) or a verbal noun (VN).

Be ready to give your reasons according to the model.

Model: Protecting (G.) buildings (VN) from strokes of lightning was a great achievement in the field of electricity. – Защита зданий от ударов молнии была большим достижением в области электричества.

Protecting – это герундий, так как после него стоит прямое (беспредложное) дополнение – buildings. Buildings – это отглагольное существительное, поскольку есть s.

1. It is necessary to complete the experiment without destroying the substance. 2. A typical horizontal wind machine stands as tall as a 20-story building and has three blades that span 200 feet across. 3. After finding the new word in the dictionary, I wrote it down and went on reading. 4. Wind is caused by the uneven heating of the earth's face by the sun. 5. Showing the technical difficulties of the scheme is the object of the paper. 6. Computers occupy one of the leading places among the greatest achievements of modern engineering. 7. Rapid developing of satellite services in telecommunications attracts worldwide attention. 8. Project management software offers some advantages to business including the potential for significant savings by ensuring that projects are completed on time. 9. Since the beginning of the 20th century the successful development of electricity has begun throughout the industrial world. 10. Russian scientists played a great role in the spreading of satellite television in Russia. 11. No changes can be made in that branch of industry without introducing the most up-to-date technology. 12. Proper measurement is of great importance for getting the necessary data. 13. The handling of goods in factories is being rapidly mechanized nowadays. 14. Proper treatment of boiler feed water is an important part of operating and maintaining a boiler system. 15. The advantage of using the winding is that it increases the strength of the magnetic field produced by a given current. 16. The equipment for producing the fluid is divided into two major classes: pumps for handling liquids and fans, blowers and compressors for handling gases and vapors.

VOCABULARY

1. **Thermoelectric** *(adj.)* – термоэлектрический

The **thermoelectric** component of the heat flux flows from lower to higher temperatures.

2. **Power generator** *(n.)* – электрогенератор

The synchronous three-stage **power generator** is the source of electrical energy.

3. **Solid-state device** *(n.)* – полупроводниковый прибор; твердотельный прибор

Solid-state devices, such as a transistor, use conductors to control the flow of signals through a circuit.

4. **Heat sink** (heatsink) *(n.)* – теплоотвод; система охлаждения; радиатор

Internal fans and **heat sinks** can help keep the machine cooled inside.

5. **Maintain at** *(v.)* – сохраняться, поддерживаться (на уровне)

The temperature in the conference rooms is **maintained at** about 23 °C.

6. **Temperature differential** *(n.)* – разность температур; перепад температур

As media flow increases across the sensing assembly, heat is dissipated and **temperature differential** decreases.

7. **Terminal** *(n.)* – клемма; ввод/вывод

The positive and negative **terminals** of the tested device must be connected to produce a short circuit.

8. **Invoke** (*v.)* – вызывать, запускать

You can also **invoke** the command completion by following the steps listed below.

9. **Pump** (*v.)* – качать, перекачивать

Our latest machine can **pump** a hundred gallons a minute.

10. **Refrigeration** *(n.)* – охлаждение

The food will spoil without **refrigeration.**

11. **Decay product** *(n.)* – продукт распада

In nuclear physics, a **decay product** is a remaining nuclide left over from radioactive decay.

12. **Unattended** *(adj.)* – автономный, автоматический

Unattended weather station recording (such as wind speed/direction, temperature, relative humidity, solar radiation) is used in the north pole.

13. **Data collection** *(n.)* – сбор данных

The majority of **data collection** will be undertaken by their department.

14. **Spacecraft** *(n.)* – космический корабль

The gravitational force experienced inside orbiting **spacecraft** is 10^4-10^6 g, and is commonly called 'microgravity'.

15. **Power range** *(n.)* – диапазон мощности

The power range is represented on the vertical axis.

17. **Conversion** *(n.)* – конверсия, превращение

Nanoporous metal oxide materials have numerous potential applications in various areas, including **conversion** and storage.

Ex. 6

a. Match the words with their definitions.

1) data collection
2) heat sink
3) to pump
4) terminal
5) refrigeration
6) to invoke
7) to maintain
8) spacecraft
9) current
10) load
11) decay products

a) a vehicle designed for travel in space
b) the process of making or keeping something cold
c) to continue to have; to keep in existence, or not allow to become less
d) to cause something to be used; bring into effect
e) the activity of collecting information that can be used to find out about a particular subject
f) the point at which a connection can be made in an electric circuit
g) to force liquid or gas to move from one place to another
h) a substance or an object that absorbs heat
i) the remaining nuclides left over
j) a movement of water, air, or electricity in a particular direction
k) the amount of electrical power that is supplied

b. Translate the terms with the word thermoelectric.

Thermoelectric converter; thermoelectric heat flux; thermoelectric heat pump; thermoelectric heater; thermoelectric cooler; thermoelectric pyrometer; thermoelectric cooling; thermoelectric analogy; thermoelectric thermometer; thermoelectric traction; thermoelectric transducer; thermoelectric vacuum baffle; radioactive thermoelectric generator; thermoelectric thermocouple; automatic thermoelectric switch; cascaded thermoelectric device.

READING

Thermoelectric power generator

Thermoelectric power generator is any of a class of solid-state devices that either convert heat directly into electricity or transform electrical energy into thermal power for heating or cooling. Such devices are based on thermoelectric effects involving interactions between the flow of heat and electricity through solid bodies.

All thermoelectric power generators have the same basic configuration. A heat source provides a high temperature, and the heat flows through a thermoelectric converter to a heat sink, which is maintained at a temperature below that of the source. The temperature differential across the converter produces a direct current (DC) to a load (RL) having a terminal voltage (V) and a terminal current (I). There is no intermediate energy conversion process. For this reason, thermoelectric power generation is classified as direct power conversion. The amount of electrical power generated is given by I^2RL, or VI.

A unique aspect of thermoelectric energy conversion is that the direction of energy flow is reversible. So, for instance, if the load resistor is removed and a DC power supply is substituted, the thermoelectric device shown in the figure can be used to draw heat from the "heat source" element and lower its temperature. In this configuration, the reversed energy-conversion process of thermoelectric devices is invoked, using electrical power to pump heat and produce refrigeration.

This reversibility distinguishes thermoelectric energy converters from many other conversion systems, such as thermionic power con-

verters. Electrical input power can be directly converted to pumped thermal power for heating or refrigerating, or thermal input power can be converted directly to electrical power for lighting, operating electrical equipment, and other work. Any thermoelectric device can be applied in either mode of operation, though the design of a particular device is usually optimized for its specific purpose.

The decay products of radioactive isotopes can be used to provide a high-temperature heat source for thermoelectric generators. Because thermoelectric device materials are relatively stable to nuclear radiation, and because the source can be made to last for a long period of time, such generators provide a useful source of power for many unattended and remote applications. For example, radioisotope thermoelectric generators provide electric power for isolated weather monitoring stations, for deep-ocean data collection, for various warning and communications systems, and for spacecraft. In addition, a low-power radioisotope thermoelectric generator was developed as early as 1970 and used to power cardiac pacemakers (кардиостимуляторы). The power range of radioisotope thermoelectric generators is generally between 10^{-6} and 100 watts.

Ex. 7 Answer the following questions.

1. What is a thermoelectric power generator? 2. What effects are the devices like a thermoelectric power generator based on? 3. What interactions do thermoelectric effects involve? 4. Do all thermoelectric power generators have the same basic configuration? 5. For what reason is thermoelectric power generation classified as direct power conversion? 6. What is the unique aspect of thermoelectric energy conversion? 7. What is the main difference between thermoelectric energy converters and thermionic power converters? 8. Can any thermoelectric device be applied in either mode of operation? 9. Can the decay products of radioactive isotopes be used to provide a high-temperature heat source for thermoelectric generators? 10. Why do thermoelectric power generators provide a useful source of power for many unattended and remote applications? 11. What made thermoelectric power generators useful for isolated weather monitoring stations, for deep-ocean data collection, for various warning and communications systems, and

for spacecraft? 12. When was a low-power radioisotope thermoelectric generator developed? 13. How can thermoelectric generators be used in medicine?

Ex. 8 Read the text again and decide whether these statements are true (+) or false (–), correct the false ones.

1. Solid-state devices convert heat directly into electricity.
2. Solid-state devices are based on thermoelectric effects.
3. All thermoelectric power generators differ in their basic configuration.
4. A heat source provides heat that flows through a thermoelectric converter to a heat sink.
5. The temperature differential across the converter produces an alternative current to a load.
6. The amount of electrical power generated is given by RLV, or VI.
7. The direction of energy flow invoked by thermoelectric energy conversion is reversible.
8. Reversibility makes thermoelectric energy converters similar to many other conversion systems.
9. Electrical input power can be directly converted to pumped thermal power for heating or refrigerating.
10. Materials of thermoelectric devices are rather quickly destroyed due to nuclear radiation and are short-lived.
11. The power range of radioisotope thermoelectric generators is generally between 10^{-6} and 200 watts.

Ex. 9 Fill in the gaps with appropriate words.

Early, high, devices, generated, watts, optimized, lower, lighting, electrical, thermal, design, unattended, radioisotope

1. Such … are based on thermoelectric effects involving interactions between the flow of heat and electricity through solid bodies. 2. A heat source provides the … temperature, and the heat flows through a thermoelectric converter to a heat sink. 3. The amount of electrical power … is given by I^2RL, or VI. 4. The thermoelectric device can be used to draw heat from the "heat source" element and … its temperature. 5. … input power can be directly converted to pumped thermal power for

heating or refrigerating. 6. … input power can be converted directly to electrical power for … operating electrical equipment, and other work. 7. The … of a particular device is usually … for its specific purpose. 8. Such generators provide a useful source of power for many … and remote applications. 9. In addition, a low-power radioisotope thermoelectric generator was developed as … as 1970. 10. The power range of … thermoelectric generators is generally between 10^{-6} and 100 …

LANGUAGE STUDY

Word Building

1. Суффиксы прилагательных, образованных от существительных

noun + Λ = adj

Λ	значение	Пример
-ful	значение «полноты качества» (full of)	*beautiful, colourful*
-less	отсутствие качества (without)	*colourless, useless*
-ous	слова франц. происхождения, аналог *-ful*	*courageous, famous*
-ly	свойство, характерное для предметов и лиц (having the nature of)	*friendly, lively*
-en	материал, из которого сделан предмет	*leaden, woolen*
-y, -ic, -al	имеющий качество того, что обозначено основой	*rainy, basic, natural*
-ish	национальная принадлежность, а также слабая степень свойства (origin, nature)	*Scottish, reddish*
-(i)an, -ese	национальная принадлежность, языки и т.п. (от имен собственных, географических названий)	*Japanese, Malaysian*
-ary, -ar	принадлежность или связь с чем-либо	*evolutionary, solar*
-like	подобие, схожесть	*wavelike*

2. Суффиксы прилагательных, образованных от глаголов

verb + Λ = adj

Λ	значение	Пример
-able /-ible	возможность подвергнуться действию, указанному глаголом	*changeable, measurable*
-ive/-ative	наличие определенного признака	*destructive, impulsive*
-ent /-ant	наличие определенного признака	*different, pleasant*
-ing	вызывающий эффект (признак)	*amusing, exciting*
-ed	получающий эффект (признак)	*heated, excited*

Ex. 10 Translate the following adjectives paying attention to their suffixes:

a) **noun + Λ = adj**

Logical, powerful, dreadful, metallic, dangerous, friendly, satisfactory, obligatory, contrary, electric, phonetic, tactless, cloudy, similar, circular, ordinary, elementary, intermediate, adequate, golden, wooden, Japanese, Spanish, shortish, massive, relevant, stationary.

b) **verb + Λ = adj**

Reversible, convertible, miserable, combinable, resistant, confident, evident, convenient, dependent, effective, progressive, sensible.

Translation Difficulties

but	но *He tried to repeat the experiment but couldn't.*
but = except after words such as all, everything/nothing, everyone/no one, everybody/nobody	лишь, только, кроме, за исключением *There is but one proper method to prove the theory.*

but for + smth is used to introduce the reason why something didn't happen	если бы не *But for the circuit breaker, a short circuit might cause fire.*
all but = **except (for)** meaning 'almost completely'	почти *I had all but finished the essay when the computer crashed and I lost it all.*

Ex. 11 Translate the sentences. Pay attention to the words but, but for.

1. Heat pumps differ in how they apply this work to move heat, but they can essentially be thought of as heat engines operating in reverse. 2. They would have failed the experiment last year but for your help. 3. But for tungsten, the filament will burn in no time. 4. But for friction, our world wouldn't be the same. 5. Currently, all commercial reactors are based on nuclear fission. But there is another possibility of nuclear energy generation by a safer process called nuclear fusion. 6. But for thermoelectric effects, thermoelectric power generators would be impossible. 7. Mistakes are inevitable but strive for accuracy. 8. But for the brakes, it could be impossible to stop the moving car in case of emergency. 9. Friction produces heat but the heat produced by friction is usually considered to be the lost heat or useless work. 10. But for semiconductor technology and mass production of large-scale integrated circuits, the introduction of electronic watches, calculators and similar appliances wouldn't be affordable. 11. In each case, an ordinary differential equation contains one or more functions of but one independent variable and the derivatives of those functions. 12. The Fahrenheit scale is used in England, but it is not used in Russia.

SPEAKING

Ex. 12 Search the Internet Resources and watch a video in English about the Seebeck effect. Do the tasks.

1. Explain what the Seebeck effect is, how it can be used to your group-mate or group;
2. Make presentation using video screen shorts;
3. Switch off the sound and voice a video in your own words.

Ex. 13 In ex. 12 you described the Seebeck Effect. Be ready to talk about the Peltier effect and the Thomson effect.

- Explain the difference between the Seebeck, Peltier and the Thomas effects;
- **G**ive a presentation on thermoelectric effects.

Unit 8

Grammar. Gerundial Construction **Text.** Cogeneration **Word building.** The **M**ost Common Suffixes of Adjectives Formation of Adjectives from **N**ouns Formation of Adjectives from Verbs

GRAMMAR

Gerundial Construction

Зависимый герундиальный оборот

предлог	+	Герундий
On		*Writing*

I insist on + *writing a new letter immediately.*

Независимый герундиальный оборот

(Предлог)	+	Притяжательное местоимение Существительное в притяжательном (или общем) падеже	+	герундий
Придаточное предложение:		Подлежащее		сказуемое

I insist on + *your* + *writing a new letter immediately.*

N.B.: 1. Герундиальные обороты выполняют в предложении те же функции, что и герундий. 2. Герундиальный оборот переводится придаточным предложением.

See Grammar Module

Ex. 1 Translate the following sentences paying attention to Gerundial Constructions, pointing out the Gerund and defining its function.

1. There was no hope of their finishing the experiment on time. 2. We heard of his having started a very important experiment in your laboratory. 3. We know of most metals being good conductors of heat and electricity. 4. There is no hope of our getting a complete analysis within 10 days. 5. His having obtained a residue at such a temperature was a great success. 6. The assistant apologized for his having made a mistake in the calculations. 7. They knew about our having published the results of the tests. 8. In spite of semiconductor diodes being so important, they were little used at the beginning of the last century. 9. We knew of atomic energy having been used for several years for heating houses in a small region in the UK. 10. The professor knew about the students' going to the power plant. 11. Franklin's having worked in the field of electricity is a well-known fact. 12. We were informed of the electric furnace being an ideal melting and refining unit for the steel industry. 13. Everybody heard of this new device having been implemented into practice. 14. His having done numerous experiments proved the hypothesis. 15. Student's knowing the rule helped him to pass the exam successfully.

Ex. 2 Transform the sentences using the Gerundial Construction, define its function.

Model: 1) We know that he studies Atomic Physics. – We know *of his studying* Atomic Physics (Indirect Object).

2) He reads technical journals and it helps him in his research work. – *His reading* technical journals helps him in his research work (Subject).

1. We know that all thermoelectric power generators have the same basic configuration. 2. Newton stated his laws of motion. It is very important for modern science. 3. We know that any object is prevented from moving at constant speed by air friction. 4. The direction of energy flow is reversible. It is a unique aspect of thermoelectric energy conversion. 5. We know that he has spent more than 20 years of scientific thinking before finally formulating the ideas on paper. 6. Thermoelectric device materials are relatively immune to nuclear radiation.

It is an important property for many unattended and remote applications. 7. We can directly convert a temperature difference to electricity if we apply the Seebeck effect. 8. His article was published. It is a great success.

Ex. 3 Translate the following sentences.

1. То, что Ньютон изобрел математический аппарат, необходимый для подтверждения справедливости основных законов механики, имело огромное значение. 2. Кремний напоминает углерод в образовании ряда летучих гидратов. 3. Для любого космического корабля существует опасность сгореть из-за того, что он был выведен на неправильную орбиту. 4. Состояние покоя или равномерного движения тела изменяется после воздействия на него какой-либо внешней несбалансированной силы. 5. Мы знаем, что серебро и медь являются очень хорошими проводниками электричества. 6. Известно, что любой объект не может (to be prevented from) двигаться с постоянной скоростью из-за трения воздуха. 7. Движение этого тела было изменено из-за воздействия на него внешней силы. 8. Ученые могут измерить силу гравитации в любой точке земной поверхности благодаря тому, что Ньютон сформулировал второй закон движения. 9. Графит используется в качестве замедлителя в атомном котле из-за того, что он дешевый и его способности выдерживать высокие температуры. 10. Электроны текут к катоду из-за того, что он потерял электроны и является менее отрицательно заряженным, чем отрицательная сторона батареи.

VOCABULARY

1. **Cogeneration** (= cogen = combined heat and power (**C**HP) *(n.)* – когенерация (совместное производство электроэнергии)
Biomass combustion for heat and the **cogeneration** of heat and power (**C**HP) is a commercial technology in the district heating systems.
2. **Ste**am *(n.)* – пар
If water is heated up to 100 °**C** it turns to **ste**am.
3. **Concept** *(n.)* – концепция, понятие, идея
It is very difficult to define the **concept** of beauty.

4. **Electric utility** *(n.)* – электроэнергетическая компания (энергопредприятие)
Electric utilities are facing increasing demands including ageing infrastructure, reliability, and regulation.
5. **Utility company** *(n.)* – коммунальная компания; коммунальная служба
Public **Utility Company** "Water and Sewerage" is obliged to provide potable water.
6. **Reliable** *(adj.)* – надежный
What is the most **reliable** method of calculation?
7. **Waste heat** *(n.)* – отработанное тепло
The fuel cell system also includes auxiliary components to remove **waste heat**. Depending on system size and configuration, **waste heat** may be transferred by a coolant or directly to air.
8. **Facilities** *(n.)* – оборудование, средства; возможности, аппаратура
New **facilities** should not be placed in areas of known risk, while older **facilities** may require adequate infrastructure protection or upgrading.
9. **Capture** *(v., n.)* – захватывать, улавливать; захват, улавливание
The data **is captured** by an optical scanner.
10. **End-use** *(n.)* – конечное использование (потребление)
Generally, in developing countries, **end-use** efficiency can be improved considerably using available technologies.
11. **Beneficial** *(adj.)* – полезный, выгодный, положительный
These actions include both **beneficial** and detrimental effects.
12. **Environmental impact** *(n.)* – воздействие на окружающую среду, последствия для окружающей среды
We need to be concerned about the **environmental impacts** of all this construction.
13. **Operating costs** *(n., usually plural)* – эксплуатационные расходы, эксплуатационные затраты
Significant savings occurred in documents production, travel and **operating costs**.
14. **Off-the-shelf** *(adj.)* – готовый, серийный
You can purchase **off-the-shelf** software or have it customized to suit your needs.

15. **Proven technology** *(n.)* – апробированная технология; отработанная технология; проверенная технология
We can do it with **proven technology**.
16. **Large-scale** *(adj.)* – в крупном масштабе, крупномасштабный, массовый, широкий
They have announced **large-scale** changes in the organization.
17. **Implementation** *(n.)* – осуществление, внедрение; применение
He summarized by saying we needed better planning and **implementation**.

Ex. 4

a. Match the words with their definitions.

	a) a service that is used by the public, such as an electricity or gas supply or a train service
	b) trusted or believed because he, she, or it works or behaves well in the way you expect
1) steam	c) a hot gas that is produced when water boils
2) cogeneration	d) the effect that the activities of people and businesses have on the environment
3) concept	
4) off-the-shelf	e) a cost involved in using a machine, piece of equipment, building, etc.
5) facilities	
6) electric utilities	f) used to describe a product that is available immediately and does not need to be specially made to suit a particular purpose
7) reliable	
8) large-scale	g) helpful, useful, or good
9) environmental impact	h) an idea, theory, etc. about a particular subject
10) operating costs	i) a company that supplies something such as electricity, gas, or water to the public
11) beneficial	j) the use of a heat engine or power station to generate electricity and useful heat at the same time
12) utility companies	
	k) involving many people or things, or happening over a large area
	l) buildings, equipment, and services provided for a particular purpose

b. Translate the terms with the word cogeneration.

Cogeneration-based district heating; cogeneration steam; cogeneration system; cogeneration turbine; industrial cogeneration; nuclear cogeneration plant; nuclear cogeneration; steam cogeneration; thermal cogeneration plant; waste-to-energy cogeneration plant; cogeneration units; industrial cogeneration; micro cogeneration; cogeneration installations.

READING

Cogeneration

At the beginning of the twentieth century, steam was the main source of mechanical power. However, as electricity became more controllable, many small "power houses" that produced steam realized they could also produce and use electricity, and they adapted their systems to cogenerate both steam and electricity. Then from 1940–1970, the concept developed of a centralized electric utility that delivered power to the surrounding area. Large utility companies quickly became reliable, relatively inexpensive sources of electricity, so the small power houses stopped cogenerating and bought their electricity from the utilities.

Cogeneration is the simultaneous generation from a single energy source of two forms of energy, usually heat and electricity. Traditional generating systems produce only heat or electricity by burning fuel. Burning fuel generates a lot of heat, and the exhaust gases can be hotter than 932°F (500 °C). Traditionally, this "waste heat" would be vented into the environment for disposal. Cogeneration facilities capture some of that waste heat and use it to produce steam or more electricity. Both systems release the same amount of energy, but cogeneration obtains more end-use from that energy.

There are several reasons why cogeneration is a beneficial technology. Cogeneration is an excellent method of improving energy efficiency, which has positive environmental and economic results. The most important environmental reason to cogenerate is that vast amounts of precious, non-renewable resources are being wasted by inefficient uses. For example, only 16% of the energy used for industrial processes creates useful energy or products. About 41% of the

waste is unavoidable because some energy is always lost whenever energy is transformed. However, 43% of the wasted energy could potentially be used in a more energy-efficient process. Cogeneration is an excellent way to increase energy efficiency, which reduces both environmental impacts and operating costs.

Another benefit of cogeneration is that it is an off-the-shelf technology. It has been used in some forms for over a century and therefore most technical problems have been solved. Because cogeneration is a reliable, proven technology, there are fewer installation and operating problems compared with new, untested technology.

There are several barriers to the large-scale implementation of cogeneration. Although the operating costs of cogeneration facilities are relatively small, the initial costs of equipment and installation are relatively large. Also, multinational oil companies and central utility companies have substantial political influence in many countries. These companies emphasize their own short-term profits over the long-term environmental costs of inefficient use of non-renewable resources. Other barriers to cogeneration are the falsely depressed costs of fossil fuels, relative to their true, longer-term costs and future shortage.

Ex. 5 Answer the questions.

1. What was the main power source at the beginning of the twentieth century? 2. Why did the small power houses stop cogenerating? 3. What is the main difference between traditional generating systems and cogeneration systems? 4. What temperature can the exhaust gases generated by burning fuel reach? 5. Do both systems (traditional and cogeneration) release the same amount of energy? 6. What is the most important environmental reason to cogenerate? 7. Why is about 41% of the waste unavoidable? 8. Is energy lost whenever it is transformed? 9. What amount of the wasted energy could potentially be used in a more energy-efficient process? 10. Why can cogeneration be considered as an off-the-shelf technology? 11. Are the operating costs of cogeneration facilities small or large? 12. What is the reason of multinational oil companies and central utility companies to be against cogeneration?

Ex. 6 Match the words to make word combinations and give their equivalents in Russian. Use them in the sentences of your own.

1)	mechanical	a)	companies
2)	electric	b)	heat
3)	simultaneous	c)	generation
4)	generating	d)	resources
5)	waste	e)	implementation
6)	non-renewable	f)	process
7)	energy-efficient	g)	power
8)	environmental	h)	technology
9)	operating	i)	costs
10)	off the-shelf	j)	utility
11)	large-scale	k)	system
12)	oil	l)	impacts

Ex. 7 Rearrange the sentences to reproduce the text Cogeneration.

1. Besides, multinational oil companies and central utility companies emphasize their own short-term profits over the long-term environmental costs of inefficient use of non-renewable resources.
2. The exhaust gases produced by burning fuel can be hotter than 932 °F.
3. Steam was the main source of mechanical power at the beginning of the twentieth century.
4. Another benefit of cogeneration is that it is an off-the-shelf technology.
5. As electricity became more controllable, many small "power houses" adapted their systems to cogenerate both steam and electricity.
6. There are fewer installation and operating problems compared with new, untested technology.
7. Cogeneration is an excellent way to increase energy efficiency, which reduces both environmental impacts and operating costs.
8. From 1940 to 1970 the small power houses stopped cogenerating and bought their electricity from the utilities.
9. Cogeneration facilities capture some of that waste heat and use it to produce steam or more electricity.
10. There are several reasons why cogeneration is a beneficial technology.

11. There are several barriers to the large-scale implementation of cogeneration.
12. Although the operating costs of cogeneration facilities are relatively small, the initial costs of equipment and installation are relatively large.

LANGUAGE STUDY

Word Building

Ex. 8 Fill the table with missing words.

Verb, Noun	Adjective
Create	…
…	Possessive
Act	…
Attract	…
Mass	…
…	Resistant
Differ	…
…	Limitless
…	Logical
Progress	…
Reverse	…
…	Metallic
Gold	…
Convert	…
…	Protective

Ex. 9 Translate the following adjectives and point out the suffixes.
Obvious, numerous, various, dangerous, synchronous, continuous, powerless, sensorless, useless, suitable, applicable, allowable, desirable, measurable, appreciable, reasonable, controllable, recognizable, valuable, theoretical, formal, electromechanical, powerful, useful, active, generative, regulative, constructive, effective, relative, reactive, affirmative, negligible, feasible, dynamic, scientific, analytical.

Ex. 10 Read and translate the words with the same stem, state the part of speech.

Combined – combination – combinative – combinatorial – combine – to combine; efficient – efficiency – efficacy; reality – real – realism – realist – realistic – really; to realize – realization – realizable; controllable – controller – controlling – controls – controlled; compared – comparative – comparatively – to compare – comparison – comparable; to improve – improvable – improvement – improver; profit – to profit – profitable – profitably – profiteer; to distribute – distributable – distributary – distributed – distributing – distribution – distributive – distributor; various – variety – to vary – variable; to replace – replaceable – replacement.

Translation Difficulties

Предлог = для, чтобы, на, за, в *as for* = что касается; *for example* = например	They reconstructed the experiment *for* commission. *As for* this element… Take this substance *for instance/example*…
Предлог = в течение (период времени)	They have studied the phenomena *for* two years.
Союз = *so/as/since* = так как	He failed the exam *for* he missed the lectures.
Если бы не	If it were *not for* the professor I wouldn't cope with the test.

Ex. 11 Translate the sentences. Pay attention to the word for.

1. This scientist was the first to use tungsten for filament. 2. The professor was sent for immediately. 3. For a power station using combustion, the efficiency of the cycle is limited by the temperature at which the rotating machine can operate. 4. They always got tired during their experiment for the work they carried out was extremely difficult. 5. **D**ifferent types of meters are used for measuring alternating current. 6. As for cogeneration, it is known to be a highly beneficial technology. 7. "Laser" is an acronym for light amplification by stimulated emission of radiation. 8. It is necessary to have a large collection of

atoms in the excited state for the laser to work efficiently. 9. Persians had already been using windmills for 400 years by 900 AD in order to pump water and grind grain. 10. Wind turbines cannot be built everywhere simply because many places are not windy enough for suitable power generation. 11. For an automatic system to be successful it must tune a transmitter at least as accurately as it can be done manually. 12. The problem is far too involved for one to be able to solve it. 13. The data obtained cannot be regarded as evidence of the postulated reaction for the system is greatly complicated by other reactions. 14. Two hours are sufficient for the reaction to occur.

SPEAKING

Ex. 12 Read English idioms with the word "steam" and try to explain their meaning. Give Russian equivalents if any.

IDIOMS:

run out of steam; get/pick up steam; let/blow off steam

Ex. 13 Role-play an international conference and discuss the pros and cons of Cogeneration.

Work in groups: a) Perenco Representatives, b) Green Party Activists.

Use these phrases while:

– Giving reasons (Sometimes when we give opinions, we may want to give a reason): Firstly…; Secondly…; One reason is…; Another is…; To start with…; Added to that…; For one thing…

– Interrupting (Sometimes, if we are exchanging opinions with other people, we may want to interrupt them politely): Excuse me. Can I just say...?; Could I come in here…?; Sorry to interrupt but... Yes, but...

– Stopping someone from interrupting you: If you'd let me finish…; Just a minute…

Ex. 14 Make a presentation on one of the topics.

– History of Cogeneration;
– Common CHP Plant Types;
– Combined Heat and Power District Heating;
– Industrial CHP;
– Thermal Efficiency in a Cogeneration System.

Unit 9

Grammar: Set expressions. **D**erivative, Compound and Composite **P**repositions
Text: Nuclear Energy
Word building: The **M**ost Common Suffixes of Adjectives
Formation of Adjectives from Nouns
Formation of Adjectives from Verbs

GRAMMAR

Set expressions.
Derivative, Compound and Composite Prepositions

As a matter of fact (in fact) … – на самом деле, фактически	(In) so far … – на данный момент (пока)
No matter what … – Независимо от того, что	Just as… – точно так же, как; подобно тому, как
According to … – согласно, в соответствии с	At the expense of … – за счет, ценой
Compared with … – по сравнению	In spite of … – несмотря на
In case … – в случае	On the contrary… – напротив, в отличие от
Excluding … – исключая, за исключением	Instead of … – вместо того чтобы
In (one's) turn … – в свою очередь	In addition to … – в дополнение к, вдобавок к
Owing to … – вследствие, по причине, благодаря	Notwithstanding … – несмотря на, вопреки
the rest of … – остаток	At any rate … – в любом случае, так или иначе
To deal with … – иметь дело с, рассматривать	At least … – по крайней мере

See Grammar Module

Ex. 1 Read and translate the following sentences.

1. As a matter of fact, the methods used in measuring activities depend upon well-known equilibrium laws. 2. No matter what material the cathode may be made of, the electrons are always given off. 3. Our most accurate knowledge about climate sensitivity, at least so far, is based on empirical data from the earth's history. 4. In case one end of the wire is made positive by removing electrons from it, the shortage of electrons at this end will cause free electrons to be attracted toward it. 5. In fact, the heavier the substance, the more complicated is the atom. 6. Steam may be passed into an engine to produce mechanical energy and the latter in its turn may drive a dynamo to produce electrical energy. 7. The efficiency of the machine is 80%, the rest of the power being lost in the resistance to friction. 8. The question of setting a unit of e.m.f. can be dealt with in the same manner as for current. 9. At any rate one cannot carry out experiments without lab technique having been mastered well enough. 10. According to historical data, Democritus thought all substances to be made up of tiny particles which could not be further divided. 11. The modern diodes differ but little from the early models in so far as its principle of operation is concerned. 12. Just as there are some solids which conduct electricity much better than others, so among liquids we have good and poor conductors of electricity. 13. When a gas expands against an external pressure it does work at the expense of the kinetic energy of its molecules. 14. On a contrary, in certain cases friction becomes a help necessary instead of being a difficulty causing only wear and losses. 15. The aircraft carries 461 people excluding the crew and cabin staff.

Ex. 2 Fill in the blanks with the words from the box. Translate the sentences.

1. according to; 2. as a matter of fact; 3. at the expense; 4. nevertheless; 5. at least; 6. in fact; 7. in its turn of; 8. in dealing with; 9. so far; 10. in addition to; 11. notwithstanding; 12. in case; 13. the rest of

1. …, all the atoms were formed in the first few minutes of the universe existence. 2. One of the difficulties in using transistors for producing optical devices is that transistor components are intended to

conduct electricity, … some of the time. 3. … this electronic force is direct, the current is direct. 4. …, the method of connecting the armature and field winding of the series motor is exactly the same as for the corresponding generator. 5. Steam may be passed into an engine to produce mechanical energy and the latter … may drive a dynamo to produce electrical energy. 6. In 1819 Volta returned to his native town Como where he spent … his life. 7. … direct currents any potential difference in excess of five volts should be considered unsafe. 8. … the data made scientists look for new conducting materials and for practical applications of the phenomenon. 9. …, manufacturing of antiferromagnets has been quite complex and time-consuming. 10. Electricity is used in every home … its industrial applications. 11. Nowadays science is developing at a great pace. …, progress in some areas remains slow and difficult. 12. No single state should ensure its own security … another. 13. … the reductions the global threat posed by nuclear weapons has not subsided.

Ex. 3 Translate the following sentences.

1. В случае необходимости большая часть тепла может быть выведена. 2. Идея атома была впервые введена Демокритом, которого, на самом деле, мы должны назвать отцом современной атомной теории. 3. Согласно идее М.В. Ломоносова, наука должна служить людям. 4. Несмотря на некоторые замечания, исследование А.-М. Ампера внесло огромный вклад в науку об электричестве. 5. Проблема ресурсного обеспечения не исчезла. Наоборот, кажется, она становится все более актуальной. 6. В дополнение к русскому языку, М.В. Ломоносов хорошо владел иностранными языками, а именно немецким, французским, греческим и латынью. 7. На самом деле первый закон термодинамики – это просто закон сохранения энергии, применяемый для преобразования тепла в работу. 8. В любом случае, будучи преобразованной в тепло и потраченной впустую, часть энергии, подаваемой на любой двигатель или генератор, теряется внутри самой машины. 9. Гиперболические уравнения будут рассмотрены в его последнем исследовании.

VOCABULARY

1. **Nuclear** ['nju:klɪə] *(adj.)* – ядерный, атомный

The country had agreed to disable its main **nuclear** fuel production plant by the end of the year.

2. **Release** *(v.)* – освобождать, высвобождать

Highly toxic dioxins were **released** into the air.

3. **Nucleus** *(n.)* – *(pl. Nuclei)* – ядро

This **nucleus** has captured the slow-moving neutrons.

4. **Fission** [ˈfɪʃən] *(n.)* – деление, расщепление

Industrialized nations should increase their efforts in supporting energy efficiency, renewable energy, and nuclear **fission**.

5. **Fusion** [ˈfju:ʒən] *(n.)* – слияние, сплав, объединение

The energy generation of the sun is based upon the thermonuclear **fusion** of hydrogen into helium.

6. **Split (apart)** *(v.)* – расщеплять, раскалывать; разделять

German scientists have managed **to split** the atom, releasing 200 million volts.

7. **Neutron** [ˈnju:trɒn] *(n.)* – нейтрон

Neutron was discovered by James **C**hadwick in 1932.

8. **Positively charged** *(adj.)* – положительно заряженный

The nucleus contains **positively charged** protons and electrically neutral neutrons.

9. **Explosion** [ɪkˈsploʊʒən] *(n.)* – взрыв

The fire was caused by a gas **explosion**.

10. **Chain reaction** (nuclear reaction) *(n.)* – цепная реакция

Maybe this explosion triggered the **chain reaction**.

11. **Hydrogen** [ˈhaɪdrədʒ(ə)n] *(n.)* – водород

Compressed **hydrogen** has an energy density of only 5.6 megajoules per liter.

12. **Uranium** [jʊəˈreɪnɪəm] *(n., adj)* – уран, урановый

Depleted **uranium** has the same chemical and physical properties as natural **uranium**.

13. **Isotope** [ˈaɪsətəʊp] *(n.)* – изотоп

Even if you take a neutron away, leaving you with two protons and just one neutron, that **isotope** of helium is stable as well.

14. **Species** ['spi:ʃi:z] *(n.)* – вид, разновидность, класс
Many plant and animal sp**ecie**s are found only in the rainforests.
15. **Break** ap**art** *(v.)* – разбить на составляющие; разъединить
The explosion caused the aircraft **to break** ap**art.**

Ex. 4

a. Match the words with their definitions.

1) nucleus
2) fission
3) fusion
4) neutron
5) particle
6) explosion
7) nuclear reaction
8) hydrogen
9) uranium
10) isotope

a) a process in which two nuclei, or a nucleus and an external subatomic particle, collide to produce one or more new nuclides
b) the process of dividing the nucleus of an atom, resulting in the release of a large amount of energy
c) the central part of an atom, usually made up of protons and neutrons
d) an extremely small piece of matter
e) a part of an atom that has no electrical charge
f) a chemical element that is a heavy, radioactive metal, used in the production of nuclear power and in some types of nuclear weapon
g) the technique of joining atoms in a reaction that produces energy
h) a form of an atom that has a different atomic weight from other forms of the same atom but the same chemical structure
i) a violent burst, often with a loud noise
j) a chemical element that is the lightest gas, has no colour, taste, or smell, and combines with oxygen to form water

b. Translate the terms with the word <u>nuclear</u>.

Nuclear energy/power; nuclear power plant; nuclear fuel; nuclear industry; nuclear facility; nuclear fusion; nuclear energy; nuclear fission; nuclear mass; nuclear physics; nuclear weapon; nuclear tests; nuclear

component; nuclear device; the nuclear core of the congregation; the operator of a nuclear power plant; nuclear bomb; concentrated nuclear fuel; aboveground nuclear tests; detection of nuclear explosions; atomic/nuclear energy; atomic/nuclear age; nuclear scientist.

Ex. 5 Jumbled words.

a. Unjumble the words:

Model: Soiteop ----> isotope

nxsieploo – …; enghdroy – …; sfinsio – …; eeemlnt – …; dirrouerfumth – …

b. Make 5 more jumbled words for your desk mate to solve.

READING

Nuclear Energy

Nuclear energy is one that can be released from the nucleus of an atom. There are two ways to produce this energy, either by fission or fusion. Fission occurs when the atomic nucleus is split apart. Fusion is the result of combining two or more light nuclei into one heavier nucleus. Most often, when people discuss nuclear power, they are talking about nuclear fission. Power production from fusion is still in its infancy.

Atoms are made up of several parts: protons, neutrons, electrons, and a nucleus. A nucleus is the positively charged center of an atom. Protons are positively charged particles, and neutrons are uncharged particles. Electrons orbit around the nucleus and are negatively charged. Fission can occur in two ways – first, in some very heavy elements, such as rutherfordium, the nucleus of an atom can split apart into smaller pieces spontaneously. With lighter elements, it is possible to hit the nucleus with a free neutron, which will also cause the nucleus to break apart.

Either way, a significant amount of energy is released when the nucleus splits. The energy released takes two forms: light energy and heat energy. Radioactivity is also produced. Atomic bombs let this energy out all at once, creating an explosion. Nuclear reactors let this

energy out slowly in a continuous chain reaction to make electricity. After the nucleus splits, new lighter atoms are formed. More free neutrons are thrown off that can split other atoms, continuing to produce nuclear energy. The first controlled nuclear reaction took place in 1942.

The atoms of different elements have different numbers of particles. Some elements are very simple and light. Hydrogen is the simplest and lightest element because it has only one proton, one electron, and no neutrons. In contrast, the heaviest element in nature is uranium. (Some heavier elements have been artificially produced in laboratories, but these elements do not exist in nature.) Uranium atoms contain ninety-two protons and ninety-two electrons. The number of neutrons can vary, depending on the isotope of uranium under consideration. An isotope is a "species" of an element. It contains a different number of neutrons from other isotopes of the same element. Generally, uranium nuclei contain either 143 or 146 neutrons.

For nuclear energy, uranium is the most important element. Uranium is used as fuel to produce nuclear reactions. It makes a good fuel source because uranium atoms are so big and heavy. They are easier to break apart. These large atoms can be thought of as a house built with playing cards. The house becomes increasingly unstable as cards are added, and is more likely to fall apart the bigger and heavier it gets. In a nuclear power plant, the goal is to create fission from uranium fuel and to be able to speed the reaction up (or slow it down) to control the amount of energy being produced.

Ex. 6 Answer the questions.

1. What are the ways to produce nuclear energy? 2. What is fusion? 3. What is the difference between protons, neutrons and electrons? 4. In what way can fission occur? 5. How do atomic bombs let out the energy released? 6. When are new lighter atoms formed? 7. Do the atoms of different elements have the same numbers of particles? 8. Why is hydrogen the simplest and lightest element? 9. How many neutrons do uranium nuclei generally contain? 10. What is used as fuel to produce nuclear reactions? 11. Why does uranium make a good fuel source?

Ex. 7 Match the words to make word combinations and give their equivalents in Russian. Use them in the sentences of your own.

1) power	a) produced
2) positively	b) production
3) uncharged	c) energy
4) free	d) reactors
5) light	e) charged
6) atomic	f) reaction
7) nuclear	g) particles
8) chain	h) unstable
9) artificially	i) bombs
10) increasingly	j) neutron

Ex. 8 Read the text once more and give a heading to each paragraph. Complete the chart with the headings and the keywords from the text.

Headings to the paragraphs	Keywords (3-5)
§ 1 …	

LANGUAGE STUDY

Word Building

Ex. 9

a. Use suffixes to form adjectives.

n + *-less* = *adj:* power, use, name, meaning, point, help, sense, worth;

n + *-ous* = *adj:* instant, disaster, industry, enormity, numeral;

n + *-al* = *adj:* optic, spectre, experiment, inertia;

n + *-ful* = *adj:* success, use, fit;

v + *-able/-ible* = *adj:* to move, to connect, to heat, to reduce, to suit, to prove, to control, to process, to observe, to use, to understand, to afford, to sustain, to avail, to consider, to wear, to reason, to accept, to change, to fashion, to charge, to access;

v+ *-ive* = *adj:* to attract, to refract, to negate, to posit, to conduct, to destruct.

b. Read the adjectives, point out the suffixes and give the nouns of the same stem.

Leaden – ..., natural – …, electric – ..., efficient – ..., economical – ..., environmental – ..., powerful – ..., harmful – ..., traditional – ...

c. Read the adjectives, point out the suffixes and give the verbs of the same stem.

Dependent – ..., attractive – ..., habitable – ..., alterative – ..., workable – ..., unlimited – ..., adaptable – ..., comparable – ..., reliable – ...

Ex. 10 Read the chains of derivatives and give their Russian equivalents.

Commune – communal – (un)communicable – communicant – communicate – communication – (un)communicative – communicator; cover – coverage – covering – discover – discoverer – discoverable – discovery – uncover – uncovered – uncovering; (in)frequency – frequent – frequentative – frequenter – frequently – infrequent; physic – physical – physician – physicist – physically – physico-chemical – physics – physiologic(al) – physio – physiology – physiotherapy; rely – (un)reliable – reliably – reliance – reliant – reliability; sense – senseless – sensibility – sensible – sensibly – sensitive – sensitivity – sensor – insensible – insensibility – insensitive; technic(al) – technically – technician – technics – technique – technocrat – technography – technologic(al) – technologist – technology – high-tech.

Translation Difficulties

either... or	*или... или... , как ... так и, чем ... и*
neither ... nor	*ни... ни...*

Ex. 11 Translate the sentences. Pay attention to the word <u>either … or, neither … nor</u>.

1. If the direction of either the magnetic or electronic flux is reversed, the direction of the travel of the radio wave is reversed too. 2. Neither

solidity nor rest exists from the molecular point of view. 3. If either the transmitter or the receiver is detuned, the operator misses the transmission. 4. In any event, current theories either empirical or electronic, appear to account for this result. 5. Greeks could neither understand their observations in the field of electricity nor make any use of them. 6. The primary energy source for heating gas may be either ordinary combustion or fission. 7. Without friction we could neither walk nor stand. 8. Electricity can neither be created nor destroyed. 9. Many lasers give off invisible radiation either infrared or ultraviolet. 10. The numbers are either odd or even. 11. Such satellites can contain either television cameras or photographic equipment for transmitting pictures to the Earth.

SPEAKING

Ex. 12 Analyze tables 1 and 2 and make generalizations about the data. Use the plan given below.

Plan:

1. What does the table show? 2. What do the numbers represent? 3. Make a thesis (a statement or an opinion that is presented with evidence in order to prove that it is true). 4. Support your thesis. 5. Make an appropriate conclusion.

Use the phrases:

The table shows ... A wide range in the percentage ... The rest of … A number of ... According to the data ... If to compare with ... On the contrary… Vice versa … We can sum up ... (In) so far… etc. (*Use Prepositional Phrases and Compound Prepositions from the Grammar table).*

Table 1. World Total Energy Supply

Total Energy Supply (TES) provides a means to evaluate the energy supplied to an energy system from all fuel types. It accounts for energy supplied in its primary form, prior to any conversions such as coal to electricity.

Type	*%*
Fossil fuels	77%
Biofuels & waste	9%
Nuclear	4%
Hydro	7%
Wind & solar	3%
Geothermal	0.3%
Marine	0.0015%

Source: Annual shares IEA (*The International Energy Agency)*.

Table 2. Top five nuclear electricity generation countries

Country	Number of nuclear power plants	Nuclear electricity generation capacity (million kilowatts)	Nuclear electricity generation (billion kilowatt hours)	Nuclear share of country's total electricity generation
US	131	98.12	809.41	19%
France	71	63.13	382.40	70%
China	43	45.52	330.12	5%
Russia	48	28.37	195.54	18%
South Korea	27	23.09	138.81	25%

Source: U.S. Energy Information Administration, International Energy Statistics.

Ex. 13 Search the Internet and find more information about nuclear energy. Speak on:

- Types of nuclear reactors; be ready to explain the abbs FNR, LWRs, PHWRs, GCRs;
- The first industrial nuclear power station;
- The peaceful uses of atomic energy.

Module 4. Renewable energy sources

Unit 10

Grammar. Participle I and Gerund
Text. Renewable Energy
Word building. The suffixes of adverbs and numerals

GRAMMAR

Participle I and Gerund (Сравнение Причастия I и Герундия)

Participle I	Gerund
Функция в предложении	
Определение, обстоятельство	Любой член предложения
Наличие предлога	
Предлог не ставится. Может стоять союз *when (while)*	В функции обстоятельства и определения часто стоит предлог
Наличие местоимения или существительного	
Перед причастием не ставится	Перед герундием может стоять притяжательное местоимение или существительное в притяжательном или общем падеже

See Grammar Module

Ex. 1 Compare the phrases. Define the Participle or the Gerund.

working motor – working model
boiling water – boiling point
melting point – melting ice
freezing liquid – freezing point
reading student – reading lamp
operating engine – operating time
burning fuel – burning cycle
cooling device – air-cooling system

Ex. 2 Define the function of the Participle or the Gerund in the sentences.

1. Generally speaking, doing work on an object simply means transferring energy to that object. 2. Having used a laser beam, scientists obtained accurate calculations of Jupiter's temperature. 3. The temperature at which the melting of a substance occurs is the melting point of that substance. 4. Using electricity on a large scale opens up great possibilities in various fields of science and everyday life. 5. Moving through the magnetic field, the coil of wire will cut the lines of force. 6. In 1879 Edison succeeded in creating an improved lamp which solved the problem of getting cheap electricity on a large scale. 7. In selecting the propellant combinations, chamber pressures and temperatures must be considered. 8. There are in existence today a wide variety of instruments capable of detecting and measuring various types of instruments. 9. Connecting two conductors of the same material, length and size in parallel has the same effect as a single conductor twice as large as either of the two. 10. While absorbing a quantum of energy from some outside source, an electron jumps to a higher level. 11. Boron is used in making solid propellants for rockets. 12. Gamma rays differ from visible light only in having a much higher frequency and a much shorter range. 13. Scientifically speaking, energy is the capacity of doing work. 14. Overheating an engine is prevented by providing a cooling system. 15. Knowing the landing speed and the load it is possible to calculate the necessary wing area.

Ex. 3 Find the Participle Construction and the Gerundial Construction. Translate the sentences.

1. The failure was due to the operator's having been careless in using the instrument. 2. The beam travelled 800,000 km in space, its velocity approaching that of light. 3. We know of the atomic reactor being fed with uranium. 4. The first incandescent lamps consisting of a glass bulb with a carbon rod serving as a filament were imperfect, their life being only 30 minutes. 5. We know of his having worked at the improvement of the device for several years. 6. The transformer being of high efficiency, the power input to the primary winding will be but

slightly more than the amount of power being supplied by the secondary one. 7. **A**s we know, mechanical energy is transformed into heat, the process being the example of the conservation of energy. 8. Very small transformers are cooled by the atmosphere, no special cooling arrangements being necessary. 9. Several remarkable **R**ussian scientists have made a great contribution to electrical engineering, P.N. **Y**ablochkov being the best known to everyone. 10. D.I. Mendeleyev's having created the Periodic Table was of great importance to chemistry.

Ex. 4 Complete the sentences with the correct form of the Participle or the Gerund.

1. Various methods of (cool) transformers are adopted in practice, (depend) upon the size and the local conditions. 2. Every electrical circuit (carry) alternating current radiates a certain amount of electrical energy in the form of electrical waves. 3. (Introduce) several carbon rods instead of one, the scientists made the incandescent lamp serve a longer period. 4. **A** steam engine is driven by steam (go) through the cylinders. 5. In (rotate) the magnet, we also rotate its magnetic field. 6. (Produce) by the laser, the narrow intense beam travels great distances without spreading. 7. (Launch) a satellite is done by (fire) it from a multistage rocket. 8. (Make) the experiment, the researcher recorded the data. 9. (**C**onnect) a galvanometer to the circuit, we were able to detect the current. 10. (**U**nderstand) the physics of the Sun has more than academic interest. 11. We know of the experiment (carry out) in the laboratory now. 12. This is the result of our not (specify) input and output variables for the network.

VOCABULARY

1. **Re**n**e**w**able** *(adj.)* – возобновляемый

The future roles of hydropower and other **re**n**e**w**able** forms of energy ought to be studied.

2. **Rege**n**e**r**ate** *(v.)* – воспроизводить

This highly efficient technique enables communities to **rege**n**e**r**ate** even badly degraded soil.

3. **Exhaustible** *(adj.)* – небезграничный; исчерпаемый

The supply of energy depends, to a large extent, on systems that are unsustainable owing to the depletion of **exhaustible** fossil-fuel resources.

4. **Biomass** *(n.)* – биомасса

Biomass absorbs carbon dioxide from the atmosphere.

5. **Heating** *(n.)* – подогрев

This room has underfloor **heating**.

6. **Cooling** *(n.)* – охлаждение

All engines were switched to an all-electric **cooling** system to reduce power loss and fuel consumption.

7. **Fossil fuel** – ископаемое топливо

Fossil fuel technology has advanced more quickly than renewables technology.

8. **Petroleum** *(n.)* – бензин

Extraction, refining and burning of **petroleum** fuels all release large quantities of greenhouse gases, so petroleum is one of the major contributors to climate change.

9. **Carbon dioxide** – двуокись углерода

As the source of available carbon in the carbon cycle, atmospheric **carbon dioxide** is the primary carbon source for life on earth.

10. **Emission** *(n.)* – выпуск; выделение (тепла, света, запаха)

Passenger transport still generates a significant part of total greenhouse gas **emission** so we need to think about more sustainable transport systems.

11. **Contribution** *(n.)* – вклад

This invention made a major **contribution** to road safety.

12. **Access** *(n.)* – доступ

The system has been designed to give the user quick and easy **access** to the required information.

13. **Surface** *(n.)* – поверхность

Adsorption involves the transfer of a component onto a solid **surface**.

14. **Turbine** *(n.)* – турбина

A one-megawatt **turbine** can produce enough electricity annually to meet the needs of 700 households.

15. **D**am *(n.)* – дамба; плотина
A dam is a barrier that stops or restricts the flow of surface water or underground streams.
16. **O**pera**t**e *(v.)* – действовать; работать; управлять
How do you **o**pera**t**e the remote control unit?
17. **T**idal p**o**wer plan**t** – приливная электростанция
The world's first large-scale **t**idal p**o**wer plan**t** was in France, which became operational in 1966.
18. **Photovoltaic** sys**t**em – фотоэлектрическая система
A p**hotovoltaic** sys**t**em consists of an arrangement of several components, including solar panels to absorb and convert sunlight into electricity.
19. **Collector** *(n.)* – анод (фотоэлемента); коллектор (для солнечных установок); коллектор (транзистора или СВЧ-прибора)
The electrons diffuse through the base from the region of high concentration near the emitter toward the region of low concentration near the **collector**.
20. **Remote area** – удалённая область
More satellites are needed to provide telephone coverage in **remote areas**.

Ex. 5

a. Match the words with their definitions.

1) turbine
2) renewable
3) exhaustible
4) collector
5) biomass
6) petroleum

a) relating to forms of energy that are produced using the sun, wind, etc.
b) the region in a transistor into which charge carriers flow from the base
c) capable of being used up
d) any of various types of machines in which the kinetic energy of a moving fluid is converted into mechanical energy
e) a thick, black to yellow, flammable liquid mixture of hydrocarbons
f) vegetable matter used as a source of energy

b. Translate the terms with the word cooling.

Active cooling system; air cooling; forced air cooling; forced air cooling system; brake cooling; brake cooling oil; brake cooling oil filter; brake cooling oil filter check; charged battery cooling time; closed-cycle cooling water; emergency equipment cooling water; direct cooling; direct cooling system; emergency cooling; emergency cooling function; main loop cooling system.

READING

Renewable Energy

Renewable energy is the energy that is regenerative or, for all practical purposes, virtually inexhaustible. It includes solar energy, wind energy, hydropower, biomass (derived from plants), geothermal energy (heat from the earth), and ocean energy. Renewable energy resources can supply energy for heating and cooling buildings, electricity generation, heat for industrial processes, and fuels for transportation. The increased use of renewable energy could reduce the burning of fossil fuels (coal, petroleum, and natural gas), eliminate associated air pollution and carbon dioxide emissions, and contribute to national energy independence and economic and political security. There are power plants that burn wood, agricultural residues, and household trash to produce electricity.

Renewable energy makes important contributions to world energy supplies. Hydroelectric power is a major source of electrical energy in many countries. Hydropower, produced from flowing water passing through hydroelectric turbines, is the leading renewable energy source. Most hydropower is produced at large dams, although there are many small systems operating around the world, such as the small hydropower plant in Nepal, which provides power for the tourist and market town near Mt. Everest. The production of hydroelectricity from year to year varies with rainfall.

In developing countries, many people do not have access to or cannot afford electricity or petroleum fuels and use biomass for their

primary energy needs. Biomass includes wood, agricultural crops and residues, municipal refuse, wood and paper products, manufacturing process waste, and human and livestock manure. It can be used to heat homes and buildings, produce electricity, and as a source of vehicle fuel.

Geothermal energy (heat from the earth) created deep beneath the earth's surface is tapped to produce electricity in twenty-two countries. Geothermal hot springs can also heat buildings, greenhouses, fish farms, and bathing pools.

The world's oceans are a vast and practically untapped source of energy. There are a few operating wave and tidal power plants around the world, and several experimental ocean thermal energy conversion (OTEC) plants have also been built. In Hawaii, a small OTEC plan was built which uses the temperature of warm surface water to evaporate cold seawater in a vacuum to produce steam that turns a turbine and generator.

The simplest uses of solar energy are for drying crops, and heating buildings and water. Solar-heated homes and solar water heaters can be found in nearly every country around the world. Solar water heaters use collectors to heat water that is stored in a tank for later use. Homes can be heated by using a stone floor to absorb sunshine coming through windows, or by using solar collectors to heat a large tank of water that can be distributed for heating at night. Concentrated sunlight can be used to produce high-temperature heat and electricity. Photovoltaic (PV) systems are based on solar electric cells, which convert sunlight directly to electricity. They can be used to power hand calculators or in large systems on buildings. Many PV systems are installed in remote areas where power lines are expensive or impossible.

Ex. 6 Answer the questions.

1. What is the difference between renewable forms of energy and conventional ones? 2. How can renewable sources be used? 3. How can the use of renewable energy reduce air pollution? 4. What type of renewable energy is used most often? 5. Where is the most hydropower used? 6. What energy is created deep beneath the earth's surface?

7. What is biomass? 8. What sources of renewable energy are considered to be unlimited? 9. How can the houses be heated by the sun? 10. How do photovoltaic systems operate? 11. What types of renewable energy do you know? 12. What regions of Russia can use solar energy?

Ex. 7 Complete the sentences using the correct form of the word.

1. (Renew) energy is the energy that is (generate) or virtually inexhaustible.
2. Renewable energy resources can supply energy for (heat) and (cool) buildings and electricity (generate).
3. Renewable energy makes important (contribute) to world energy supplies.
4. In (develop) countries many people do not have access to or cannot afford electricity.
5. There are a few (operate) wave and tidal power plants around the world.
6. The (simple) uses of solar energy are for drying crops, and heating buildings and water.
7. Solar water (heat) can be found in nearly every country around the world.
8. (Concentrate) sunlight can be used to produce high-temperature heat and electricity.

Ex. 8 Make the pairs of words.

1) practical	a) plant
2) geothermal	b) water
3) electricity	c) purposes
4) industrial	d) supplies
5) fossil	e) energy
6) carbon dioxide	f) processes
7) energy	g) generation
8) world energy	h) emissions
9) flowing	i) fuels
10) hydropower	j) independence

LANGUAGE STUDY

Word Building
Наиболее употребительные суффиксы наречий и числительных

Суффиксы наречий			Суффиксы числительных		
Суфф.	**значение**	**пример**	**Суфф.**	**значение**	**пример**
(прил.+) –ly	таким образом, способом	*entirely* всецело	*–teen*	количественное числительное от 13 до 19	*fifteen* пятнадцать
–ward(s)	направление движения	*backwards* назад	*–ty*	десятки	*seventy* семьдесят
–wise	в таком направлении, таким способом	*clockwise* по часовой стрелке	*–th*	порядковое числительное	*the fourth* четвертый

Ex. 9

a. Make the adverbs from the following adjectives.

Clear, careless, cautious, quick, load, patient, different, impressive, sad, economic, smooth, proper, heavy, terrible, harmful, active, scientific, dangerous, transparent, artificial.

b. Make the ordinal numbers.

One, two, three, four, five, ten, eleven, twelve.

c. Translate the pairs: adjective-adverb (exceptions).

Good – well, difficult – with difficulty, direct – direct, high – high, late – late, near – near, short – short, fast – fast, hard – hard, early – early, daily – daily, wrong – wrong, straight – straight.

Ex. 10 Complete the following sentences with the adjective and adverb in brackets. Use each word once only.

1. … control is widely employed in many technological and biological systems. Long text messages are … split into multiple messages and sent as a series. (automatic / automatically)

2. New testing methods have made the process much more ... Quality control now runs more ... (efficient / efficiently)

3. These additives can have pollution impacts if not ... disposed of after use. This task can be done by just using the ... file. (proper / properly)

4. **D**emand for electricity is ... lower in the evening. Statistics show that there is a ... fall in demand after 10 p.m. (general / generally)

5. People are becoming more interested in ... friendly products. There is a growing interest in ... issues. (environmental / environmentally)

6. Safety procedures must be ... observed to avoid accidents. All products are manufactured in ... compliance with the quality standards. (strict / strictly)

Translation **Difficulties**

Ex. 11 Translate the sentences. Pay attention to the word provided.

1. He provided all the necessary documents. 2. Ohm's law provided the possibility of determining resistance provided the voltage and current are known. 3. Provided the Earth's mass were twice as great as it is, it would attract any body twice as strong. 4. The exploration of the Moon provided a great deal of scientific knowledge. 5. On-board radio systems provided reliable communication with the Earth. 6. A vehicle is considered a sounding rocket provided it rises above the atmosphere out to 4,000 miles. 7. These transitions of electrons may occur provided sufficient energy is available. 8. He will define other parameters provided you tell him the weight and the density of the substance. 9. The number of workshops and plants provided with automatic control is increasing. 10. The researchers provided an update on the status of the project.

SPEAKING

Ex. 12 Comment on the following statements:

- The advantages of renewable energy sources are their |inexhaustibility, a positive impact on the preservation of the ecological and thermal balance of the planet, and the availability of applications;
- Renewable energy sources are mainly a technology but not a fuel, unlike fossil fuels;
- Solar, wind, hydro and geothermal energy are absolutely free and always available;
- Renewable energy sources have one disadvantage. It is a low degree of concentration, so it is impossible to transfer the |received energy over long distances.

Give your reasons using the following phrases:

I believe....	It is considered…
I suppose....	I'm afraid I have to disagree.
In my opinion....	That's not entirely true.
It seems to me that....	On the contrary…
From my point of view....	I'm not so sure about that. **M**aybe, but
I'd like to point out that....	it seems to me that….
Some people say that....	I partly agree, but I still believe that….
Well, it is considered that....	I don't agree. In my opinion, ….
It goes without saying that....	I completely disagree. To me,….

Ex. 13 Read the following dialogue, try to act out it or a similar dialogue.

Mr A: Hi, **Mr B**! It's **Mr A** here. I'm calling to find out how your project's coming along.

Mr B: **N**ot bad. I'm mostly on schedule.

Mr A: When do you plan to finish your material about renewable energy sources?

Mr B: Just a moment, I'll look at the planner. Here it is, um… I believe by the end of the next month.

Mr A: Why so late? Any difficulties?

Mr B: You see, I'm not a specialist in this area, as you know! So I've got some more issues to find out.

Mr A: Why haven't you asked me for help? I wonder what you fail to know about renewables.

Mr B: Let's start with their application.

Mr A: Well, just general remarks! All types of renewables are used to produce energy and replace fossil fuels.

Mr B: Does it mean that in future they will be the main sources of energy on the planet?

Mr A: Right you are! Technology is developing very rapidly! But not all countries can afford renewables because of the climate features.

Mr B: OK. I see. Let's go through some information about types of renewables then.

Mr A: If I am not mistaken, there are five of them: hydroelectric power, biomass, geothermal energy, tidal power and solar energy, the latter being the most promising among others.

Mr B: It means engineers should design more solar panels to make this type of energy more widespread.

Mr A: Sure. Unfortunately, only the countries with more than 350 sunny days a year can use it! What is left? Oh, yes, hydropower! The energy is produced by falling water. Do you know that it's the most popular one since all locations have water pools? Hydropower provides more than 60% of all renewable power around the world.

Mr B: Yes, I can remember the biggest hydropower plants in Russia, China, Southern and Northern America.

Mr A: Yes, you are absolutely right! As you see, you've managed to cope with your tasks yourself!

Mr B: Thanks a lot, Mr A! Bye.

Mr A: You're welcome. I'll get back to you in a week. Bye for now.

Unit 11

Grammar. Impersonal and indefinite personal sentences
Text. Solar Cells
Word building. Compound words

GRAMMAR

Impersonal and indefinite personal sentences
(Безличные и неопределенно-личные предложения)

Формальное подлежащее	Сказуемое	Перевод
It	V	безличной конструкцией (*Доказано..., Известно..., Невозможно...*)
It was impossible to dissolve the substance in water.		
One We, you, they	V	неопределенно-личной или безличной конструкцией (*Считают..., Утверждают..., Необходимо...*)
One must be careful when handling gas. *They say he will complete the test on Monday.*		

See Grammar Module

Ex. 1 Read and translate the following indefinite personal sentences.

1. One should distinguish between an electromotive force and a potential difference. 2. We can turn mechanical energy into electrical energy by using a generator. 3. One must know that like charges repel and unlike charges attract. 4. One may also say that the latent heat of the vaporization of water is the quantity of heat required to convert 1 gr of water at 1,000 °C into 1 gr of steam. 5. We should remember the "Bernouilli effect" because it is one of the basic laws of thermodynamics. 6. They say that solids and liquids are almost incompressible. 7. You should clearly understand that the direction and magnitude of the electric forces are represented by the lines of force. 8. When the entire system has reached thermal equilibrium, you may begin taking

the measurements. 9. One may write two loop equations and make appropriate elementary substitutions to obtain a differential equation for the current. 10. You can extend the equivalent circuit to include second and higher-order generators. 11. One cannot expect a complicated problem like that of using wave power to be solved in near future. 12. Calculations based on such data give values which agree with the results obtained from the curves we get by the conventional method. 13. We had to repeat the experiment to check up previous results. 14. They are concerned with only the latter effect.

Ex. 2 Read and translate the following impersonal sentences.

1. When considering storage batteries, it is often convenient to use "ampere hours" in calculating the charge and discharge of a battery. 2. It is easy to understand why warmer water evaporates more rapidly than a cold one. 3. It may happen that many of the evaporated molecules finally return to the surface of the liquid. 4. It is well known that electrical charges in motion constitute current. 5. It has been found that laser beams can be turned into electricity with very high efficiency. 6. It is obvious that a current will not flow in a circuit made up entirely of metallic wires. 7. It requires almost no power to operate the grid as there is normally no current flowing in the grid circuit. 8. It is frequently necessary to find the components of a force in other than horizontal and vertical directions. 9. It is necessary to determine the length of transmission lines required to transform the resulting impedance point. 10. It is evident that magnetic amplifiers of this type have a limitation on their speed of response. 11. It is important to ensure that the noise arising from all sources is negligible. 12. In the case of metals, it is well known that condensation at low temperatures produces disordering and related changes in conductivity. 13. It is believed that a barrier layer in this region exists. 14. We cannot predict when any individual resistor will fall. 15. One will have to make further simplifying calculations.

Ex. 3 Translate the following sentences.

1. Кислород трудно выделить из химических соединений, так как большинство из них очень стабильны. 2. При исследовании структуры атома, принято выражать энергию в электрон-вольт единицах.

3. В прошлом году конгресс проводили в августе. 4. Говорят, что охлаждающая жидкость должна быть как можно более низкой температуры. 5. Для ускорения таких тяжелых частиц, как протоны, используют постоянное магнитное поле. 6. Чтобы изучить принцип действия проводников и диэлектриков, можно провести следующий простой эксперимент. 7. При предварительном обсуждении было принято, что все силы лежат в одной плоскости. 8. Предположим, что диафрагма заряжена положительна. 9. Иногда ошибка в расчетах может быть получена из-за неточных измерений. 10. Очень сложно дать численную оценку этим эффектам. 11. Особый интерес представляет определение амплитуды сигналов в данном случае. 12. Доказали, что данные цепи имеют схожие резонансные характеристики с резонансными цепями. 13. Предполагается, что остальные элементы цепи не имеют шума. 14. Отмечали максимальное рабочее напряжение. 15. Установили, что полученные значения соответствуют тем, что были получены традиционным способом.

VOCABULARY

1. **Solar electric cell** – солнечная электрическая батарея

A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect.

2. **Convert** *(v.)* – преобразовывать

Hydraulic pumps **convert** mechanical energy into hydraulic energy or vice versa.

3. **Absorption** *(n.)* – поглощение; абсорбция

Radiation a**bsorptio**n efficiency depends on the orientation of the molecules in the structures.

4. **Ionization** *(n.)* – ионизация

Widespread **ionizatio**n occurs readily in the earth's upper atmosphere.

5. **Crystal** *(n.)* – кристалл

Silicon **crystal**s grown in a laboratory convert light into electrical energy.

6. **Negative charge, positive charge** – отрицательный заряд, положительный заряд

An electric current is a flow of electric charges, and for that to happen, you need an imbalance between **positive** and **negative charge**s.

7. **State** *(n.)* – состояние

The selection of an ionization source depends on the substance **state** before ionization.

8. **Hole** *(n.)* – *зд.* дырка

The electron-**hole** pair is the fundamental unit of generation and recombination in inorganic semiconductors.

9. **Photon** *(n.)* – фотон

The modern **photon** concept originated during the first two decades of the 20th century with the work of Albert Einstein.

10. **Lattice** *(n.)* – решётка

A crystal is made up of a periodic arrangement of one or more atoms at each **lattice** point.

11. **Pole** *(n.)* – полюс

Most weather satellites are stationed over the equator or travel over the **poles**.

12. **External circuit** – внешний контур

This potential difference can drive an electric current if an **external circuit** is attached to the terminals.

13. **Conductivity** *(n.)* – проводимость

Copper has a high **conductivity**.

14. **Open circuit** – обрыв в цепи (холостой ход)

Open-circuit voltage is the difference of electrical potential between two terminals of a device when disconnected from any circuit.

Ex. 4

a. Match the words with their definitions.

1) solar energy
2) hydroelectric power
3) geothermal energy
4) tidal power
5) renewables

a) sources of alternative energy, such as wind and wave power
b) energy obtained by tapping underground reservoirs of heat
c) energy derived from the sun in the form of solar radiation
d) energy of falling water or any other hydraulic source
e) the use of the rise and fall of tides to generate electric power

b. Translate the terms with the word solar.

Absorbed solar radiation; active solar collector; autonomous solar array; beam solar radiation; closed loop solar collector; daily solar radiation; direct solar radiation; fixed spherical solar collector; flat-plate solar water heater; germanium solar cell; high-efficiency solar battery; large area solar cell array; multilayer solar cell; orbital solar power plant; rechargeable solar battery; satellite solar power plant; silicon solar array; solar energy conversion; solar farm; solar power engineering.

READING

Solar Cells

A solar cell is, in principle, a simple semiconductor device that converts light into electric energy. The conversion is accomplished by absorbing light and ionizing crystal atoms, thereby creating free, negatively charged electrons and positively charged ions. If these ions are created from the basic crystal atoms, then their ionized state can be exchanged readily to a neighbour from which it can be exchanged to another neighbour and so forth; that is, this ionized state is mobile; it behaves like an electron, and it is called a hole. It has properties similar to a free electron except that it has the opposite charge.

Solar cells can be made from single crystals, crystalline and amorphous semiconductors. Each photon of the light that has a high enough energy to be absorbed by the crystal's atoms will set free an electron-hole pair. The electron and hole are free to move through the lattice in a Brownian motion; however, on average they will never move too far from each other. When the electron comes too close to a hole during their Brownian motion, they will recombine. On the other hand, when they experience an electric field, this will tend to separate the electrons from the holes; the electrons will drift toward the positive pole (the anode), and the positively charged holes will drift toward the cathode. Recombination will then take place in the external circuit (within the electric wires). Consequently, a current will flow. Since it is generated by photons, one speaks of a photocurrent. And the semiconductor that performs this effect is called a photoconductor. Photo-

conductors are passive devices. They react to light by changing their electric conductivity. To activate them an external electric power source, such as a battery, needs to be supplied to draw a current that increases with increasing light intensity. There are many photoconductor devices in our surroundings; as for example, in cameras, in street-light controls to switch the lights off at dawn and on at dusk, or for light barriers in garage door safety controls.

However, if an electric field is incorporated into the semiconductor, it will separate the electrons and holes. The part of the crystal that accumulates the electrons will be negatively charged; the part that accumulates the holes will be positively charged. The resulting potential difference, referred to as an open circuit, can be picked up by an electrometer. When electrodes are provided at both sides, a current can flow between them. The crystal, when exposed to sunlight, acts as a battery and becomes a solar cell.

Ex. 5 Answer the questions.

1. What device is a solar cell compared with? 2. What is the result of absorbing light and ionizing crystal atoms in a solar cell? 3. What can solar cells be made from? 4. How do the electron and the hole move through the lattice? 5. What happens when the electron comes too close to a hole during their Brownian motion? 6. Where does the recombination take place? 7. What is the result of the recombination? 8. What is a photoconductor? 9. How are photoconductors applied in everyday life? 10. When will the electrons and holes be separated? 11. How does the crystal, when exposed to sunlight, act?

Ex. 6 Find the words or phrases in the text that mean the same as the following expressions.

1. A substance, as silicon or germanium, with electrical conductivity intermediate between that of an insulator and a conductor (S…)
2. The smallest component of an element having the chemical properties of the element (A…)
3. An elementary particle that is a fundamental constituent of matter, having a negative charge (E…)

4. An electrically charged atom or group of atoms formed by the loss or gain of one or more electrons (I…)
5. A gap, usually the valence band of an insulator or semiconductor, that would normally be filled with one electron (H…)
6. Any of various devices, or units within such devices, that are capable of converting some form of energy into electricity (C…)
7. A closed path through which an electric current flows or may flow (C…)

Ex. 7 Think over the definitions of the terms which appear in the text and then agree or disagree with the following statements.

1. A solar cell is a conductor that converts light into electric energy.
2. The conversion is the absorption of light and ionization of crystal atoms.
3. A hole has properties similar to a free electron except that it has the opposite charge.
4. Brownian motion is the ordered movement of microscopic particles, caused by collisions between these particles.
5. Photoconductors increase their electrical conductivity by the absorption of electromagnetic radiation.
6. Potential difference is the difference between the potentials of several points in an electric field.

LANGUAGE STUDY

Word Building

Compound words

Сложные существительные	*handbook* *editor-in-chief*	справочник главный редактор
Сложные прилагательные	*dark-blue*	темно-синий
Сложные местоимения	*somebody* *something*	кто-то что-то
Сложные глаголы	*to fulfil*	осуществлять
Сложные причастия	*long-lasting*	продолжительный

Ex. 8 Translate the compound words.

Aircraft, alongside, anywhere, background, backward, blackout, bypass, crossover, earthquake, fireball, foresee, gearshift, handmade, ironwork, keyboard, keyword, landmark, lifeguard, low-frequency, mainland, meantime, moreover, pathfinder, radiofrequency, radiolocation, railroad, rainfall, rangefinder, rapid-turning, ready-mounted, record-player, setback, sidewalk, skyscraper, software, supercharge, supernatural, teamwork, timetable, underestimate, undergo, woodshop, workshop.

Ex. 9 Read and translate the words with the same stem.

Convert – conversion – convertible – converted –converter – reconvert; absorb – absorbent – absorber – absorbing – absorbed – absorbency –absorbable – absorbance; ionize – ionization – ionized – ionizer; charge – chargeable – charger – discharge – overcharge – recharge – charging – charged; exchange – exchangeable – exchanger; move – movable – moveless – movement – mover – moving – remove; combine – combination – combinational – combinative – recombine; separate – separation – separator – separated – separately – separative – separateness; generate – generation – generative – generator – regenerate – generating – generated; perform – performance – performer; react – reactance – reaction – reactive – reactor – reactant; accumulate – accumulation – accumulative – accumulator – accumulated.

Translation Difficulties

Ex. 10 Translate the sentences. Pay attention to the words like/unlike.

1. The internal combustion engine like the steam engine is a prime mover. 2. Unlike transformers, converter units are able to convert voltage and frequency thanks to the combination of machines with differing numbers of poles. 3. Glass and silk aren't the only materials known to behave like this. 4. Unlike traditional lasers, these lasers are much safer for the eyes. 5. Just like the voltage, the resistance is a quantity relative between two points. 6. Unlike electric charges, magnetic ob-

jects possess two poles of the opposite effect, denoted "north" and "south" after their self-orientation to the earth. 7. This force, like that caused by static electricity, extended itself invisibly over space. 8. Unlike network administrators, the network engineer focuses on high-level design and planning. 9. Laser light itself, unlike ordinary light, is monochromatic. 10. It is important to note that lead dioxide is metallic and is an electrical conductor, unlike other metal oxides that are usually insulators. 11. A steam engine, like a modern-day internal combustion engine, is an example of a larger class of machine called a heat engine. 12. As the tide flows through tunnels in the barrage, the water turns large fan-like turbines and generates electricity. 13. Radar-like radio detection and ranging are used to assist the pilots. 14. A diode may be thought of as like a switch. 15. Weak van der Waals forces create attraction but don't form strong bonds between unlike layers. 16. Like waves, quantum particles can interfere constructively or destructively.

SPEAKING

Ex. 11 Role-play the following situation.

You are at the International scientific conference on Global Warming for the first time. You are listening to a report of a famous scientist. Ask him about:

- The reasons of global warming;
- The origin of the greenhouse effect;
- The influence of global warming on nature;
- The ways of reducing carbon dioxide emission;
- The role of renewables in preventing global warming.

Give your ideas on the mentioned problem. Thank the speaker.

Ex. 12 Make a presentation on one of the topics:

- The types of renewable sources of energy;
- Solar energy;
- Hydroelectric power;
- Pros and cons of renewables.

Module 5. Radio Engineering

Unit 12

Grammar. Non-finite Forms. **Infinitive**: Forms and Functions
Text. Electromagnetic **R**adiation
Word building. Prefixes and their meanings

GRAMMAR

Infinitive: Forms

	Active	**Passive**
	Simultaneousness	
Indefinite	to accept	to be accepted
Continuous	to be accepting	—
	Priority	
Perfect	to have accepted	to have been accepted
Perfect Continuous	to have been accepting	—

See Grammar Module

Infinitive: Functions

1. Подлежащее	***To prove*** *this law is of utmost importance.*
2. Именная часть сказуемого	*Their task is* ***to maintain*** *the temperature at 100 degrees. Their aim is* ***to improve*** *the equipment.*
3. Часть составного глагольного сказуемого	*He intended* ***to complete*** *the experiment by the weekend.*
4. Дополнение	*Peter asked me* ***to help him in*** *his experiment. The researcher asked the laboratory assistant* ***to carry*** *out the experiment.*
5. Определение	*There is a lot of work* ***to be done****.*
6. Обстоятельство	*You must apply great force* ***to break*** *this glass.*

Ex. 1 Read and translate the sentences. Define the function of the Infinitive.

1. To increase the speed the designers have to improve the aircraft shape and engine efficiency. 2. Here are some facts to prove the theory. 3. I think I'll be able to solve this problem. 4. He was happy to have been helped with the experiment. 5. The equation is too difficult to be solved quickly. 6. The function of a boiler is to transfer heat to water in the most efficient manner. 7. The force that causes electrons to move is called the difference of potentials. 8. To perform this work one must have all the necessary equipment. 9. They had new equipment to use in their research. 10. An economizer and an air heater are provided to cool the products of combustion to the low temperature necessary for high efficiency. 11. Some molecules are large enough to be seen in the electron microscope. 12. The professor was the first to focus attention on this type of reaction. 13. Experiments helped Mendeleyev to discover the properties of new chemical elements. 14. To generate narrow beams, the lens must be much larger than the wavelength of the radio waves. 15. Alpha radiation is not able to penetrate the skin. 16. The problem to be solved consists in finding the new radar characteristics. 17. Other commands allow the computer to choose among different sets of instructions according to some criterion.

Ex. 2 Define the Infinitive form. Choose the sentences with the infinitive expressing a) simultaneousness; b) priority of action. Translate the sentences into Russian.

1. The professor to have demonstrated the experiment at the conference is an outstanding scientist. 2. They can calculate the exact value using this modern equipment. 3. I remember to have read about this type of transmitter in some latest Physics journals. 4. A radio antenna can receive information transmitted by a laser instead of applying a special receiver for the light. 5. We know light and radio waves to be of the same nature. 6. Can this test have been done in such a short period of time? 7. He must be working at his research in the university library. 8. They met the group of Russian physicists to have discovered that ray of light can be directly turned into radar signals.

9. This is a device to have been used in their experiment. 10. Parameters to be measured in a control experiment include the density and the temperature of the fuel.

Ex. 3 Translate the following sentences using the Infinitive.

1. Чтобы намагнитить магнитное тело или создать магнитный поток в цепи всегда требуется затратить энергию. 2. Пирометр используется для измерения температуры горячих металлов. 3. Для повышения надежности крупных промышленных центров последние питаются от нескольких электростанций, объединенных в общую сеть. 4. В большинстве случаев невозможно заставить некоторые типы счетчиков функционировать должным образом на очень высоких частотах, используемых в работе радио. 5. Проводить опыты с атмосферным электричеством было очень опасно в то время. 6. Сила, которая заставляет электроны двигаться, называется разностью потенциалов. 7. Учёные пытаются решить проблему, связанную с новыми явлениями электричества. 8. Электрическое давление, которое измеряется в вольтах, вызывает протекание электричества. 9. Чтобы электрический ток непрерывно протекал по проводу, в одном месте должна быть непрерывная подача электронов, а в другом – непрерывная подача положительных зарядов. 10. Прохождение тока через проводник провода вызывает выделение в нем тепла. 11. Чтобы быть хорошим инженером, необходимо много читать и учиться. 12. Человек научился расщеплять атомы для того, чтобы получить большое количество энергии. 13. Громоотвод – металлическое приспособление для защиты зданий от молний. 14. Намагнитить предмет – это значит поместить его в поле магнита.

VOCABULARY

1. **Electro**m**ag**n**etic** [ɪˌlektrə(ʊ)mægˈnetɪk] *(adj.)* – электромагнитный

The elementary excitations of the **electro**m**ag**n**etic** fields are the photons.

2. **Radiation** *(n.)* – излучение; радиация; облучение
A considerable portion of the heat is wasted by **radiation**.
3. **Transmission line** *(n.)* – линия передачи
One of the most common types of a **transmission line** is a coaxial cable.
4. **Printed circuit board (PCB)** [prɪn.tɪd ˈsɜː.kɪt ˌbɔːd] – печатная плата
Printed circuit boards are used in nearly all electronic products and in some electrical products, such as passive switch boxes.
5. **Transfer** *(v.)* – передавать; перевести; перенести
You can **transfer** digital images from your camera to your computer.
6. **Constraints** *(n.)* – ограничения; препятствия
Maintenance of these technical systems was affected because of the budgetary **constraints**.
7. **Incorporate** *(v.)* – включить (в состав чего-л.); объединять
This aircraft **incorporates** several new safety features.
8. **RF communication** – радиосвязь (радиочастотная связь)
Half-duplex **RF** systems as a variant of **RF communication** systems are used in such devices as walkie-talkie and wireless keyboard mouse.
9. **(Electrical) circuitry** [ˈsɜːkɪ.trɪ] – электросхема
The circuitry in this computer is protected from power surges.
10. **Sound waves** – звуковые волны; звуковые колебания
We can detect **sound waves** in the atmospheres of sun-like stars.
11. **Make sure** *(v.)* – убедиться; удостовериться; обеспечить
Make sure the power is switched off first.
12. **Impedance** [ɪmˈpiːdəns] *(n.)* – сопротивление (импеданс)
The heat generated in the core has to pass the heat **impedance** of the coating before it reaches the water flow.
13. **Standpoint** *(n.)* – точка зрения; позиция; план; аспект
He looks at things from a technological **standpoint**.
14. **Magnitude** *(n.)* – масштаб; величина; размах; магнитуда
They don't seem to grasp the **magnitude** of the problem.

15. **Pro**pa**gate** *(v.)* – распространять(ся)
James Clerk Maxwell showed that electromagnetic waves could **pro**pa**gate** through free space in 1864.
16. **Mutu**al ['mju:tʃuəl] *(adj.)* – взаимный; совместный
It was a m**utu**al effort.

Ex. 4 Fill in the gaps with appropriate words:from the list.

circuitry, magnitude, antenna, transmission lines, propagate, wires

1. … mostly use high-voltage AC (alternating current), but an important class of those uses high voltage direct current. 2. Don't touch those … whatever you do. 3. The … in this fighter aircraft has been protected against strong magnetic fields. 4. Mechanical waves … through a medium – air or water, making it oscillate as they pass by. 5. The … and complexity of these tasks should not be underestimated. 6. The parts of radio include the speaker, dials, and …

Ex. 5

a. Match the words with their definitions.

	a) energy in the form of waves or particles
	b) a piece of thin metal thread with a layer of plastic around it, used for carrying electric current
1) wire	c) the large size or importance of something
2) sound waves	d) an area around a magnet or something magnetic, in which it has a force to attract objects to itself
3) printed circuit board	e) the form that sound takes when it passes through the air, water, etc.
4) magnetic field	f) electrical circuits considered as a group
5) radiation	g) to include something within something else
6) magnitude	h) to move someone or something from one place to another
7) to transfer	i) a set of electrical connections made by thin lines of metal fixed onto a surface
8) circuitry	j) something that limits the range of a person's actions or freedom
9) to incorporate	k) a specialized cable or other structure designed to conduct electromagnetic waves in a contained manner
10) transmission line	
11) constraints	

b. Translate the terms with the word combination <u>electromagnetic radiation</u>.

Stray electromagnetic radiation; electromagnetic radiation hazard; electromagnetic radiation masking; nuclear electromagnetic radiation; electromagnetic radiation analysis; electromagnetic radiation spectrum; quantized electromagnetic radiation; electromagnetic radiation generator; electromagnetic radiation reflector; polarized electromagnetic radiation; electromagnetic radiation shielding; spectrum of electromagnetic radiation; infrared radiation; radiation leak; synchrotron radiation; solar radiation; ultraviolet radiation.

READING

Electromagnetic Radiation

When we think of electricity, we naturally think of wires. From high-voltage transmission lines to tiny traces on a printed circuit board, wires are still the fundamental means to transfer electrical energy from one location to another. But history has consistently demonstrated that human beings are rarely, if ever, satisfied with the fundamental way of doing things, and thus we should not be surprised to learn that the appearing of electricity was followed by widespread efforts to free electrical functionality from the physical limits.

There are various ways to incorporate "wireless" functionality into an electrical system. One of these is the use of electromagnetic radiation, which is the basis for **RF** communication. However, it's important to recognize that electromagnetic radiation is not unique in its ability to extend electrical circuitry into the wireless domain. **A**nything that can travel through a nonconductive material – mechanical motion, sound waves, heat – could be used as a (perhaps crude) means of converting electrical energy into information that does not rely on conductive interconnections.

With this in mind, we can ask ourselves the more relevant questions: Why is electromagnetic radiation the preferred method? Why are other types of wireless communication of such secondary importance? Before we answer these questions, let's make sure we understand what electromagnetic radiation is.

As the name implies, electromagnetic radiation involves both electric fields and magnetic fields. If you have voltage – such as the voltage across the impedance of an antenna – you have an electric field (from a mathematical standpoint, the electric field is proportional to the spatial rate of change of voltage). If you have electric current – such as the current passing through the impedance of an antenna – you have a magnetic field (the strength of the field is proportional to the magnitude of the current). The electric and magnetic fields are present even if the magnitude of the voltage or current is constant. However, these fields would not propagate. If we want a wave that will propagate out into the universe, we need changes in voltage and current.

The key to this propagation phenomenon is the self-sustaining relationship between the electric and magnetic components of electromagnetic radiation. A changing electric field generates a magnetic field, and a changing magnetic field generates an electric field. This mutual regeneration is manifested as a distinct entity, namely, an electromagnetic wave. Once generated, this wave will travel outward from its source, careening day after day, at the speed of light, toward the depths of the unknown.

Ex. 6 Answer the questions.

1. What are the fundamental means of transferring electrical energy from one location to another? 2. What was followed by widespread efforts to free electrical functionality from the physical limitations and why? 3. What ways to incorporate "wireless" functionality into an electrical system do you know? 4. What is the basis for RF communication? 5. Why is electromagnetic radiation not unique in its ability to extend electrical circuitry into the wireless domain? 6. Why is electromagnetic radiation the preferred method? 7. Why are other types of wireless communication of such secondary importance? 8. What is electromagnetic radiation? 9. What field do you create if you have electric current such as the current passing through the impedance of an antenna? 10. What is the strength of a magnetic field proportional to? 11. Will the electric and magnetic fields propagate in case the magnitude of the voltage or current is constant? 12. What is the key to a wave propagation phenomenon?

Ex. 7 Read the text once more and give a heading to each paragraph. Complete the chart with the headings and the keywords from the text.

Headings to the paragraphs	*Keywords (3-5)*
§ 1 ...	...

Ex. 8 Complete the sentences using the correct form of the word.

1. Wires are still the (fundament) means of transferring electrical energy from one (locate) to another.
2. The (appear) of electricity was followed by widespread efforts to free electrical functionality from the constraints of physical interconnections.
3. There are (vary) ways to incorporate (wire) functionality into an electrical system.
4. Electromagnetic (radiate) is the basis for RF communication.
5. From a (mathematics) standpoint, the electric field is (proportion) to the (space) rate of change of voltage.
6. If you have electric current (pass) through the impedance of an antenna you have a magnetic field.
7. The key to the (propagate) phenomenon is the self-sustaining relationship between the electric and magnetic components of electromagnetic (radiate).
8. Once (generate), an (electromagnet) wave will travel outward from its source at the speed of light toward the depths of the unknown.

Ex. 9 Make the pairs of words.

1) transmission	a) material
2) fundamental	b) lines
3) physical	c) waves
4) various	d) method
5) nonconductive	e) interconnections
6) sound	f) ways
7) preferred	g) means
8) mathematical	h) standpoint
9) propagation	i) phenomenon
10) mutual	j) regeneration

LANGUAGE STUDY

Word Building

Common Prefixes (Наиболее употребительные префиксы)

co-	совместность какого-либо действия с кем-то или чем-то	*coexist* – сосуществовать *cooperative* – совместный
re-	повторность действия, чаще всего переводится «пере-», часто присоединяется к глаголам	*redirect* – перенаправить *redo* – переделать
de-	отход (от чего-л.), устранение, обратные процессы	*degrade* – ухудшать, понижать
ex-	«предыдущий», «прошлый». всегда пишется через дефис	*ex-member* – бывший участник
en- (em-)		
en- (em-)	«вводить в определенное состояние», «окружать», «наделять чем-то». Перед согласными *b, m* и *p* префикс *en-* меняется на *em-*.	*encircle* – окружать, делать круг *enlarge* – увеличивать, расширяться
over-, under-, sub-		
over-	чрезмерность, превышение чего-то, сверх чего-то, или то, что находится над чем-то	*overweight* – перевес, излишек веса
under-	антоним к *over-* и переводится как «недо», «под-»	*underestimate* – недооценивать
sub-	нахождение под чем-то, подчинение, подразделение, а также имеет значение «почти»	*subsection* – подсекция

super-, hyper-, hypo-		
super-	нахождение над чем-то, выше чего-то, превышение норм, качества, размера и т.д.	*supernatural* – сверхъестественный
hyper-	преувеличение, превышение чего-то, синонимичен приставке *super-*; часто используется в научных терминах, переводится как «сверх-», «очень», «гипер-»	*hyperactive* – гиперактивный *hypersonic* – сверхзвуковой
hypo-	противоположен по значению к *hyper-*, означает что-то ниже нормы, находящееся снизу, часто употребляется в терминах	*hypoactivity* – пониженная активность
ultra-, infra-		
ultra-	находящееся за пределами, крайнее. Слова с таким префиксом переводятся как «сверх», «ультра».	*ultraviolet* – ультрафиолет *ultrasonic* – сверхзвуковой
infra-	нахождение ниже чего-либо, под чем-то. Переводится как «под-», «нижне-», «инфра-».	*infrared* – инфракрасный *infrasonic* – инфразвуковой, подтональный
pre-, post- (парные антонимы)		
pre-	предшествование чему-то, что-то, что было перед, до	*prehistoric* – доисторический *prewar* – довоенный
post-	что-то, что было после, следовало за чем-то	*postwar* – послевоенный

Ex. 10

a) Translate the words paying attention to prefixes.

En- enclose, encase; *em-* empower, embody; *de-* decode, decompose, deactivate; *re-* retransmit, reform, replace; *sub-* submenu, subnormal, substation; *over-* overvoltage, overload, overheat.

b) Translate the pairs of words and point out the prefix.

Model: fast (быстрый) → ultrafast (сверхбыстрый) – ultra-

1) circle → encircle
2) estimate → underestimate
3) structure → infrastructure
4) conductivity → superconductivity
5) sensitive → hypersensitive

Ex. 11 Form the words using given prefixes. Translate the words you get.

en-+ Adj / N + (-en) → *V:* courage, able, large, joy, trap, tight, strength, length, wide, broad, light;

re- + Root: to place, to present, to use, to connect, to form, to write, to read, to cycle, to establish, to search, to invent, construction, vision, presentation, productive, chargeable.

Ex. 12 For each line choose a prefix and form new words.

de-, co-, pre, re-, sub-

Model: over- weight (вес) → overweight (перевес)

1) to pay → (предоплата), historic→ (доисторический);
2) write → (переписывать), to do → (переделывать); to consider → (пересматривать), arrangement → (перегруппировка, перестановка), to cycle → (перерабатывать), to place → (заменять), to fill → (дозаправить)
3) cordinate → (подчинять), marine (морской) → (подводная лодка);
4) motivation→ (демотивация); bug (ошибка)→ (отладка);
5) author → (соавтор), exist → (сосуществовать).

Translation Difficulties

time(n.)	время, час; раз; срок
time(v.)	рассчитывать, засекать;
It's (high) time(for/to)	Пора
at the same time	в то же самое время, одновременно; наряду; тем не менее
on time	в заранее оговоренное время, по расписанию, не раньше и не позже (*ant*. late – поздно)
in time	заблаговременно, с запасом времени
just in time	в самый последний момент, как раз вовремя
in no time	очень быстро

Ex. 13 Translate the sentences. Pay attention to the words time, times.

1. Wireless communication was invented before my time. 2. The students went to a conference abroad and had a good time there. 3. Six times four is twenty-four. 4. He works in this laboratory three times a week. 5. It took a long time before people could understand the nature of lightning. 6. They carried out an experiment measuring the pressure in the tube from time to time. 7. It is high time to add these substances to the solution. 8. Using a new furnace they could melt the metals in no time. 9. For a long time static electricity was the only electrical phenomenon to be observed by man. 10. The file can be accessed by many users at the same time. 11. I like that Prof. Black is very punctual and all our lab works always start on time. 12. We start the reaction at 11.30. Be on time. We won't wait for you. 13. The conference starts at 10 a.m. Will you be in time? We need to fill in the registration forms. 14. I hope you come in time to help me to adjust this new reflector. 15. You are right on time. We are about to start testing the antenna. 16. We measure time in minutes, hours, days, etc.

SPEAKING

Ex. 14 Speak on Electromagnetic Radiation using your table of the ex. 7 as a prompt.

Ex. 15
a. Look at the names listed below and say what do you know about these scientists and their contribution to the radiation discovery. Think if you can add to this list.

b. Search the Internet for additional information. Speak about / make a presentation on these scientists' contribution to the field of radiation.

Radiation: Discovery
William Herschel; Johann Wilhelm Ritter; Heinrich Hertz; Wilhelm Röntgen; Henri Becquerel; **M**arie Curie; Ernest Rutherford; Paul Villard; Henri Becquerel; **T**homas Royds; Edward **A**ndrade; Victor Hess; James Chadwick.

Unit 13

Grammar. Complex **O**bject
Text. Satellite Communication
Word building. Negative Prefixes

GRAMMAR

Complex Object (Сложное дополнение)

Подлежащее	**Сказуемое** (действительный залог)	**Существительное** (в общем падеже) **или личное местоимение** (в объектном падеже) + **инфинитив**
Scientists **Ученые**	**expect** *ожидают, что*	**lasers to solve the problem.** *лазеры решат проблему.*

See Grammar Module

Ex. 1 Translate these sentences paying attention to Complex Object.

1. They expected these new installations to be widely used in various kinds of power stations. 2. We know the alternating current to flow first in one direction and then in the other. 3. The students saw the thermometer mercury fall to the fixed point. 4. The induced voltage causes the current to flow and the rotor to revolve. 5. We may expect a short circuit to result from a wire fault. 6. The invention of James Watt made the engine double its velocity. 7. A fan forces the combustion air to flow through the air heater into the furnace. 8. Some stations find the cyclone furnace to be advantageous. 9. They proved the combustion in the cyclone furnace to be complete and to have practically no carbon loss. 10. The practice proved the cyclone furnace to be suitable for a wide range of coals. 11. In the burner, the gas under pressure enters the furnace through a burner port and lets a flow of air pass through the port. 12. In the ring burner, the gas flows through a ring and causes the air to flow both around and within the gas. 13. The depth of the active layer enables an adequate supply of air to penetrate the fuel layer and enter the furnace. 14. The mixing of the volatile matter with turbulent air permits the volatile matter to burn smokelessly. 15. We proved this suggestion to be wrong. 16. We made this reaction run at reduced pressure. 17. It is usually rather difficult to get nitrogen to combine with other elements. 18. These properties let him suggest that they had got a novel compound.

Ex. 2 Make up your own sentences with Complex Object according to the models.

a. Model: They believe that this element influences the property of this material.

They believe this element **to influence** the property of this material.

1. They consider that this material contains iron. 2. They suppose that this steel is stainless. 3. We expect that they form ceramics by the action of heat and subsequent cooling. 4. We know that ceramics is strong, stiff, brittle and chemically inert. 5. We believe that they use this material in this structure. 6. They think that this alloy contains nickel. 7. We know that oxygen is extremely hard to liberate from a compound.

b. Model: We know that he investigated this problem.
We know him **to have investigated** this problem.
1. He believes that they made an experiment. 2. He thinks that they used these data for their experiment. 3. They think that atomic energy became the main source of power supply in the 21st century. 4. We know that they described the experiment in the scientific article. 5. We expect that manufacturers increased the aluminium application in the production. 6. We consider that research technology changed. 7. **A** video amplifier is expected to cover a very wide range of frequencies. 8. They assume that temperature changes up to 200 °**C** had no effect on this substance.

Ex. 3 Match the parts (I-IV) to make sentences with Complex Object. Translate the sentences.
Model: *We know lightning to be a discharge of electricity.* – Известно, что молния – это разряд электричества.

I	II	III	IV
We know	all bodies Russian scientists Galileo the charges the electric current **lightning** the alternating current the static electricity the storage batteries	**to be** to have invented to flow to produce to have been to have greatly contributed to be to consist to contain	positive and negative important effects of atoms an air thermometer first in one direction and then in another a **discharge of electricity** to the science of electricity the only electrical phenomenon observed by man chemicals generating electric current under certain conditions.

VOCABULARY

1. **Satellite** ['sætəlaɪt] *(n.)* – спутник, сателлит; спутниковый
The new **satellite TV** channels offer viewers greater freedom of choice.

2. **Artificial** [ɑ:tɪˈfɪʃəl] *(adj.)* – искусственный
This product contains no **artificial** colors – only natural substances are used.
3. **Approximately** *(adv.)* – примерно; приблизительно; около; порядка
The space shuttle can carry a maximum payload of **approximately** 50,000 pounds.
4. **Orbit** *(v.)* – вращаться или двигаться по орбите
On this mission, the shuttle **will orbit** (the earth) at a height of several hundred miles.
5. **Relay** *(v.)* – *зд.* передавать, транслировать
The broadcasts were **relayed** by satellite.
6. **Digital signal** – цифровой сигнал
Until the late 1990s, the cost of **digital signal** processors for DSL was too high.
7. **Data** [ˈdeɪtə] *(n.)* – данные, информация, сведения, факты
He entered the raw **data** into a spreadsheet.
8. **Ancillary** [ænˈsɪləɪ] **equipment** – вспомогательное оборудование
Expensive **ancillary equipment** was required for the operation to work.
9. **Handheld** *(adj.)* – портативный, ручной, переносной
Mobile phones, data cards, **handheld** game consoles and cellular routers allow users to connect to the internet wirelessly.
10. **Altitude** *(n.)* – высота; высота над уровнем моря
The plane's flying at an **altitude** of 40,000 feet.
11. **Rotation** *(n.)* – вращение, поворот, чередование/ ротация; *зд.* оборот вокруг оси
The earth completes 366 **rotations** about its axis in every leap year.
12. **Track** *(v.)* – отслеживать; следить, прослеживать; выслеживать meteorologists are **tracking** the storm.
13. **Launch** [lɔ:n(t)ʃ] *(v.)* – запускать; начинать
You can **launch** the program by double-clicking on the icon.
14. **Diameter** [daɪˈæmɪtə] *(n.)* – диаметр
We need a pipe with a **diameter** of about six inches.

15. **Low-frequency** *(adj.)* – низкочастотный

Low-frequency sound waves are long and strong, and it takes a lot of mass and energy to reduce and slow them down.

16. **Revolution** *(n.)* – вращение, оборот (*вокруг другого предмета)*

The **revolution** of the earth around the sun was proposed by Copernicus.

17. **Run out** *(v.)* – закончиться; кончиться; заканчиваться; иссякнуть

I've **run out** of milk/money/ideas/patience.

18. **Coverage** *(n.)* – здесь охват, зона действия

Check out the wireless service provider's **coverage** before you sign a contract.

N.B.

Rotation	Revolution
An object's circular motion around a fixed center or axis.	An object's circular motion around an external point or another body.
Refers to the spinning of Earth on its axis which causes day-time and nighttime, covering a period of 24 hours (Causes the different time zones).	Refers to the movement of Earth around the sun covering a period of one year (Causes the seasons to change).

Ex. 4

a. Match the words with their definitions.

1) coverage	a) a device sent up into space to travel around
2) rotation	the earth, used for collecting information or
3) handheld	communicating by radio, television
4) diameter	b) the area in which a particular service is avail-
5) approximately	able, or particular goods are sold
6) revolution	c) made by people, often as a copy of something
7) altitude	natural
8) artificial	d) close to a particular number or time although
9) run out	not exactly that number or time capable of being
10) satellite	used up

e) small enough to hold in your hand
f) the distance from one side to the opposite side of a circle, measured by a line passing through the center of the circle
g) height above sea level
h) to finish, use, or sell all of something so that there is none left
i) the motion of a body in which the body moves in a circular motion around itself along a perpendicular axis / an object's circular motion around a fixed center or axis
j) an object's circular motion around an external point or another body

b. Translate the terms with the word satellite.

Communication satellite; satellite dish; to launch/orbit a satellite; weather satellite; satellite-borne; broadcast satellite service; broadcast via satellite; digital broadcast satellite; direct broadcast satellite; satellite television/TV; satellite radio/phone/communications; satellite photograph/map/image; satellite broadcaster/provider/company; a satellite channel/show/service; remote sensing satellite; geostationary meteorological satellite; satellite internet access; global navigation satellite system; satellite tracking.

READING

Satellite Communication

Artificial satellites provide communication links between various points on Earth. Satellite communications play a vital role in the global telecommunications system. Approximately 2,000 artificial satellites orbiting Earth relay analog and digital signals carrying voice, video, and data to and from one or many locations worldwide.

Satellite communication has two main components: the ground segment, which consists of fixed or mobile transmission, reception, and ancillary equipment, and the space segment, which primarily is the satellite itself. A typical satellite link involves the transmission or up-

linking of a signal from an Earth station to a satellite. The satellite then receives and amplifies the signal and retransmits it back to Earth, where it is received and reamplified by Earth stations and terminals. Satellite receivers on the ground include direct-to-home (DTH) satellite equipment, mobile reception equipment in aircraft, satellite telephones, and handheld devices.

The first practical concept of satellite communication was proposed by 27-year-old Royal Air Force officer Arthur C. Clarke in a paper published in the October 1945 issue of Wireless World. Clarke, who would later become an accomplished science fiction writer, proposed that a satellite at an altitude of 35,786 km above Earth's surface would be moving at the same speed as Earth's rotation. At this altitude, the satellite would remain in a fixed position relative to a point on Earth. This orbit, now called a "geostationary orbit," is ideal for satellite communications, since an antenna on the ground can be pointed to a satellite 24 hours a day without having to track its position.

The first artificial satellite, Sputnik 1, was launched successfully by the Soviet Union on October 4, 1957. Sputnik 1 was only 58 cm in diameter with four antennas sending low-frequency radio signals at regular intervals. It orbited Earth in an elliptical orbit, taking 96.2 minutes to complete one revolution. It transmitted signals for only 22 days until its battery ran out and was in orbit for only three months, but its launch sparked the beginning of the space race between the United States and the Soviet Union.

American engineers developed key technologies in the 1950s and '60s that made commercial communication satellites possible. They calculated the precise power requirements to transmit signals to satellites in various Earth orbits. Their main contribution to satellite technology was the development of the travelling wave tube amplifier, which enabled a satellite to receive, amplify, and transmit radio signals. They also developed spin-stabilization technology that provided stability to satellites orbiting in space.

The Soviet Union continued its development of satellite technology with the Molniya series of satellites, which were launched in a highly elliptical orbit to enable them to reach the far northern regions of the country. The first satellite in this series, Molniya 1, was

launched on April 23, 1965. By 1967 six Molniya satellites provided coverage throughout the Soviet Union.

The successful development of satellite technology paved the way for a global communications satellite industry.

Notes to the Text

traveling wave tube amplifier – усилитель трубки для передачи волн

direct-to-home (DTH) satellite – спутник непосредственного (прямого) вещания на бытовые приёмники

Ex. 5 Answer the questions.

1. What are artificial satellites used for? 2. What two main components does satellite communication have? 3. What does the ground segment of satellite communication consist of? 4. What does a typical satellite link involve? 5. What do satellite receivers on the ground include? 6. What was Arthur C. Clarke? 7. What was Arthur C. Clarke's contribution to the satellite communication? 8. According to Arthur C. Clarke, what altitude would the satellite remain in a fixed position relative to a point on Earth at? 9. What orbit is ideal for satellite communications? Why? 10. What country launched the first artificial satellite? 11. What was the essence of key technologies of American scientists? 12. What satellites series did the SU continue its development of satellite technology with? 13. What paved the way for a global communications satellite industry?

Ex. 6 Read the text once more and
a) fill in the table:

Date	Event
October 1945	
October 4, 1957	
the 1950s and '60s	
April 23, 1965	
1967	

b) say what each number is related to in the text:

2,000; 27(-year-old); 35,786 (km); 24 (hours); 1; 58 (cm); four; 96.2 (minutes); one; 22 (days); three (months), the first; 1, six.

Ex. 7 Decide whether these statements are True (T) or False (F). Correct the wrong ones.

1. Approximately 4,000 artificial satellites orbiting Earth relay analog and digital signals. 2. Satellite communication has the ground segment, the intermediate segment and the space segment. 3. A satellite link involves the transmission or uplinking of a signal from an Earth station to a satellite. 4. The satellite receives and amplifies the signal and retransmits it to some other satellites. 5. Satellite receivers on the ground include direct-to-home (**DTH**) satellite equipment, mobile reception equipment in aircraft, satellite telephones, and handheld devices. 6. The first practical concept of satellite communication was proposed by a 60-year-old Sandford professor. 7. At an altitude of 35,786 km, the satellite would remain in a fixed position relative to a point on Earth. 8. The development of the travelling wave tube amplifier enabled a satellite to receive, amplify, and transmit radio signals. 9. The first artificial satellite Sputnik 1 launch was not successful. 10. Sputnik 2 was only 58 cm in diameter with four antennas sending low-frequency radio signals at regular intervals.

LANGUAGE STUDY

Word Building

Common Prefixes (Наиболее употребительные префиксы)

inter-, intra-, trans-		
inter-	«среди чего-то», «между определенными группами	*interact* – взаимодействовать
intra- */intro-*	«внутри», «в пределах чего-то»	*intraday* – в течение дня *introspect* – всматриваться, самоанализ
trans-	«действие через что-то», изменение, передача, переход из одного состояния в другое	*transform* – изменять, трансформировать *transnational* – транснациональный

pro-, retro-		
pro-	движение вперед, продвижение или в значении «за что-либо», «в поддержку»	*prospective* – будущий, ожидаемый
retro-	«назад», «позади»	*retrospective* – относящийся к прошлому
extra-, out-		
extra-	чрезмерность, выход за пределы, высшая степень чего-то	*extracentral* – внецентральный
out-	значение «вне», «наружу», а также «быть или сделать что-то лучше, чем кто-то другой», «превзойти»	*outdo* – превзойти, побороть *outstanding* – выщающийся, знаменитый
hemi-, semi-		
hemi-	(греч.) означает физическую симметричную половину, «наполовину»	*hemisphere* – полушарие *hemicycle* – полукруг
semi-	(лат.) кроме значения половины, действия, выполненного наполовину, передает значение «практически», «слегка», «до некоторой степени»	*semicircular* – полукруглый
mono-, multi- (парные антонимы)		
mono-	единичное, неразделенное, единственное	*monochromic* – одноцветный
multi-	многочисленное, неоднородное	*multipurpose* – многоцелевой *multiway* – многоканальный
mini-, micro-, macro-		
mini-	уменьшенная копия чего-то, что-то маленькое	*miniature* – миниатюра *minimize* – уменьшать, минимизировать
micro-	очень малых размеров, невидимое невооруженным взглядом или в миллион раз меньше, чем основная мера	*microwave* – микроволновой *microsecond* – микросекунда (миллионная доля секунды)
macro-	(антоним к *micro-*) большое, продолжительное	*macrograph* – макроснимок *macrocosmos* – макрокосмос

Ex. 8

a) Translate the words paying attention to prefixes.

macro- macroscopic, macroeconomics; *micro-* microelectronics, microelement, micrometer, microscope, microwatt; *extra-* extracurricular, extraordinary, extrapolation, extrasensory; *multi-* multicolor, multipurpose, multiuser, multiway.

b) Translate the pairs of words and point out the prefix.

Model: fast (быстрый) → ultrafast (сверхбыстрый) – ultra-

1) tone → monotonous
2) colour → multicolour
3) ordinary → extraordinary
4) long → prolong
5) action→ retroaction

Ex. 9 For the words given in a) find the Russian equivalents in b).

a) 1) macrolevel, 2) interconnection, 3) microelement, 4) semicycle, 5) multiaccess, 6) microfilming, 7) outbreak, 8) macrograph, 9) outlying, 10) multiway, 11) micrograph, 12) micrometer, 13) microscopical, 14) monoband

b) 1) микроскопический, 2) взрыв, 3) макроуровень, 4) микросъемка, 5) многоканальный, 6) многоадресный, 7) одноленточный, 8) микроэлемент, 9 макроснимок, 10) полуцикл, 11) удаленный, 12) микрометр, 13) взаимосвязь, 14) микроснимок

Ex. 10 For each line choose a prefix and form new words.

out-, semi-, pro, trans-

1) standing (постоянный) → (выдающийся), building (строение)→ (пристройка), to weigh (весить) → перевешивать;

2) final (финал)→ (полуфинал), circular (круглый) → (полукруглый); automatic → полуавтоматический;

3) scientific (научный) → (про-научный); motion (движение) → (продвижение, содействие);

4) form (формировать, образовывать) → (изменять), Atlantic (атлантический)→ (трансатлантический).

Translation Difficulties

mean/means (n.)	1) *pl.* средства (к существованию); богатство; 2) средство, способ; 3) средняя величина
mean (adj.)	средний, серединный, скупой, плохой, подлый
mean (meant, meant) (v.)	значить, означать; иметь в виду; намереваться; подразумевать, думать; предназначать;
by means of	посредством чего-либо
by no means (=definitely not)	категорическое отрицание (ни в коем случае)

Ex. 11 Translate the sentences. Pay attention to the word mean, means.

1. Thomas Savery patented a means of pumping water out of coal mines by steam power in 1698. 2. The increase in the temperature means the change in the rate of the electron movement. 3. The mean of 5, 4, 10, and 15 is 8.5. 4. The mean velocity of the electron movement is indicated by a special device. 5. By the watt is meant the energy expended per second by an unvarying electric current. 6. These artificial satellites are the best means to provide communication links between various points on Earth. 7. Iron is by all means the most important metal, not alone because of its cheapness, but because of the high value of applying in different devices. 8. If one electron is removed from the atom by some means or other, the balance between positive and negative charge is destroyed. 9. By no means can this device be put into operation. 10. What do you mean by that? 11. That was a mean thing to do. 12. This means that we will first deal with ordinary differential equations.

SPEAKING

Ex. 12 Discuss the advantages and disadvantages of satellites.

a) Work in pairs (groups). Compare two lists of pros and cons (A and B) and make your own ones *(joining these together and adding your personal ideas).*

b) Divide into two groups ("Pros" and "Cons") and speak in turns. Expand on the statements in the table below and add your own ones.

Pros and Cons (the advantages and disadvantages) of Satellite Communication	
A	**B**
+ /the advantages/ Pros:	
1. Area of coverage is more than that of terrestrial systems. 2. Each and every corner of the earth can be covered. 3. Transmission cost is independent of coverage area. 4. More bandwidth and broadcasting possibilities.	a. Reaches areas too remote and expensive for microwave or submarine cable. b. Hundreds of users or even communities can share one satellite. c. Adaptable to almost all urban or rural locations. d. Ideal for broadcast applications which only require one-way communication.
- /the disadvantages/ Cons:	
1. Launching satellites into orbits is a costly process. 2. Propagation delay of satellite systems is more than that of conventional terrestrial systems. 3. Difficult to provide repairing activities if any problem occurs in a satellite system. 4. Free space loss is more. 5. There can be congestion of frequencies.	a. High voice delay or data latency. b. About 4x as costly as microwave or fiber for the same bandwidth. c. Solar outages twice a year, about 8 minutes per day, about 6 days in a row. d. Susceptible to moisture degradation (heavy rain or snow storms). e. Rather large antennas in most cases.

Use the phrases:

I/We believe...; From my/our point of view....; I/We suppose.... In my/our opinion....

It seems to me/us that...; I/We agree that …; but …I/We don't agree/think that; etc …

Ex. 13 Prove the statement "Satellite communication plays a vital role in our daily life" expanding on the following applications of satellite communication:

- Radio broadcasting and voice communications;
- TV broadcasting such as Direct to Home (DTH);

- Internet applications such as providing Internet connection for data transfer;
- **M**ilitary applications and navigations;
- **Rem**ote sensing applications;
- Weather condition **m**onitoring & forecasting.

Unit 14

Grammar. Complex **S**ubject **Text. A**ntenna **Word buil**ding. Prefixes (**R**evision)

GRAMMAR

Complex Subject

Конструкция Сложное подлежащее (субъектный инфинитивный оборот) состоит из подлежащего (существительного в общем падеже или местоимения в именительном падеже) и инфинитива, стоящего после сказуемого (глагола в страдательном или действительном залоге):

Подлежащее	**Сказуемое**	**Инфинитив**
a) глагол в страдательном залоге		
The atom Атом,	**is known** ***как известно,***	**to emit** rays of different length. испускает лучи различной длины.
(***Известно***, что атом испускает лучи разной длины.)		
b) глагол в действительном залоге		
Heavy water Тяжелая вода,	**proved** как оказалось,	**to freeze at about 4°C.** замерзает при температуре около 4°С.
(***Оказалось***, *что тяжелая вода замерзает при температуре около 4°С.*)		

See Grammar Module

Ex. 1 Translate the sentences paying attention to Complex Subject.

1. Magnetic flux is considered to arise due to the action of a magnetic force on a magnetizable body. 2. Lightning proved to be a discharge of electricity. 3. Some liquids, called electrolytes, are found to change greatly when an electric current passes through them. 4. The alternating current used for power and lighting is assumed to go through 50 cycles in one second. 5. The Fahrenheit scale is known to be used in English speaking countries. 6. The term "radar" is known to be composed of the first letters of "radio, detection, and ranging." 7. Heat is known to be a form of energy. 8. Coal is considered to be a valuable fuel. 9. The cyclone furnace is known to be water. 10. All pulverized coal-fired furnaces constructed today are considered to be partially or completely water-cooled. 11. Optical technology has been found to be cost effective. 12. The laser is known to be a device producing an intensive beam of light by amplifying radiation. 13. A glass tube filled with neon gas was found to be suitable for the use as a signalling source. 14. Artificial satellites are known to provide communication links between various points on Earth. 15. This system appears to possess many advantages.

Ex. 2 Combine the sentences using the Complex Subject construction.

Model: Amber attracts and holds minute light objects after rubbing. It is known. – Amber *is known* to attract and to hold minute light objects after rubbing.

The results were valid. It has been shown. – The results *are shown* to have been valid.

1. The processes are interrelated. It has been found. 2. The argument is wrong. It has recently been shown. 3. This value is negligible. It has been expected. 4. The process occurs regularly. It has recently been proved. 5. The particle has a complex structure. It is known. 6. This approach is much better. It has recently been demonstrated. 7. These data are invalid. It has recently been shown by some reports. 8. Such an experiment is quite feasible. It has recently been proved. 9. The effect is

due to gravity. It has been thought until very recently. 10. Uranium possesses the highest atomic weight. It is proved. 11. Oxygen is colourless. It is known. 12. Heat passes from a hotter body to a colder one. It is known. 13. A fuse melts and breaks the circuit. It is expected. 14. The electrical bell circuit is a typical example of a series circuit. It is known.

Ex. 3 Answer the questions. Use the Complex Subject construction.
Model: What is known about a 1200 Baud radio teletype service? (is used by aircrafts). – A 1200 Baud radio teletype service is known to be used by aircrafts.

1. What is supposed about all students? (know Newton's laws of mechanics). 2. What is known about modern remotes? (control multiple devices). 3. What is proved about lighting? (is a discharge of electricity). 4. What is known about Alexander Popov? (is one of the first persons to invent a radio receiving device). 5. What has been found about solar wind? (consists of a completely ionized plasma). 6. What is said about digital cellular telephones? (quickly became the main communication tool). 7. What is said about pure annealed copper? (has 100 per cent conductivity). 8. What is supposed about a home area network? (covers an area of 50 meters). 9. What is said about electronic computers? (are as important for people as nuclear energy). 10. What is known about the substance? (has a high melting point).

Ex. 4 Translate the following sentences and define the Infinitive Constructions.
1. High velocity steam jets in the furnace allow the combustion to be improved and the smoke to be reduced. 2. High velocity steam jets in the furnace proved to improve the combustion and reduce the smoke. 3. These conditions of burning permit large amounts of fine particles of carbon to be blown upward into the furnace. 4. These conditions of the burning are expected to permit large amounts of fine particles of carbon to be blown upward into the furnace. 5. Lightning proved to be a discharge of electricity. 6. The student is certain to know that alternating voltage can be increased and decreased. 7. Heat is known to be a form

of energy. 8. We know the electrons to flow from the negative terminal of the battery to the positive one. 9. This scientist seems to have been working on the problem of splitting the atom. 10. The students saw the thermometer mercury fall to the fixed point. 11. Coal is considered to be a valuable fuel. 12. We know many articles to have already been written on that subject. 13. The electrolytes appear to change greatly when the current passes through them.

Ex. 5 Form sentences with Complex Subject construction according to the model given below.

Model: a-e-g-b – The current *is known* to consist of moving electrons.

I	II	III	IV
a. The current b. Professor Rihman c. Amber d. Lomonosov e. Electrical effects f. The Centigrade scale g. The Fahrenheit scale thermometers	a) was observed b) are known c) is said d) is proved **e) is known** f) are known g) is cosidered	a) to have started b) to be used c) to have been observed d) to have been killed e) to attract and to hold f) to be used **g) to consist**	a) by man centuries ago. **b) of moving electrons** c) for Moscow on foot. d) light objects after rubbing. e) in English-speaking countries. f) by a stroke of lightning. g) in Russia

Ex. 6 Translate the following sentences using Complex Subject.

1. Говорят, что этот прибор описан в предыдущей статье. 2. Доказано, что ток течёт от положительного потенциала к отрицательному. 3. Говорят, что мой друг – хороший математик. 4. Известно, что Ломоносов основал Московский университет. 5. Кажется, что это вещество имеет некоторые другие свойства. 6. Известно, что переменный ток меняет своё направление. 7. Было замечено, что свойства элементов зависят от их атомного веса. 8. Перегрузка линии, скорее всего, приведет к короткому замыканию. 9. Вероятно, вы сдадите зачет на отлично.

VOCABULARY

1. **Aeri**al [ˈeəriəl] (also mainly **US** an**te**nna) = an antenna *(n.)* – *зд.* антенна; воздушный, авиационный, эфирный

Owners are responsible for the siting of television **aeri**als and satellite dishes on their property.

2. **Reflector** [rɪˈflektə(r)] *(n.)* – отражатель

Reflectors are placed along the lanes of the highway.

3. **Succession** [səkˈseʃ(ə)n] *(n.)* – последовательность, непрерывный ряд

The **succession** of flashing lights gave an illusion of movement.

4. **Transmitter** [trænzˈmɪtə] *(n.)* – передатчик

A television **transmitter** sends the signals that reach your **TV**.

5. **Rod** *(n.)* – штанга, стержень, шток

The concrete is strengthened with steel **rod**s.

6. **Induction coil** – индукционная катушка

Invented in 1836 by Nicholas **C**allan, **the induction coil** was the first type of transformer.

7. **Oscillating currents** – колебательные токи

The **oscillating current** pushes the electrons in the antenna back and forth, creating oscillating electric and magnetic fields.

8. **Waveguides** *(n.)* – волновод

There are different types of **waveguides** for different types of waves.

9. **Frequency modulation (FM)** – частотная модуляция

Demonstration of **frequency modulation** was carried out on the laboratory model.

10. **Wavelength** *(n.)* – длина волны

The station is broadcasted on the **FM wavelength**.

11. **Adjust** *(v.)* – регулировать, устанавливать, приспосабливать

You may need **to** ad**just** the image on your screen to keep it centered. These desks can **be** ad**justed to** the height of any child.

12. **Dipole** [ˈdaɪpəʊl] *(n.)* – радио антенна-диполь, дипольная (двухполюсная) антенна

With most **FM** radio stations today, a vertical **dipole** gives as much signal as a horizontal one.

13. **Helical** ['helɪkl] *(adj.)* – спиральный, винтовой, геликоидальный

Sirius, the brightest star in the heavens, travels a **helical** path through space.

14. **Linear** ['lɪnɪə] *(adj.)* – линейный

This system of **linear** equations has one solution.

15. **Planar** ['pleɪnə] *(adj.)* – плоский, плоскостной, планарный

In graph theory, a **planar** graph is one that can be embedded in the plane.

Ex. 7

a. Match the words with their definitions.

1) aerial
2) helical
3) waveguides
4) adjust
5) transmitter
6) induction coil
7) wavelength
8) succession
9) dipole

a) a number of similar events or people that happen, exist, etc. after each other

b) a simple type of radio aerial (= a structure that receives or sends out radio signals) that is shaped like the letter T

c) a type of electrical transformer used to produce high-voltage pulses from a low-voltage direct current (DC) supply

d) a piece of equipment for broadcasting radio or television signals

e) a structure that guides waves

f) the distance between two waves of energy or the length of the radio wave used by a particular radio station for broadcasting programmes

g) in the shape of a helix

h) to change something slightly, especially to make it more correct, effective, or suitable

i) a structure made of metal rods or wires that receives or sends out radio or television signals

b. Translate the terms with the word antenna.

Mast antenna; coil antenna; drag antenna; elevation antenna; sense antenna; slot antenna; split antenna; spot-beam antenna; trailing antenna; transmitting antenna; wide aperture antenna; wire antenna; directional antenna; omni-directional antenna; end-on directional antenna; highly directional antenna; conical-horn antenna; weakly directional antenna; corrugated horn antenna; broadside directional antenna; reentrant horn antenna.

READING

Antenna

Antenna, also called Aerial, is known to be a component of radio, television, and radar systems that directs incoming and outgoing radio waves. Antennas are usually metal and have a wide variety of configurations, from the mast like devices employed for radio and television broadcasting to the large parabolic reflectors used to receive satellite signals and the radio waves generated by distant astronomical objects.

The first antenna is known to have been devised by the German physicist Heinrich Hertz. **D**uring the late 1880s, he carried out a landmark experiment to test the theory of the British mathematician-physicist James Clerk Maxwell that visible light is only one example of a larger class of electromagnetic effects that could pass through air (or empty space) as a succession of waves. Hertz built a transmitter for such waves consisting of two flat, square metallic plates, each attached to a rod, with the rods in turn connected to metal spheres spaced close together. An induction coil connected to the spheres caused a spark to jump across the gap, producing oscillating currents in the rods. The reception of waves at a distant point was indicated by a spark jumping across a gap in a loop of wire.

The Italian physicist Guglielmo Marconi, the inventor of wireless telegraphy, constructed various antennas for both sending and receiving, and he also discovered the importance of tall antenna structures in transmitting low-frequency signals. In the early antennas built

by Marconi and others, operating frequencies were generally determined by antenna size and shape. In later antennas, frequency was regulated by an oscillator, which generated the transmitted signal.

More powerful antennas were constructed during the 1920s by combining a number of elements in a systematic array. Metal horn antennas were devised during the subsequent decade following the development of waveguides that could direct the propagation of very high-frequency radio signals.

Over the years, many types of antennas have been developed for different purposes. An antenna may be designed specifically to transmit or to receive, although these functions may be performed by the same antenna. A transmitting antenna, in general, must be able to handle much more electrical energy than a receiving antenna. An antenna also may be designed to transmit at specific frequencies. Frequency modulation (FM) broadcasting is carried out at a range from 88 to 108 megahertz (MHz). At these frequencies, a typical wavelength is about 3 meters long, and the antenna must be adjusted more precisely to the electromagnetic wave, both in transmitting and in receiving. Antennas may consist of single lengths of wire or rods in various shapes (dipole, loop, and helical antennas), or of more elaborate arrangements of elements (linear, planar, or electronically steerable arrays). Reflectors and lens antennas use a parabolic dish to collect and focus the energy of radio waves, in much the same way that a parabolic mirror in a reflecting telescope collects light rays. Directional antennas are designed to be aimed directly at the signal source and are used in direction-finding.

Notes to the Text

electronically steerable array (ESA) – антенная решётка с электронным управлением пучка (антенная решетка с электронным сканированием луча)

lens antenna – линзовая антенна; антенна-линза

directional antenna – направленная антенна

loop of wire – проволочная петля

horn antenna – рупорная антенна

loop antenna (loop) – рамочная антенна, рамка

Ex. 8 Answer the questions.

1. What is antenna? 2. Who devised the first antenna? 3. What was the purpose of Heinrich Hertz's experiment he carried out in the late 1880s? 4. What kind of transmitter did Hertz build? 5. What was the reception of waves at a distant point indicated by? 6. What was Guglielmo Marconi's contribution to antennas improving? 7. In what way were more powerful antennas constructed during the 1920s? 8. What are the different purposes many types of antennas have been developed for? 9. What antenna, in general, must be able to handle much more electrical energy? A transmitting antenna or a receiving antenna? 10. What range is FM broadcasting carried out at? 11. What shapes may antennas consisting of single lengths of wire or rods be? 12. What do reflectors and lens antennas use to collect and focus the energy of radio waves?

Ex. 9 Complete the sentences using the correct form of the word in brackets. State the part of speech.

1. Antennas are usually metal and have a wide (to vary) of configurations. 2. The first antenna (to devise) by the German physicist Heinrich Hertz. 3. Hertz built a transmitter for such waves (to consist) of two flat, square metallic plates. 4. The reception of waves at a (distance) point was indicated by a spark jumping across a gap in a loop of wire. 5. The (Italy) physicist Guglielmo Marconi, the inventor of (wire) telegraphy, constructed (vary) antennas for both sending and receiving. 6. In the early antennas (build) by Marconi and others, operating frequencies were generally (determine) by antenna size and shape. 7. An antenna may be designed (specifical) to transmit or to receive. 8. A (transmit) antenna must be able to handle much more electrical energy than a (receive) antenna. 9. The antenna must be adjusted to the electromagnetic wave, both in (transmit) and in (receive). 10. (reflect) and lens antennas use a parabolic dish in much the same way that a parabolic mirror in a (reflect) telescope collects light rays.

Ex. 10 Make the pairs of words.

1)	parabolic	a)	antennas
2)	radio	b)	currents
3)	electromagnetic	c)	waves
4)	oscillating	d)	modulation
5)	landmark	e)	effects
6)	wireless	f)	telegraphy
7)	low-frequency	g)	experiment
8)	systematic	h)	reflectors
9)	metal horn	i)	array
10)	frequency	j)	signals

LANGUAGE STUDY

Word Building

Ex. 11 Fill in the gaps with the appropriate prefixes from the box. Use each prefix once only.

over- semi- em- in- dis- mis- micro- dis- re- en-

1. Antenna captures available signals, and *-cards* the unwanted ones.
2. The keyboard is used as a device to *-put* data into a computer.
3. *-phone* is picking up the original sound in the first place.
4. The battery usually *-charges* not to the point.
5. Cell phone *-ables* people to communicate at any distance.
6. Setting a battery in the place one can't *-arrange* plus and minus.
7. *-use* of electric devices leads to serious injure or even death.
8. Information *-load* makes listeners tired.
9. Silicon is an example of a very good *-conductor*.
10. When the frequency is picked up, *-phasized* and fed round loop antenna, we get resonance effect.

Ex. 12 Read the derivatives, state their part of speech and give Russian translation.

Cover *(n, v)* – coverage – covering *(n)* – discover – discoverer – discoverable – discovery – uncover – uncovered – recovered; efficiency – inefficiency – efficiently; inefficiently – coefficient; exact *(adj, v)* –

exactly – exactness – exactitude – exacting *(adj)* – inexact; rely – reliable – unreliable – reliably – reliance – reliant – reliability; possible – impossible – possibly – impossibly; reduce – induce – reducible – reduction – reductionism – reductionist *(adj)*; access *(n, v)* – accessible – inaccessible – accessibly – inaccessibly – accessibility – inaccessibility – accession; mark *(n, v)* – remark – marked – unmarked – marking *(n)* – marker – markedly; consider – reconsider – considerable – inconsiderable – considerably – considered *(adj)* – considerate – inconsiderate – considerately – inconsiderately – consideration reconsideration; secure *(adj, v)* – securely – security – securely – insecurely; sense *(n ,v)* – nonsense – senseless – sensibility – sensible – sensibly – sensing element – sensitive – sensitivity – sensor – insensible – insensibility – insensitive; depend – dependant *(n)* – dependent – (in)dependent – dependence – independence – independently – dependency – dependable – dependably; move *(n, v)* – remove – movement – mover – movable – removable – immovable – moving – movingly – unmoved – remove – removal – remover.

Translation Difficulties

Указательное местоимение (that, those)	***That*** *experiment was extremely dangerous.*
Относительное местоимение (that)	*The experiment* ***that*** *he carried out was important.*
Союз (that)	*We know* ***that*** *the experiment was extremely dangerous.*
Эмфатическая конструкция (that)	***It is*** *this experiment* ***that*** *was dangerous.*
Замена ранее упомянутых существительных. В таком случае за ними обычно стоит предлог (чаще всего *of*) или причастие в функции определения. При переводе на русский язык слова *that* и *those* рекомендуется заменять существительными.	*The preparations for that experiment were quite different from* ***those*** *of the rest research.*
That is = i.e.	*То есть*

Ex. 13 Translate the sentences. Pay attention to the word <u>that, those</u>.

1. In order to see the molecules separately we must necessarily use radiation with a wavelength thousands of times shorter than that of visible light – or, in other words, we have to use radiation called X-rays. 2. Another advantage of the heat exchanger is that it is easily dismantled for inspection and cleaning. 3. A barometer is an instrument that is used for measuring air pressure. 4. The direction of current in a conductor is still taken in the conventional manner, i.e. (that is) from positive to negative ones. 5. The rate is identical to that of the free-flowing reaction. 6. A heat pump is a machine or device that moves heat from one location (the 'source') to another location (the 'sink' or 'heat sink'), using work. 7. The properties of solid bodies are quite different from those of fluids. 8. We now know that atoms are made up of different numbers of electrons, neutrons and protons, and these too are made up of even smaller particles. 9. The reaction is similar to that observed by us. 10. The light falling on your face left the Sun just 8 minutes ago. In those 8 minutes, it travelled 93 million miles. 11. It is the computer that performs these calculations. 12. Wind energy is a domestic, reliable resource that provides more jobs than any other energy technology – more than five times that from coal or nuclear power. 13. In heating, ventilation, and cooling applications, a heat pump normally refers to a vapor compression device that includes a reversing valve and optimized heat exchangers so that the direction of heat flow may be reversed.

SPEAKING

Ex. 14

a. Act the dialogue:

- Good morning. It's AW office. How can I help you?
- You see, I bought an antenna at your company and got absolutely no channels!
- Don't worry. Just check to make sure you have correctly connected the antenna to your HDTV or receiver. Re-Scan for Channels.

- I tried all these but no results!
- Make sure your TV's setup menu is set to the Antenna or Air mode.
- Of course, it is! I have read the TV manual and studied the detailed instructions.
- Reposition the antenna in a different location. Maybe higher on a wall or closer to a window. Facing the direction of the broadcast tower is usually the best. Signal strength will vary based on certain conditions.
- I try the reposition with no much use… You see, I know the distance from the tower, hills, buildings and even tall trees can impact reception.
- Try to re-scan for channels after moving the antenna. Have you got an amplifier?
- Yes, I have and it is supposed to be quite efficient.
- You see, if the antenna has an amplifier and it's being used and a signal cannot be received, you should turn off the amplifier and try again. In some instances, the amplifier may cause self-oscillation, which may interfere with the signal. Try the antenna in different locations, sometimes moving a few feet can make a difference.
- Well, I'll try once more. Thanks for help.
- You are welcome. Please, call again if no results, and we'll send our antenna service master to adjust your antenna.

b. Stage your own dialogue. Use the questions below as a prompt:

- My antenna was working the other day and now it's not, what happened?
- When I install the antenna, will I have an on-screen guide so I can see what shows are on?
- Why can't I get the same channels with my new antenna that I was able to get with my old satellite or cable provider?
- Besides the antenna what else do I need to purchase?

- Will my TV get the new digital signals? Do I need a converter box in order to get local off-air channels on my HDTV?
- Why are there some channels that I can no longer receive after the switch from analog to digital?
- What HD and Digital channels can I get in my area if I purchase an OTA antenna?
- Do I need a VHF or UHF digital TV Antenna for my HDTV?
- Will a TV antenna work for me if I have many trees around my house?

Ex. 15 Make a presentation / Say what you know about:

a. History of smart antennas. Use the plan:

1. Directional antennas
2. Phased array radar
3. Adaptive antenna arrays
4. Digital antenna arrays
5. Advanced processing techniques
6. Space division multiple access (SDMA)
7. Development of 4G MIMO
8. Emerging 5G MIMO-OFDM standards

b. History of radar: Early contributors. Use the plan:

1. Heinrich Hertz
2. Guglielmo Marconi
3. Christian Hülsmeyer

c. History of radio. Use the plan:

1. Invention
2. 19th century (Hertzian waves, Guglielmo Marconi)
3. 20th century (Wavelength (meters) vs. frequency (kilocycles, kilohertz, Digital era)
4. Later 20th-century developments (Telex on radio, Radio navigation, Color television, Mobile phones, Digital era).

Module 6. Electronics

Unit 15

Grammar. The Attribute. Ways of expressing the Attribute
Text. Light-Emitting Diode (LED)
Word building. Negative Prefixes

GRAMMAR

The Attribute. Ways of expressing the Attribute
Определение. Способы выражения определения

Attribute (Определение)	
Отвечает на вопросы:	what? what kind of? – какой? which? – который? whose? – чей? how much? how many? – сколько?
Выражается в предложении:	
прилагательным	***fast*** movement
числительным	***two kilos*** of iron
местоимением	***his*** bulb lamp
существительным в общем падеже	***power*** plant
Существительным в притяжательном падеже	***engineer's*** project
существительным с предлогом	The roof ***of the house*** needs painting.
наречием	the inventor ***there***
инфинитивом	This is the meter ***to use*** in the experiment. We will study minerals ***to be obtained*** in this mountain.

причастием	The student ***reading*** the article isn't using a dictionary. Yesterday the professor told us about his experiments ***being carried*** at his laboratory. Stones ***thrown*** into the water go to the bottom.
герундием	The independent particle model has the advantage of ***possessing*** a high degree of physical visuality. The student has no objection to ***being sent*** to the conference.

See Grammar Module

Ex. 1 Translate the following expressions with the Attribute.

Direct current (DC), alternating current (AC), an electric charge, a charge carrier, an electromotive force (EMF), an electrical insulator, electric shock, technical failure, electrical supply, mains electricity, a power grid, AC generation, field coil, electromagnetic induction, a power station, a transmission line, an electric circuit, a parallel circuit, a series circuit, a power socket, an electric wire.

Ex. 2 Find the Attribute. Define the part of speech and translate the sentences.

1. Molecular electronics – designing carbon-based molecules to act as wires, diodes, transistors and other microelectronic devices – is one of the most dynamic fields of nanotechnology. 2. With up to four stacked diodes in a device, the lasers can output up to 80 W of infrared power at a pulse length of 100 ns. 3. An integrated circuit contains a transistor and a diode. 4. Complex systems of radio transmission networks have been set up throughout the world. 5. A diode is the simplest possible semiconductor device and is, therefore, an excellent beginning point if you want to understand how semiconductors work. 6. The device made at our laboratory will be used in industry. 7. Electronic technologies to watch: diodes that convert waste heat into electricity and cheap com-

puter chips printed like newspapers. 8. The field emission cathode can be used as an efficient cold cathode in a variety of electronic devices. 9. Scientists working at new computers have a lot of different problems to solve. 10. Even the simplest information can be forgotten or distorted in the process of transmission. 11. **O**ptical and transmission electron microscopies were performed on the samples. 12. **O**ur company is currently undertaking some of transmission system upgrade work. 13. I wondered if we will ever find a way for a more efficient transmission of knowledge. 14. It is a large printed circuit board. 15. The method described allowed to calculate all necessary characteristics.

Ex. 3 Insert the phrases with the Attribute in the right sentence. Translate the sentence.

mental and physical energy; electron transfer mechanisms; rapidly developing area; new high-precision instruments; genetic code phenomena; two-thirds of nanotubes; advantage of using

1. In this paper we survey the possibilities arising from the application of … . 2. I will give a review of paper covering the most overwhelming problems in the field of the … . 3. This conference has brought together a large number of researchers working in the … of high-energy physics. 4. The literature to be reviewed in connection with this problem should primarily be concerned with theoretical treatments of the … . 5. After six hours of work at school, students have little … to do more work at home. 6. About … are semiconductors, and the remaining third are metals. 7. At least one … this technique is obvious.

VOCABULARY

1. **Light-emitting diode (LED)** *(n.)* – светодиод

A single red **LED** shows that the power is switched on.

2. **Application** *(n.)* – применение

The research has many practical **applications**.

3. **Optical signal** *(n.)* – оптический сигнал, световой сигнал

Optical signals propagating in the waveguide can be manipulated in phase and/or intensity at high speed, using optical modulators.

4. **Transmission** *(n.)* – передача

A system in a vehicle that changes the gears itself so that the driver does not have to is called an automatic **transmission**.

5. **Inventor** *(n.)* – изобретатель

He made a career as an **inventor** of quick-selling gadgets.

6. **Light bulb** *(n.)* – электрическая лампочка, осветительная лампа

The room was lit only by a single 40-watt **light bulb**.

7. **Emit** *(v.)* – излучать

The metal container began to **emit** a clicking sound.

8. **Heat energy** *(n.)* – тепловая энергия, теплота

Heat energy can be transferred from one object to another.

9. **Diode** *(n.)* – диод

An integrated circuit contains a transistor and a **diode**.

10. **Electrical valve** *(n.)* – электрический вентиль, электрический клапан, электрический элемент

English **Electrical Valve** Company, currently known as E2V, is an English electronics company.

11. **Electronic density** *(n.)* – электронная плотность

Visualization of **electronic density** gives a better indication of molecular size.

12. **Junction** *(n.)* – соединение, p-n переход

This quantum mechanical tunneling process is an important mechanism for thin barriers such as those in metal-semiconductor **junctions**.

13. **Semiconductor** *(n.)* – полупроводник

A device containing a **semiconductor** is used in electronics.

14. **Investigate** *(v.)* – исследовать, изучать, выяснять

These physical events have not yet been thoroughly **investigated**.

15. **Generate (light)** *(v.)* – создавать (свет)

The solid-state junctions are the only elements of the **LED** light source that **generate** and emit **light**.

16. **Detect (light)** *(v.)* – обнаруживать (свет)

The sensor **detects** changes in light level and temperature.

Ex. 4

a. Match the words with their definitions.

1) light bulb
2) light-emitting diode (LED)
3) semiconductor
4) application
5) diode
6) wire
7) transmission
8) electrical current
9) electronic density
10) electrical valve

a) a device that produces light on electrical and electronic equipment
b) an electronic device in which the electric current passes in one direction only
c) the glass part that fits into an electric lamp to give light when it is switched on
d) the act or process of sending out an electronic signal or message or of broadcasting a radio or television program
e) metal in the form of thin thread; a piece of this
f) a solid substance that conducts electricity in particular conditions, better than insulators but not as well as conductors
g) practical use
h) a non-negative function integrating to the total number of electrons
i) an electron tube from which all or most of the gas has been removed, permitting electrons to move with low interaction with any remaining gas molecules
j) the movement of electrically charged particles, atoms, or ions, through solids, liquids, gases, or free space

b. Translate the terms with the word <u>diode</u>.

Diode action; diode alternating current switch; diode amplifier; diode and rectifier tester; diode and rectifiers; diode anode; diode arrangement; diode array; diode array analysis; diode-transistor logic; stacked diodes; vacuum diode; light-emitting diode; organic light-emitting diode; semiconductor diode; Esaki (tunnel) diode; Zener diode; diode laser; p-n junction diode; thermionic diode; faulty diode.

READING

Light-Emitting Diode (LED)

Light-emitting diodes (LEDs) – small colored lights available in any electronics store – are widely used in modern society. They are the indicator lights on our stereos, automobile dashboards, and microwave ovens. Numeric displays on clock radios, digital watches, and calculators are composed of bars of LEDs. LEDs also find applications in telecommunications for short range optical signal transmission such as TV remote controls. They have even found their way into jewelry and clothing – witness sun visors with a series of blinking colored lights decorating the water face. The inventors of the LED had no idea of the revolutionary item they were creating. They were trying to make lasers, but on the way they discovered a substitute for the light bulb.

Light bulbs are really just wires attached to a source of energy. They emit light because the wire heats up and gives off some of its heat energy in the form of light. LED, on the other hand, emits light by electronic excitation rather than heat generation. Diodes are electrical valves that allow electrical current to flow in only one direction, just as a one-way valve might in a water pipe. When the valve is "on", electrons move from a region of high electronic density to a region of low electronic density. This movement of electrons is accompanied by the emission of light. The more electrons that get passed across the boundary between layers, known as a junction, the brighter the light. This phenomenon, known as electroluminescence, was observed as early as 1907. Before working LEDs could be made, however, cleaner and more efficient materials had to be developed.

LEDs were developed during the post-World War II era; during the war, there was a great interest in materials for light and microwave detectors. A variety of semiconductor materials were developed during this research effort, and their light interaction properties were investigated in some detail. During the 1950s, it became clear that the same materials that were used to detect light could also be used to generate light. Researchers at AT&T Bell Laboratories were the first to

exploit the light-generating properties of these new materials in the 1960s. The LED was a forerunner, and an unexpected byproduct, of the laser development effort. The tiny colored lights held some interest for industry because they had advantages over light bulbs of a similar size: LEDs use less power, have longer lifetimes, produce little heat, and emit colored light.

The advantages of the LED over the light bulb for applications requiring a small light source encouraged manufacturers to start the commercial manufacture of LEDs. Sudden widespread market acceptance in the 1970s was the result of the reduction in production costs and also of clever marketing, which made products with LED displays. The technology is still developing today as manufacturers seek ways to make the devices more efficiently, less expensively, and in more colors.

Notes to the Text

byproduct – побочный продукт
water face – поверхность воды

Ex. 5 Answer the following questions.

1. What is a light-emitting diode? 2. Are numeric displays on clock radios, digital watches, and calculators composed of bars of LEDs? 3. Have LEDs found their way into jewelry and clothing? 4. What did the inventors of the LED think about their invention? 5. Are light bulbs just wires attached to a source of energy? 6. Diodes are electrical valves that allow electrical current to flow in only one direction, aren't they? 7. What is a junction? 8. What was developed during the post-World War II era? 9. What are the advantages of the LED over the light bulb for applications? 10. What is the purpose of the LED manufacturers nowadays?

Ex. 6 True or false sentences.

1. LEDs are the indicator lights on our stereos, automobile dashboards, and microwave ovens.
2. LEDs can't be found in TV remote controls.

3. The inventors of the LED were trying to make lasers, but on the way they discovered a substitute for the vacuum tube.

4. Light bulbs don't emit light because the wire doesn't heat up and give off some of its heat energy in the form of light.

5. When the valve is "on", electrons move from a region of high electronic density to a region of low electronic density.

6. The movement of electrons is accompanied by the emission of heat.

7. The phenomenon, known as electroluminescence, was observed as early as 1907.

8. LEDs were developed during World War II.

9. During World War II there was a great interest in materials for light and microwave detectors.

10. During the 1960s, it became clear that the same materials that were used to detect light could also be used to generate light.

Ex. 7

a. Insert the active vocabulary in the part of the text. Some words can be used more than once.

the light bulb	LEDs	lasers
colored lights	the indicator lights	lights
transmission	inventors	applications

… – small colored … available in any electronics store – are ubiquitous in modern society. They are … on our stereos, automobile dashboards, and microwave ovens. Numeric displays on clock radios, digital watches, and calculators are composed of bars of … . … also find … in telecommunications for short range optical signal … such as TV remote controls. They have even found their way into jewelry and clothing – witness sun visors with a series of blinking … adorning the brim. The … of the … had no idea of the revolutionary item they were creating. They were trying to make …, but on the way they discovered a substitute for … .

b. Make the pairs of words.

1)	light-emitting	a)	radio
2)	optical	b)	light
3)	electronics	c)	watch
4)	light	d)	diode
5)	indicator	e)	property
6)	electronic	f)	bulb
7)	colored	g)	lights
8)	digital	h)	density
9)	electrical	i)	store
10)	clock	j)	current
11)	light-generating	k)	signal

LANGUAGE STUDY

Word Building

Negative Prefixes

Пре-фикс	***Употребление***	***Пример***
Un-	С префиксом ***un-*** можно образовать наибольшее количество слов с противоположным значением, также он является основным при образовании отрицания у глаголов. Не существует четкого правила, когда и где его нужно употреблять. Слова с этим префиксом нужно просто запоминать. Но существуют некоторые частные случаи: ○ Чаще всего употребляется перед гласными в прилагательных и причастиях: *usable* – ***un****usable* (годный – непригодный). ○ Перед согласными: *magnitized* – ***un****magnetized* (намагниченный – ненамагниченный). ○ Глаголы с ***un-*** чаще всего имеют не отрицательное значение, а противоположное: *chain* – ***un****chain* (сковывать – освобождать). ○ Добавляется к словам германского происхождения: *teachable* – ***un****teachable.*	*unable*

In-	***In-*** чаще всего употребляется: ○ Перед сочетанием букв ***ac***: *accurate* – ***in****accurate* (точный – неточный). НО ***un****acceptable* – неприемлемый. ○ Перед согласным ***c***: *capable* – ***in****capable* (способный – неспособный). ○ Исключения: ***in****formal* – неформальный; ***in****articulate* – невнятный. ○ Добавляется к словам латинского происхождения ***in****educable – необучаемый.*	*inactive*
Im-	***Im-*** употребляется перед прилагательными, начинающимися с согласной ***p***.	*impossible*
Il-	Употребляется со словами, начинающимися с согласной ***l***.	*illogical*
Ir-	Употребляется со словами, начинающимися с согласной ***r***.	*irreplace-able*
Mis-	Префикс ***mis-*** обозначает что-то «неправильное», «ошибочное», так как чаще всего она именно в этом значении употребляется, ***mis-*** употребляется только с существительными, глаголами и причастиями.	*misunder-stand*
Dis-	Префикс ***dis-*** употребляется: ○ Прилагательные и причастия: *organized* – ***dis****organized* (организованный – неорганизованный). ○ Слова, начинающиеся с произносимой ***h***: *harmonious* – ***dis****harmonious* (гармоничный – негармоничный). ○ С некоторыми словами, начинающимися с согласной: *ˈpassionate* – ***dis****passionate* (страстный – бесстрастный). ○ С существительными и глаголами: ***dis****satisfy – неудовлетворять.*	*disap-ˈproval*
Anti-	Префикс ***anti-*** обозначает «против». Слова с префиксом *anti-* могут писаться как с дефисом, так и без него.	*anti-choice*

Non-	Префикс ***non-*** употребляется довольно редко, он происходит от частицы ***no***, иногда может заменять другие префиксы (например, ***un-***): ***non****re-coverable* – ***un****recoverable* (не восстановляемые).	*non-conductor*
A-	Префикс ***a-*** присоединяется только к словам, начинающимся с согласной буквы. Этот префикс обозначает отсутствие какого-то признака («без» чего-либо) и добавляется к прилагательным, которые оканчиваются на *–al*: normal – **a**normal (нормальный – ненормальный)	*apolitical*
De-	Префикс ***de-*** добавляется к глаголам и обозначает обратное действие: mount – **de**mount (монтировать, собирать – демонтировать, разбирать).	*deactivate*

Ex. 8 Translate the following words paying attention on the words with negative prefixes and without them.

Insist, incorrect, interesting, inflammable, inhabitable, invaluable, unadvisable, undisciplined, unfriend, unfollow, unpack, unpaid, unmarked, unmask, unprofessional, unrecoverable, unusable, devalue, distasteful, disadvantageous, disorganized, nonfiction, nonsense, nonresident, nonstop, non-transferrable, antiwar.

Ex. 9 Make the new words with negative prefixes from the following words and translate them.

Accurate, balance, teachable, organic, decent, credible, formal, adequate, complete, conduct, activate, correct, honorable, take, developed, affected, depressant, educable, rational, inform, understanding, legal, believable, resistible, mobile, perfect, possible, mature, regular, responsible, legible, logical, social, code, construct, form, frost, agree, agreement, loyal, lead, place, essential, existent, government.

Translation Difficulties

Ex. 10 Translate the sentences. Pay attention to the word once.

1. I will text you once I finish my homework. 2. I will call you once I get the new solution. 3. Send me your report once you finish the pro-

ject. 4. I knew at once that something was wrong. 5. It must be done at once. 6. Once standards are established, system performance is measured and compared with the standard. 7. Once a company has gained a reputation for releasing buggy software, it takes a long time and lots of effort to overcome people's negative perceptions. 8. Click the button once to show the non-printing characters; click on it again to hide them. 9. This makes it easy to see two views of the same document or to scroll to two different parts of a large document at once. 10. Once you've located the Word icon, point to it using your mouse, then click on it twice quickly (double-click) to launch the program. 11. We have to resolve this matter once and for all.

SPEAKING

Ex. 11

a. Read the following dialogue, try to act it out and translate it into Russian.

Customer: Good afternoon. Is that Electronic Tools?

Secretary: Yes, that's right. How can I help you?

Customer: I would like to place an order.

Secretary: Hold the line, please. I'll put you through to Order Department.

Clerk: Order Department, how can I help you?

Customer: We received your catalogue last month, and I'd like to order some LEDs, please.

Clerk: Certainly. Could you quote the reference number?

Customer: Let me have a look… Right, 500 LEDs, reference 0590.

Clerk: I'll just enter data. 500 LEDs at 5000 pounds.

Customer: That's all right.

Clerk: Shall I confirm the order? Could I have your company name and address or do you have an account with us?

Customer: I'm calling from Electronics Ready. Our account number is 138/ER.

Clerk: Oh, yes – the address is Queen Street, Oxford?

Customer: That's right. As this is a repeat order, could you grant us a discount?

Clerk: I'm sorry, that's not company policy. However, we could allow you a longer credit period.

Customer: Thank you. We need the goods urgently, can you supply them from stock and dispatch them at once?

Clerk: I'm afraid there's a two-week lead time but I'll check with production. We should be able to send the goods by the end of the month at the latest.

Customer: Well, please do your best.

Clerk: How would you like delivery to be made – rail, road or air freight?

Customer: I think air would be the quickest.

Clerk: There will be a small supplement for air freight on the invoice.

Customer: That's O.K. – I'll send you an order confirmation by fax. Thank you for your help.

Clerk: Thank you for calling. Goodbye.

Ex. 12 Read the instructions recorded on the answering machine and write the message that you would leave.

This is 02 55 67 83 49, True Orders Inc. There is no one on premises at the moment, but you may leave your order after the tone. Please leave your name, address and account number. Quote the item number from our catalogue, the quantity of goods required and the size, if applicable. We will fax you an order acknowledgement and dispatch the goods as soon as possible. Thank you for your call.

Order from: Mark Thomas, Easy Exchange, 10 High Street, Oxford.
A/C № 000007896
50 Euro-converters – item №754 / EU – 5 euro each? Quantity discount
Needed before 5, May 2022

Unit 16

Grammar. The Attributive Clauses
Text. Lasers
Word building. Stress Change

GRAMMAR

The Attributive Clauses
Придаточные определительные предложения

Отвечает на вопросы:	what? / which? – какой? / который?
	Соединяется в предложении:
относительными местоимениями: **who** – который, **whom** – которого, **whose** – чей, которого, **which** – который, **that** – который	The engineer *that (who)* lives in the neighboring street is a very famous scientist. The word *that (which)* stands for Light Amplification by Simulated Emission of Radiation is a laser. This is one of the few really good lasers *that* was developed last month.
наречиями: **when** – когда, **where** – где, куда, **why** – почему	A university is a place *where* students are taught.

Ограничительные определительные предложения

Содержат информацию, уточняющую значение слова, к которому они относятся. Опущение ограничительного придаточного предложения часто ведет к неясности или изменению смысла главного предложения. Ограничительные определительные придаточные предложения не выделяются запятыми.

Can you remember the name of the university where we visited a large library?

Описательные определительные придаточные предложения
Предоставляют дополнительную информацию, которая не является обязательной для понимания смысла главного предложения. В отличие от ограничительного, описательные придаточные и вовсе могут быть вынесены в отдельное предложение, при этом главное не понесет никакого смыслового ущерба. Выделяются запятыми.
They stopped at the library, which they had never been into before.

See Grammar Module

Ex. 1 Insert who, whom, whose, which, that.

1. The only people … knew it were engineers. 2. Albert Einstein was a scientist to … we should be thankful for the invention of the theory of relativity. 3. A figure … has three sides is called a triangle. 4. Our university, … was founded 90 years ago, is one of the oldest educational establishments in Russia. 5. The question … I asked was very important. 6. Do you have anything … will help me with my report? 7. The railroad line … connected Moscow with Saint-Petersburg was built at the close of the 19th century. 8. I have bought the book … our professor recommended. 9. The student with … I travelled last year is an excellent swimmer. 10. I have bought the book about … you told me. 11. I have just read an article … contains very interesting facts about the system of education in England. 12. The young engineer with … I am working graduated from the MPEI. 13. The young professor … book I am reading now graduated from Oxford University.

Ex. 2 Find the Attribute Clauses. Translate the following sentences.

1. Scientists all over the world who had taken part in the conference were quick to realize the importance of radio. 2. The Russian scientist A.S. Popov, who invented the radio, worked much on the problem of radio communication. 3. The device that is being made at our laboratory will be used in the industry soon. 4. The system of communication in any country, that is spoken all over the world, is unthinkable today without satellites. 5. Scientists who work at the new computer equipment have a lot of different problems to solve. 6. A simple radio tele-

scope, that contains a directional antenna, collects incoming radio waves and delivers the collected energy to a receiver. 7. The studies which have been described in this paper have become classical ones. 8. The wave length that is so determined will not be exactly accurate. 9. The ions that are formed this way will be accelerated in the direction towards the cathode. 10. The first practical spectroscope, which was designed in 1858, was provided with a glass prism and used only for visible light. 11. The photoelectric current, that has been measured by means of the galvanometer, is directly proportional to the intensity of light. 12. The gamma-rays that are observed here may be identified with the ones observed in the previous experiments. 13. The decimal system, which was developed by French scientists, was introduced in Russia by D.I. Mendeleev.

Ex. 3 Complete the sentences with the correct form of the Attribute Clauses.

1. Simultaneous translation (to provide) at the conference was excellent. 2. We are going to study mechanisms (to underlie) photosynthesis. 3. The knowledge (to gain) on the subject during the past decade is rather important. 4. For further details, the reader is referred to the paper (to present) by Dr Brown. 5. The calculation depends on the peculiar laws (to govern) the movement of molecules. 6. New discoveries (to add) valuable information on the true forms of molecules may be made. 7. Facts (to demonstrate) that there were large potential irregularities in the energy level throughout the crystal were found. 8. An equation (to describe) the depolarization of the fluorescence has been found. 9. A theory (to take) into account the angular distribution of the scattered light is presented. 10. The theoretical importance of the wave theory of matter (to apply) to electrons will be discussed at the conference.

VOCABULARY

1. **Laser** *(n.)* (light amplification by stimulated emission of radiation) – лазер

The coating absorbs some of the **laser**'s light, a percentage of which is made into a photocurrent.

2. **Amplification** *(n.)* – усиление

New models of equipment include amp**lification** and signal transmission products.

3. **Involve** *(v.)* – охватывать, включать в себя

Sarah has been working at West Mid for the past 13 years and her job **involves** a variety of tasks.

4. **Excited state** – возбужденное состояние

Nuclear isomers are **excited states** that eventually decay to the ground state, mostly by gamma radiation.

5. **Ground state** – основное состояние, невозбужденное, неактивное состояние

When an atom or ion is in its **ground state**, the electrons spend a lot more time close to the nucleus than they do when the atom is in an excited state.

6. **Photon** *(n.)* – фотон

A photon has zero rest mass, but it carries energy and momentum.

7. **Reflect** *(v.)* – отражать

The lightness or darkness of a color affects whether it can absorb or **reflect** heat and light.

8. **Solid-state** *(adj.)* – твердотельный

This process defines the structure of a **solid-state** device, which in essence is planar.

9. **Implement** *(n., v.)* – выполнение, выполнять

Our two-color scheme is easily **implemented** using conventional continuous wave excitation.

10. **Research** *(n., v.)* – исследование, изучение, исследовать, изучать

The company takes advantage of the time and resources to explore and **research** ideas.

11. **Carbon dioxide** *(n.)* – диоксид углерода

This substance is **carbon dioxide**, into which carbonates decompose when heated.

12. **Etch** *(v.)* – вытравливать

The acid also can **etch** the surface, which increases the water penetration through the face of the joint.

13. **Co**ndense *(v.)* – сжать, уменьшать объем

During the evening, the water vapour **co**ndense**d** on the internal components of the wall panel when the ambient air temperature dropped.

14. **Fiber optic**s *(n.)* – волоконная оптика

The cable TV company is laying miles of **fiber-optic** cables.

15. **Str**and *(n.)* – нить

Fiber optics are thin **str**ands of glass or plastic that transmit light by reflecting it.

Ex. 4

a. Match the words with their definitions.

1) laser
2) emission
3) strand
4) fiber optics
5) radiation
6) amplification
7) movement
8) source
9) photon

a) the production and discharge of something, especially gas or radiation

b) an act of moving

c) a particle representing a quantum of light or other electromagnetic radiation

d) a part of a field-effect transistor from which carriers flow into the inter-electrode channel

e) the use of thin flexible fibers of glass or other transparent solids to transmit light signals, chiefly for telecommunications or for internal inspection of the body

f) a device that generates an intense beam of coherent monochromatic light (or other electromagnetic radiation) by stimulated emission of photons from excited atoms or molecules

g) a single thin length of something such as thread, fiber, or wire, especially as twisted together with others

h) the emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles which cause ionization

i) the action of increasing the amplitude of an electrical signal or other oscillation

b. Translate the terms with the word laser.

Laser beam, laserdisc, laser-guided, laser gun, laser show, laser light show, laser pen, laser printer, laser tag, laser and infra-red irradiation detector, laser ablated atoms, laser ablation, laser ablation analysis, laser ablation electrospray ionization, dye laser.

READING

Lasers

A laser is an extremely focused, extremely narrow, and extremely powerful beam of light. Actually, the term laser is an acronym, standing for Light Amplification by Simulated Emission of **R**adiation. Simulated emission involves bringing a large number of atoms into what is called an "excited state". **G**enerally, most atoms are in a ground state and are less active in their movements, but the energy source that activates a laser brings about population inversion, a reversal of the ratios, such that the majority of atoms within the active medium are in an excited rather than a ground state. As the atoms become excited, and the excited atoms outnumber the ground ones, they start to cause multiplication of the resident photons. This is stimulated emission.

A laser consists of three components: an optical cavity, which involves two mirrors facing one another, an energy source, and an active medium. One of the mirrors fully reflects light, whereas the other is a partly reflecting mirror. The light not reflected by the second mirror escapes as a highly focused beam.

There are four types of lasers: solid-state, semiconductor, gas, and dye. Solid-state lasers are generally very large and extremely powerful. Having a crystal or glass housing, they have been implemented in nuclear energy research, and in various areas of industry. Whereas solid-state lasers can be as long as a city block, semiconductor lasers can be smaller than the head of a pin. Semiconductor lasers (involving materials such as arsenic that conduct electricity, but do not do so as efficiently as the metals typically used as conductors) are applied for the difficult work of making compact discs and computer microchips.

Gas lasers contain carbon dioxide or other gases, activated by electricity in much the same way the gas in a neon sign is activated. Among their applications are eye surgery, printing, and scanning. Finally, dye lasers, as their name suggests, use different colored dyes. (Laser light itself, unlike ordinary light, is monochromatic.) Dye lasers can be used for medical research, or for fun – as in the case of laser light shows held at parks in the summertime.

Laser beams have a number of other useful functions, for instance, the production of compact discs (CDs). Lasers etch information onto a surface, and because of the light beam's qualities, can record far more information in much less space than the old-fashioned ways of producing phonograph records. Lasers used in the production of CD-ROM (Read-Only Memory) disks are able to condense huge amounts of information – a set of encyclopedias or the New York metropolitan phone book – onto a disk one can hold in the palm of one's hand. Laser etching is also used to create digital videodiscs (DVDs) and holograms. Another way that lasers affect everyday life is in the field of fiber optics, which uses pulses of laser light to send information on glass strands.

Notes to the text

outnumber – превосходить численностью
dye laser – лазер на красителях, оптический квантовый генератор на пигментах
optical cavity – оптический резонатор

Ex. 5 Answer the following questions.

1. What is a laser? 2. What is simulated emission? 3. What components does a laser consist of? 4. What types of lasers do you know? 5. Are solid-state lasers very large and extremely powerful? 6. What are semiconductor lasers applied for? 7. What do gas lasers contain? 8. What can dye lasers be used for? 9. What useful functions do laser beams have? 10. Where can lasers be used in our everyday life?

Ex. 6 True or false sentences.

1. The term laser is an acronym, standing for Light Amplification by Simulated Emission of Radiation.
2. Simulated emission involves bringing a large number of atoms into what is called a "ground state".
3. The energy source that activates a laser brings about population inversion, a reversal of the ratios.
4. As the ground atoms outnumber the excited ones, they start to cause a multiplication of the resident photons.
5. Solid-state lasers can be as long as a city block, but semiconductor lasers can be smaller than the head of a pin.
6. Among gas lasers' applications are eye surgery, printing, and scanning.
7. Dye lasers can be used only for fun.
8. Laser beams are used in the production of compact discs (CDs).
9. Laser etching can't be used to create digital videodiscs (DVDs) and holograms.
10. Lasers can be used in the field of fiber optics.

Ex. 7

a. Complete the sentences with the active vocabulary.

etched	solid state	excited states	beam of light	lasers
dye laser	conducts	research	ground state	carbon dioxide

1. It stopped when a … flashed upon it from behind.
2. When that electron returns to its … , it releases energy as ultraviolet light, which is invisible.
3. By finding the energies of the … of a hydrogen atom, we can get an insight into the electromagnetic forces that bind it together.
4. He has thrown down a challenge to all the industry's chip and PC makers to realize his vision of computers capable of storing more than a million times more data than current … chips.
5. Researchers also found that photo dynamics and pulsed … had limited success, though the two therapies 'may hold promise for the future.'

6. Students extensively … their subjects, making sure they're not replicating existing work.

7. Copper … heat and electricity extremely efficiently and is less expensive at the present.

8. It does not produce any more … than the methane that we already have.

9. Statistics and morphology of typical damages of the foil and its resistance to fluorine … were investigated.

10. The final piece is shown in a light box, with holes created by lasers letting light shine through … of coloured plastics.

b. Make the pairs of words.

1) beam of	a) state
2) excited	b) light
3) ground	c) laser
4) optical	d) state
5) solid	e) laser
6) dye	f) cavity
7) semiconductor	g) state
8) carbon	h) strands
9) fiber	i) dioxide
10) thin	j) optics

LANGUAGE STUDY

Word Building

Stress Change

Одним из способов словообразования в английском языке является перенос ударения. Прием этот ограничивается трансформацией ряда двусложных слов, когда ударение на первый слог применяется для существительного, а при переносе его на второй слог получается глагол, по виду идентичный существительному. Разница – в ударении (выделено).

Например,

*Gradually in**crease** the temperature to the boiling point.* – Постепенно увеличивайте температуру до точки кипения.

*Any **in**crease in laser production would be helpful.* – Любое увеличение производства лазеров было бы полезным.

Абсолютное большинство подобных пар – существительные и глаголы. Но иногда благодаря смене ударения получаются прилагательные. Они тоже могут быть как близкими по значению, так и совершенно несвязанными между собой:

CO-ntent (содержание, содержимое) – ***con-TENT*** (довольный)
com-PACT (сжимать, сдавливать) – ***COM-pact*** (компактный)
per-FECT (совершенствовать) – ***PER-fect*** (идеальный)

Ex. 8 Read and translate the words paying attention to the word stress and meaning. In some cases, the meaning of the noun and the verb is different.

Attribute, compress, conduct, conflict, console, contract, control, contest, contrast, decrease, desert, exploit, extract, import, increase, object, permit, present, produce, project, progress, protest, record, refund, refuse, reject, subject, transfer, transport, update, upgrade.

Ex. 9 Insert the given words in the sentences. Put the words in the right form. Pay attention to the word stress and meaning.

attribute	decrease	conduct	object	progress
project	control	present	increase	console

1. A key … of the new service will be flexibility.
2. If at all possible, … a small pilot study to determine how well your research instruments work.
3. Hackers can also jack enemy vehicles and make them their own, as well as hack enemy … so friendly units can use them.
4. The main instruments are in the centre of the … panel.
5. The screening length … with ionization and the difference does not exceed 20%.
6. The new measures are intended to … efficiency.
7. She … to being called his assistant.

8. He … the report to his colleagues at the meeting.
9. Laser images were … onto a screen.
10. Technological … has been so rapid over the last few years.

Translation Difficulties

Ex. 10 Translate the sentences. Pay attention to the words before, after.

1. Before the discovery of the structure of atomic nuclei, it was thought that there existed two general types of forces explaining all natural phenomena: electrical and gravitational forces. 2. The word "helium" comes from the Greek word "sun" because an element was discovered in the sun before it was discovered on the earth. 3. After it became clear that some mistakes had been made in the calculation, the experiment was stopped. 4. After a period of discharge, the battery can be restored to its original condition by supplying energy to it from an outside source. 5. For days or weeks after the reactor has been turned off, the radiation intensity is so great inside that repairs are never attempted. 6. Some scientific theories existed many years before they were proved to be true or false. 7. Before the diaphragm can move back, however, the next pulse enters the electro-magnet coil and the diaphragm is pulled a little closer. 8. The problem, therefore, is to choose a system that will build up the signal before it reaches the detector. 9. After another stage of the amplification, the current is strong enough to operate the powerful loudspeaker. 10 After the nuclei had been broken up because of instability they gave rise to heat. 11. Starting from zero, alternating current grows in one direction, reaches a maximum, decreases to zero, after which it rises in the opposite direction, reaches a maximum, again decreases to zero. 12. The direction of the air, after it leaves a symmetrical body, is the same as before it struck the body. 13. Before K.E. Tsiolkovsky no one ever considered interplanetary navigation to be within the compass of modern technical means. 14. Before the war, the Dnieper power station generated twice as much electrical energy a year as all the power stations of tsarist Russia taken together. 15. Before going further let us be sure we understand the making of a graph.

SPEAKING

Ex. 11

a. Read the following dialogue, try to act it out and translate it into Russian.

Showing the Factory to the Foreign Partner

Mr Black *(the chief executive of the factory)*

Mr Smith *(the foreign partner)*

Mr Black: I'm glad to welcome you to our factory, **Mr Smith**.

Mr Smith: The pleasure is mine. I've been greatly impressed by what I've seen. I understand the factory is operating at full capacity.

Mr Black: Yes, we've plenty of orders, both for the domestic market and export.

Mr Smith: Is any work done by subcontractors?

Mr Black: No, we are fully self-sufficient. We have laboratories, a quality control department, packing – all here.

Mr Smith: Have you been producing this model for a long time?

Mr Black: Yes, we've introduced new technology and started a new model last year. Our designers always keep up with modern technology.

Mr Smith: Is the staff of engineers big?

Mr Black: We have design engineers and production engineers on the factory floor. All in all, it comes to about 100 people.

Mr Smith: How do you ensure quality control, **Mr Black**?

Mr Black: Well, it's done by our quality control department. And of course, final inspection is done by your engineers too.

Mr Smith: Do you also check the packing?

Mr Black: Yes, but we've recently started to use packing companies too.

Mr Smith: Is this the department where our engineers are going to be trained?

Mr Black: Yes, and in other shops too. We are setting up a training program for them.

Mr Smith: I heard there's a part-time engineering college at the factory?

Mr Black: Yes, some of the training will be done there too.

Mr Smith: I'd be very glad to look at the training program.

Mr Black: We'll send it for your approval as early as possible.

Mr Smith: The factory's social facilities are very good, I must say.

Mr Black: Yes, we give a lot of attention to this matter.

Mr Smith: You have got a medical care center, haven't you?

Mr Black: Yes, it's open round the clock to deal with emergencies.

Mr Smith: Are all your workers trade union members?

Mr Black: Yes, trade unions look after a lot of things at the factory.

Mr Smith: Thank you for your excursion. See you later. Bye.

Mr Black: You are welcome. See you. Bye.

b. Put the sentences in the right order, make up a dialogue.

a. Good. Can you tell me how many workers work here?

b. Yes. I'd appreciate it if you could arrange for me a visit to your manufacturers.

c. I see you use up-to-date technology in your factory. The factory is not overmanned, is it?

d. We can take you around the main shops and then we can have a talk in the chief engineer's office.

e. That's possible. We could take you to the plant in …, it's one of our biggest manufacturers.

f. Not if you take into account the total annual output and the range of production. In fact, most of the shops are highly automated (mechanized) as you will see.

g. You wanted to look at our manufacturing factory, didn't you, Mr …?

h. Roughly about 5 thousand.

i. That would be wonderful. I've heard a lot about their production and training facilities.

Ex. 12 Read the given phrases and make up your own dialogues.

Мы хотели бы посетить ваш завод.	We would like to see your factory.
Могли бы мы посетить ваш завод?	Could we see your factory? (Plant, factory, works, mill, enterprise, production unit / facility – завод, фабрика, предприятие)
Когда вы можете (могли бы) организовать посещение завода-изготовителя?	When can (could) you arrange a visit to the manufacturing plant?
Каков общий годовой объем выпускаемой заводом продукции?	What is the total annual output of the factory?
Это один из крупнейших заводов такого типа.	This is one of the biggest factories of its kind.
Раньше он работал на нефти, а теперь работает на электроэнергии.	They used to run on oil, now they've gone over to electricity.
Потребление энергии – … в год.	Power consumption is … per year.
Сколько рабочих занято на заводе?	How many workers does the factory employ?
Штат инженерных работников большой?	Is the staff of engineers big?
Какое сырье вы используете?	What raw materials do you use?
У вас современная технология.	You use up-to-date technology.
Цех (завод) механизирован и имеет высокий уровень автоматизации.	The shop (factory) is highly mechanized and automated.
На заводе используется слишком много рабочих. Это отражается на себестоимости единицы продукции.	The factory is overmanned. The unit cost reflects this.

Завод работает с полной загрузкой.	The factory is operating at full capacity.
Часть продукции производится подрядчиками.	Part of the production is made by subcontractors.
Контроль качества – очень существенный фактор. Он осуществляется в отделе контроля качества.	Quality control is an essential factor. It is carried out in the quality control department.
Окончательная приемка производится (осуществляется) вашими (нашими) инженерами.	Final inspection is done (carried out) by your (our) engineers.
Мы гарантируем качество на уровне мировых стандартов.	We guarantee world standards in quality.
Упаковка производится на нашем заводе (подрядчиками).	Packing is done by ourselves / us / (subcontractors).
Мы начали выпуск новой модели.	We have started producing a new model.
Наш проектный отдел (проектировщики) всегда использует(ют) современную технологию (не отстает(ют) от современной технологии).	Our design department (designers) always keeps (keep) up with modern technology.
Вы можете посмотреть бытовые условия на заводе.	You can see the factory social facilities.
На заводе есть столовые, спортзалы, зона отдыха, медицинский центр.	There are canteens, sporting facilities, a recreation centre, a medical care centre at the factory.
Медицинский центр открыт круглосуточно для оказания первой помощи.	The medical care centre (dispensary) is open round the clock for emergencies.
Мы (завод) работаем(ет) в три восьмичасовых смены.	We (The factory) work(s) in three eight-hour shifts.
Меры охраны труда хорошие (эффективные).	The labor protection is good (effective).

Наши профсоюзы обеспечивают участие рабочих в управлении заводом.	Our trade unions ensure workers' participation in management.
При заводе имеется очно-заочный (вечерний) инженерный колледж.	There is a part-time engineering college at the factory.
На заводе есть курсы для обучения специалистов.	There's a training section at the factory.
Там обучаются молодые рабочие (иностранные специалисты).	Apprentices (Foreign workers) get training there.

Unit 17

Grammar. The Conjunctionless Subordinate Attribute Clause
Text. Physics of Conductors and Insulators
Word building. Negative Prefixes. Stress Change. **R**evision

GRAMMAR

The Conjunctionless Subordinate Attribute Clause
Бессоюзное придаточное определительное предложение

Признаки бессоюзного подчинения:

1. Наличие двух пар главных членов предложения.
2. Возможен стык подлежащих/сказуемых главного и придаточного предложений.
3. Предлог, выносимый за сказуемое придаточного предложения.

The factory *they are to build* will be completely automated. – Завод, который они должны построить, будет полностью автоматизирован.

The factory *the director told us about* is completely automated. – Завод, о котором директор рассказал нам, полностью автоматизирован.

See Grammar Module

Ex. 1 Find the Conjunctionless Subordinate Attribute Clauses. Translate them.

1. The building our students live in is not far from the institute. 2. Bell was making his experiment in a room next to the room Watson worked in. 3. For a long time, Bell couldn't get the results he was looking for. 4. The discovery of Newton's mistake we will read about was made by a young physicist. 5. When Roentgen made his discovery, the room he was experimenting in was dark. 6. The plant this material is produced at is in the Urals. 7. The problem this article deals with is connected with the subject we study. 8. It is difficult to imagine the world we live in without radio, television and telephone. 9. Materials new computers depend on must be of the best quality. 10. The chief engineer must know all the goods his plant produces.

Ex. 2 Rewrite the sentences by omitting the relative pronouns. Put the prepositions in the correct place.

1. This is the book which I took from the university library. 2. Do you know the engineer to whom I was talking? 3. The students with whom I live are very pleasant. 4. This is the box out of which he took the textbooks. 5. I don't know the professor to whom you wrote a letter. 6. The man from whom I got the information is a famous scientist. 7. The applications of laser techniques that are widely spoken about are expanding very rapidly. 8. The holography technique that we have studied is becoming very popular in electronics. 9. A thorough analysis of these optimal phenomena that our engineers have made is still lacking. 10. We are now looking for an optimal solution to the problem, that our professor has told us to do. 11. The body of scientific information that our scientists are speaking about is growing at an exponential rate.

Ex. 3 Complete the sentences by using the Conjunctionless Subordinate Attribute Clauses where possible.

1. The equipment is in great demand on the world market. You are speaking about it. 2. The lecturer wasn't available at that time.

I wanted to speak to him. 3. The girl is our best student. She is speaking on the phone now. 4. We want to go to the library. The day wasn't quite convenient for some of our fellow-students. 5. That day I had no opportunity to see the engineer. I was to go on business with him. 6. I didn't like the book. My fellow-student had recommended me to read it. 7. The information was very important. We were discussing it. 8. A magnetron is a vacuum tube. Its current is affected by a magnetic field. 9. The work of Rutherford was followed by the great research work of many other scientists. It was very important. 10. The properties of these systems were spoken about. They were found by our engineers. 11. New electronic devices are dealt with in this article. They were invented by scientists. 12. The use of colour television is written in this article. It has been spoken about at the conference. 13. Solar batteries are described in this new textbook. Our engineers dealt with them.

VOCABULARY

1. Ins**ulator** ['msjuleɪtə] *(n.)* – изолятор, диэлектрик

A semiconductor is a substance which ability to conduct electricity is between that of an **insulator** like rubber and a full conductor like copper.

2. **(Free) electro**n *(n.)* – (свободный) электрон

Electric current is the movement of **electro**ns from one atom to another in a conductor.

3. **Exhibit** *(v.)* – показывать, выставлять, обладать

Electrons **exhibit** the characteristics of both particle and wave.

4. **Wave** *(n.)* – волна

The following theorem summarizes the basic relationship between travelling and stationary **wave**s.

5. **Occupy** *(v.)* – занимать, завладевать

All physical objects **occupy** space.

6. **Electrostatic** *(adj.)* – электростатический

The device shown above is an "**electrostatic** linear motor", that **I** built last year.

7. **Attraction** *(n.)* – притяжение

As an exercise, you might try computing the electrostatic **attraction** between an electron and a proton and compare it with the gravitational **attraction**.

8. **Distinction** *(n.)* – различие

There is no real **distinction** between conductors and insulators.

9. **Bond** *(n.)* – связь, сцепление, соединение

There was no effective **bond** between the concrete and the steel.

10. **Quantum physics** – квантовая физика

Quantum physics allows for the particles to be in two states at the same time.

11. **Limitation** *(n.)* – ограничение

This also placed severe **limitations** on what could be explored.

12. **Electrical conductivity** – электрическая проводимость

Cooling results in a measurable change in the **electrical conductivity** of the sensor.

13. **Valence(y)** *(n.)* – валентность

The difference in the **valence** of phosphorous and silicon provides the free electrons needed for metal-like behaviour.

14. **Shell** *(n.)* – оболочка

At this time, the maximum number of electron orbitals or electron **shells** for any element is seven.

15. **Comprise** *(v.)* – включать в себя, составлять, охватывать

Helium, which is the second lightest element, **comprises** of two protons, lithium having three.

16. **Impurity** *(n.)* – загрязненность, засоренность, примесь

The **impurities** dissolve in lead and evaporate leaving behind silver and gold.

17. **Proton** *(n.)* – протон

Overall, atoms are neutral and the number of **protons** in their nuclei equals the number of electrons.

Ex. 4

a. Match the words with their definitions.

1) insulator
2) nucleus
3) electron
4) bond
5) matter
6) particle
7) wave
8) attraction
9) motion
10) shell

a) a force under the influence of which objects tend to move towards each other

b) physical substance in general, as distinct from mind and spirit; (in physics) that which occupies space and possesses rest mass, especially as distinct from energy

c) a periodic disturbance of the particles of a substance which may be propagated without net movement of the particles, such as in the passage of undulating motion, heat, or sound

d) a substance or device which does not readily conduct electricity

e) each of a set of orbitals around the nucleus of an atom, occupied or able to be occupied by electrons of similar energies

f) a stable subatomic particle with a charge of negative electricity, found in all atoms and acting as the primary carrier of electricity in solids

g) the action or process of moving or being moved

h) the positively charged central core of an atom, consisting of protons and neutrons and containing nearly all its mass

i) any of numerous subatomic constituents of the physical world that interact with each other, including electrons, neutrinos, photons, and alpha particles

j) a connection between two surfaces or objects that have been joined together, especially by means of a substance, heat, or pressure

b. Translate the terms with the word <u>electron</u>.

Electron ablation, electron accelerating, electron acceptor, electron accelerator experiment, electron accepting ability, electron accumula-

tion, electron acoustic paramagnetic resonance, electron affinity, electron activity, electron beam, electron camera, electron cloud, electron-deficient, electron density.

READING

Physics of Conductors and Insulators

Certain types of materials allowing for easy passage of free electrons are called conductors, while those materials preventing the passage of free electrons are called insulators. Unfortunately, the scientific theories explaining why certain materials conduct and others don't are quite complex, rooted in quantum mechanical explanations in how electrons are arranged around the nuclei of atoms. Contrary to the well-known "planetary" model of electrons rotating around an atom's nucleus in circular or elliptical orbits, electrons in "orbit" don't really act like pieces of matter at all. Rather, they exhibit the characteristics of both particle and wave, their behavior being constrained by placement within zones around the nucleus referred to as "shells" and "subshells." Electrons can occupy these zones only in a limited range of energies depending on the particular zone and how occupied that zone is with other electrons. If electrons really did act like tiny planets held in orbit around the nucleus by electrostatic attraction, their actions described by the same laws describing the motions of real planets, there could be no real distinction between conductors and insulators, and chemical bonds between atoms would not exist in the way they do now. It is the discrete, "quantitized" nature of electron energy and placement described by quantum physics that gives these phenomena their regularity.

When an electron is free to assume higher energy states around an atom's nucleus (due to its placement in a particular "shell"), it may be free to break away from the atom and comprise part of an electric current through the substance. If the quantum limitations imposed on an electron limit this freedom, however, the electron is considered to be "bound" and cannot break away (at least not easily) to constitute a

current. The former scenario is typical of conducting materials, while the latter is typical of insulating materials.

An element's electrical conductivity is exclusively determined by the number of electrons existing in the atoms' outer "shell" (called the valence shell), but this is an oversimplification, as any examination of conductivity versus valence electrons in a table of elements will confirm. The true complexity of the situation is further revealed when the conductivity of molecules (collections of atoms bound to one another by electron activity) is considered.

A good example of this is the element carbon, which comprises materials of very differing conductivity: graphite and diamond. Graphite is a fair conductor of electricity, while diamond is practically an insulator (stranger yet, it is technically classified as a semiconductor, which in its pure form acts as an insulator, but can conduct under high temperatures and/or the influence of impurities). Both graphite and diamond are composed of the exact same types of atoms: carbon, with 6 protons, 6 neutrons and 6 electrons each. The fundamental difference between graphite and diamond being that graphite molecules are flat groupings of carbon atoms while diamond molecules are tetrahedral ['tetrə'hi:drəl] (pyramid-shaped) groupings of carbon atoms.

Ex. 5 Answer the following questions.

1. What is a conductor? 2. What is an insulator? 3. What do you know about the "planetary" model of electrons? 4. Why do certain materials conduct electricity? 5. How do electrons in "orbit" act? 6. What zones can electrons occupy? 7. What happened if electrons really did act like tiny planets held in orbit around the nucleus by electrostatic attraction? 8. What is the valence shell? 9. What materials with differing conductivity does carbon comprise? 10. What is the fundamental difference between graphite and diamond?

Ex. 6 True or false sentences.

1. Certain types of materials allowing for easy passage of free electrons are called insulators, while those materials resisting the passage of free electrons are called conductors.

2. The scientific theories explaining why certain materials conduct and others don't are quite simple.

3. Contrary to the well-known "planetary" model of electrons whirling around an atom's nucleus, electrons in "orbit" don't really act like pieces of matter at all.

4. Electrons really act like tiny planets held in orbit around the nucleus by electrostatic attraction.

5. It is the discrete, "quantitized" nature of electron energy and placement described by quantum physics that gives these phenomena their regularity.

6. When an electron is free to assume higher energy states around an atom's nucleus, it may be free to break away from the atom and comprise part of an electric current through the substance.

7. An element's electrical conductivity is exclusively determined by the number of electrons existing in the atoms' outer "shell".

8. Carbon comprises materials of vastly differing conductivity: graphite and diamond.

9. Graphite is practically an insulator, while diamond is a fair conductor of electricity.

10. Both graphite and diamond are composed of different types of atoms.

Ex. 7

a. Find the words or phrases in the text that mean the same as the following expressions.

1. A connection between two surfaces or objects that have been joined together, especially by means of an adhesive substance, heat, or pressure (B…)

2. The branch of physics concerned with quantum theory (Q… P…)

3. A particular kind of matter with uniform properties (S…)

4. A limiting rule or circumstance; a restriction (L…)

5. The degree to which a specified material conducts electricity, calculated as the ratio of the current density in the material to the electric field which causes the flow of current (E… C…)

6. The combining power of an element, especially as measured by the number of hydrogen atoms it can displace or combine with (V…)

7. A constituent which makes worse the purity of something (I…)

8. A stable subatomic particle occurring in all atomic nuclei, with a positive electric charge equal in magnitude to that of an electron (P…)

9. A subatomic particle of about the same mass as a proton but without an electric charge, present in all atomic nuclei except those of ordinary hydrogen (**N**…)

10. Very small (T…)

b. Make the pairs of words.

1) electrical	a) orbits
2) free	b) limitations
3) mechanical	c) conductivity
4) elliptical	d) shell
5) tiny	e) materials
6) electrostatic	f) explanations
7) quantum	g) planets
8) conducting	h) attraction
9) valence	i) electrons

LANGUAGE STUDY

Word Building

Negative Prefixes. Stress Change. Revision.

Ex. 8 Complete the following sentences with the words in brackets. Make the negative form of the words in brackets. Put the words in the right form.

1. A … can be charged by induction by exposure to an electrostatic field that is present on a surface charged with static electricity. **(conductor)**

2. Assuming I can find all the motion sensors, I can … them. **(to activate)**

3. If you take too much time completing a task, you will … everything. **(to organize)**

4. I found some of his arguments totally … . **(logical)**

5. It also slowed my computer and made it virtually … . **(usable)**

6. An … substance does not react chemically with other substances. **(active)**

7. This factor would yield … data. **(accurate)**

8. We will be using the term in the ordinary sense, without, we hope, any fear of being … . **(to understand)**

Ex. 9 Insert the given words in the sentences. Put the words in the right form. Some words may be used more than once. Pay attention to the word stress and meaning.

contest	produce	import	conflict	record
extract	compress	upgrade	update	exploit

1. The files are automatically … so they're small enough to be sent via email.

2. Directors who are aware of a … of interest in any proposed contract are required to draw it to the attention of the board.

3. We will certainly … any claims made against the safety of our products.

4. 500 companies began to … this new technology.

5. The fossils are … from the chalk.

6. Given the distance, most people tend not to … goods, preferring to furnish their properties in the local style.

7. The company have just … a luxury version of the aircraft.

8. Their efforts frequently result in thousands of databases … and numerous Web pages with many interactive features.

9. If they are dated, you should … them and then scan your system for viruses.

10. To fix the bugs, Cisco is offering free software … for various versions of its operating system, all of which are affected by the problem.

Translation Difficulties

Ex. 10 Translate the sentences. Pay attention to the word <u>one</u>.

1. One must have a very good knowledge of general engineering subjects to become a good engineer. 2. When one talks over a telephone, it is not the sound of the voice that travels over the wire, it is an electric current. 3. Engineer is one of the most important professions, it is the one that is taught at technical institutes. 4. From this experiment, it is clear that these devices are low power ones. 5. One would like to know, for example, that the effect of the ambient atmosphere is on the slow-state density and energy distribution. 6. One must pass all exams well to enter a university. 7. One must study a lot to become an engineer. 8. When put together in a molecule, these tiny fragments do not form a rigid structure, but one that can vibrate, rotate and perform other relative motions about its centre of mass. 9. One watt is the power due to a current of one ampere at tension of one volt; therefore, watts equal volts times amperes.

SPEAKING

Ex. 11 Read the following dialogue, try to act it out and translate it into Russian.

Client: Good afternoon! Will you please, bring a catalogue of spares?

Manager: Good afternoon! I've got it with me.

Client: I'd like to show you the names of some spare parts in the catalogue.

Manager: You are welcome. By the way, you can order this spare part, using a sample.

Client: Really? I'd better show you the sample. Wait a moment. I'll bring it.

Manager: Sorry, we have no spare part like that. But we could offer you a similar spare from another maker.

Client: What maker do you mean?

Manager: N. Company.

Client: This spare part won't suit us. The modification is wrong.

Manager: It's a pity!

Client: Will you please, show me the classification certificate for this part?

Manager: Here you are!

Client: I'd like to know the estimated price for the supply.

Manager: The total price can be …

Client: It's too high for us.

Manager: Well, some prices could be agreed upon with the makers. All right, we'll try to fix it up.

Client: When can you deliver the spares we have ordered?

Manager: We could arrange for the delivery by plane if you wish.

Client: On what terms could you do that?

Manager: Delivery takes place on general terms. Custom duties and transporting will be for your account.

Client: We would like to get some spare parts for our diesel engine.

Manager: What spares do you want us to supply?

Client: I've got a list of spares we'd like to get. Here you are. Can you deliver spare parts in due time?

Manager: It depends on what you are going to order. Some spares can be delivered right away.

Client: We want you to supply a single-phase voltage stabilizer – 60 pieces.

Ex. 12 Put the sentences in the right order, make up a dialogue.

a. I can certainly get all that onboard for you.

b. About the same as in other countries.

c. No, it isn't. I would like else …

d. Good morning. I am ready to take your order. What supplies would you like me to get for you while you are here?

e. How about the price?

f. What are you interested in? If it's the paint you need I have some samples.

g. How do you do, Mr N!

h. I guarantee high quality of everything I get for you. Is that all you want?

i. This time I need transformers for maintaining the voltage in the network.

j. Do you guarantee the quality?

k. We want to buy some supplies. But before I would like to look at the samples of that supplies to make sure that it is of good quality.

Ex. 13 Read the given phrases and make up your own dialogues.

We have run out of … .	У нас закончились … .
What kind of …?	Какого вида … ?
We want … .	Нам нужны … .
How much … do you need?	Сколько … вам нужно? Сколько коробок (ящиков) вам нужно?
How many boxes do you need?	
We'll take … boxes of … .	Мы возьмем … ящика … .
All right. Will you order … ?	Хорошо. Будете заказывать … ?
Certainly.	Конечно.
How many … do you want us to deliver?	Сколько … вы хотите, чтобы мы доставили?
We'd like to get (to order) … packs of … .	Мы хотели бы получить (заказать) … пачки … .
Are you going to take … ?	Собираетесь взять … ?
This time we don't need them. Thanks anyway. But we want … .	В этот раз они нам не нужны. Все равно, спасибо. Но мы хотим … .
What else?	Что еще?
Also, we'd like you to supply …	Мы также хотели бы, чтобы вы обеспечили нас … .
O.K. I've put it down.	Хорошо. Я записал.
How much do you charge per kg of … ?	Сколько вы берете (какова цена) за килограмм … ?
Here's the price list.	Вот прайс-лист.
Do you have any discount?	У вас есть какие-нибудь скидки?
Yes / Sorry, we can't make a discount.	Да / Извините, мы не можем делать скидки.

Let's arrange for the delivery.	Давайте договоримся насчет доставки.
The ordered supplies will be delivered … , I believe.	Заказанный товар будет доставлен … , я думаю.
Thanks a lot.	Спасибо.
Welcome.	Пожалуйста.

Module 7. Digital technologies

Unit 18

Grammar. The Conditional Clause (0 and 1st Conditionals)
Text. Operating systems
Word building. Interchange of Letters and/or Phones

GRAMMAR

The Conditional Clause (0 and 1st Conditionals)
Условные предложения нулевого и первого типа

Тип предложения	If-part Придаточное предложение	Result part Главное предложение
0 (zero) Conditional Всегда реальное, всегда верно, факт или очевидное условие	Present Tenses (Simple) *If the temperature rises above zero,* Если температура поднимается выше нуля,	Present Tenses (Simple) *snow melts.* снег тает.
1st (real) Conditional Реальное условие, относящееся к будущему времени	Present Tenses (Simple / Continuous) *If you study well,* Если будешь хорошо учиться,	Future Tenses (Simple / Continuous) *you will find a good job.* ты найдёшь хорошую работу.

See Grammar Module

Ex. 1 Find the Conditional Clause. Translate the sentences.

1. If you don't pay for the Internet, it doesn't work. 2. If you switch on Caps Lock, you get all capital letters. 3. When given a problem, the computer solves it with lightning speed. 4. When the CPU receives the signal, it interrupts its tasks. 5. If we look around, we can see that electricity is serving us in one way or another. 6. If ordinary gases are greatly compressed, they become liquids. 7. Superconductivity can be obtained in some materials if the temperature is very low and close to absolute zero. 8. If scientific research is closely linked with practice, the results will be good. 9. If there is a pressure change in the tires, a transmitter signals to adjust the pressure. 10. Unless the temperature rises, the speed of the molecules will not increase. 11. When you buy a new computer, you usually get software included at no extra cost. 12. If water is heated up to 100°C, it turns to steam. 13. If a solid body or liquid is heated, it will usually expand. 14. The motor car can move very quickly provided it has a powerful motor.

Ex. 2 Open the brackets using the verbs in the correct tenses.

I. If there is a power failure, you (to lose) all your data. 2. If you have a virus, it (to corrupt) your files. 3. If you don't back up (создавать резервную копию) your files regularly, you (to lose) some of them. 4. If you choose a simple password, someone (to access) your files. 5. If you don't give your files meaningful names, you (to forget) what they contain. 6. If we use alternative energy, we (not to use) the oil. 7. If there is the growing use of computers, great progress (to be made) in the field of space exploration. 8. Researchers will considerably advance the development of space technology if they (to combine) the knowledge of different sciences. 9. If a short circuit (to occur), the generator is put out of action.10. Scientists (to manage) to bring large amounts of information under control, if they use computers. II. If they (to send) us the material, we (to get) all the necessary information for our project. 12. We (to solve) the problem if you (to give) us more time. 13. The TV (not to work) if the aerial (not to be) connected. 14. In case there (to be) no current in a conductor, there will is no electric field within it. 15. We know that the experiment (give) more reliable results if we (to prepare) it with greater care.

Ex. 3 Fill in the dialogue using the First Conditional.

Andrey: Hi, Polina. How were your exams?

Polina: They were really difficult. I'm worried. If I (not to pass) my exams, I (not to go) to college. And I really want to!

Andrey: Which college do you want to go to?

Polina: I don't know. If I (to get) good grades, I (to apply) to Yale.

Andrey: What are you going to study?

Polina: If I (to go) to Yale, I (to study) law! How about you?

Andrey: I don't want to study law. If I (to do) well, I (to study) computer science.

Polina: Well, good luck! **B**ye.

Andrey: **S**ee you later.

VOCABULARY

1. **Operating system (OS)** – операционная система

There is a variety of software **operating systems** available for smart phones and other mobile devices.

2. **Software** *(n.)* – программное обеспечение

The **software** means that computers can treat voice in the same way as text, or any other form of data.

3. **Hardware** *(n.)* – аппаратное обеспечение

The machine allows multitasking without the need to extra **hardware**.

4. **Evolve** *(v.)* – выделять, переходить в, претерпевать изменения

Online games tend to **evolve** over time.

5. **Network** *(n.)* – сеть

You see, the Internet is a large **network** of inter-connected computers.

6. **Share** *(v.)* – делить, использовать функцию «поделиться»

You can also put video into Word documents, or **share** a document directly on Facebook.

7. **User** *(n.)* – пользователь

These functions also operate independently providing the **user** with complete control.

8. **Assemble** *(v.)* – установить

We plan to **assemble** a program that combines the method described here with a kinematics method to permit full-time operation.

9. **Compile** *(v.)* – составлять

Processing power, therefore, is increasingly determined by software that **compiles** computer programs into machine code.

10. **Transmit** *(v.)* – передавать

The packages have to be very light and the measuring device has to produce an electrical signal which can be **transmitted** by radio.

11. **Central processing unit (CPU)** – центральное процессорное устройство

While semiconductor materials such as silicon are utilized for memory and **central processing units**, the permanent information in computers is stored in magnetized hard drives which utilize the spin of the electron.

12. **Storage device** – запоминающее устройство, система хранения, устройство хранения

It needs a link between the virtual/main memory of the computer and the secondary **storage device** in order to access the data contained in the database.

13. **Computation** *(n.)* – вычисление

I devote a lot of my time to thinking about the relationship between mathematics and **computation**.

14. **Buffer** *(n.)* – буфер, временное хранилище информации

A **buffer** is an area in a computer's memory where data can be stored for a short time.

Ex. 4

a. Match the words with their definitions.

1) operating system	a) a number of interconnected computers,
2) software	machines, or operations
3) hardware	b) a program or piece of software designed
4) application	to fulfill a particular purpose
5) network	c) the low-level software that supports a
6) user	computer's basic functions, such as schedul-
7) personal computer	ing tasks and controlling peripherals
8) CPU	d) a person who uses or operates something

9) storage device	e) the part of a computer in which operations are controlled and executed f) a piece of computer equipment on which information can be stored g) the programs and other operating information used by a computer h) a computer designed for use by one person at a time i) the machines, wiring, and other physical components of a computer or other electronic system

b. Translate the terms with the word data.

Data & **R**eporting Manager, data & telephone outlet, data abstraction, data abstraction and modelling, data abstraction class, data back, databank, database, database management, database management system, database manager, database system, data processing, data capture, data centre, data communications, data-driven, data mining, data point, data projector.

READING

Operating systems

An operating system is a specialized collection of software that stands between a computer's hardware architecture and its applications. It performs a number of fundamental activities such as file system management, process scheduling, memory allocation, network interfacing, and resource sharing among the computer's users. Operating systems have evolved in their complexity over time, beginning with the earliest computers in the 1960s.

With early computers, the user typed programs onto punched tape or cards, which were read into the computer, assembled and run. The results were then transmitted to a printer or a magnetic tape. Accompanying each problem in a batch were instructions to the operating system (OS) detailing the resources needed by the problem, such as the

amount of CPU time required, the files needed, and the storage devices on which the files were saved. From these beginnings came the key concept of an operating system as a resource allocator. This role became more important with the rise of multiprogramming, in which several jobs reside in the computer simultaneously and share resources, for example, by being allocated fixed amounts of CPU time in turn. More sophisticated hardware allowed one job to be reading data while another wrote to a printer and still another performed computations. The operating system thus managed these tasks in such a way that all the jobs were completed without interfering with one another.

Time sharing, in which users enter commands and receive results directly at a terminal, added more tasks to the operating system. Processes, along with mechanisms such as interrupts (to get the attention of the operating system to handle urgent tasks) and buffers (for temporary storage of data during input/output to make the transfer run more smoothly) were needed. Modern large computers interact with hundreds of users simultaneously, giving each one the perception of being the sole user.

The first commercially viable operating systems were developed by IBM in the 1960s and were called OS/360 and DOS/360. Unix was developed at Bell Laboratories in the early 1970s and since has resulted in many variants, including Linux, Berkeley Unix, GNU, and Apple's iOS. Operating systems developed for the first personal computers in the 1980s included IBM's (and later Microsoft's) DOS, which evolved into various flavours of Windows. An important 21st-century development in operating systems was that they became increasingly machine-independent.

Notes to the Text

memory allocation – распределение памяти
punched card – перфокарта
resource allocator – распределитель ресурсов

Ex. 5 Answer the following questions.

1. What is an operating system? 2. What does an operating system perform? 3. What does the user do with early computers? 4. What added

more tasks to the operating system? 5. What is the key concept of an operating system? 6. What did the advent of time sharing add to the operating system? 7. How do modern large computers work? 8. What company developed the first commercially viable operating systems? 9. What was developed at Bell Laboratories in the early 1970s? 10. When were operating systems for the first personal computers developed?

Ex. 6 True or false sentences.

1. An operating system is a specialized collection of hardware.
2. Operating systems have evolved in their complexity over time, beginning with the earliest computers in the 1860s.
3. With early computers, the user typed programs onto punched tape or cards.
4. More sophisticated software allowed one job to be reading data while another wrote to a printer and still another performed computations.
5. The advent of time sharing, in which users enter commands and receive results directly at a terminal, added more tasks to the operating system.
6. Processes, along with mechanisms such as interrupts and buffers were needed.
7. The first commercially viable operating systems were developed by IBM.
8. An important 21st-century development in operating systems was that they became increasingly machine-independent.

Ex. 7

a. Find the words or phrases in the text that mean the same as the following expressions.

1. Post or repost (something) on a social media website or application (S…)
2. Translate (a program) from a higher-level programming language into machine code (A…)
3. Convert (a program) into a machine-code or lower-level form in which the program can be executed (C…)

4. Broadcast or send out (an electrical signal or a radio or television programme) (T…)

5. The processing of previously collected problems in a single batch (B… P…)

6. Facts and statistics collected together for reference or analysis (**D**…)

7. The action of mathematical calculation (C…)

8. **A** device at which a user enters data or commands for a computer system and which displays the received output (T…)

9. **A** temporary memory area in which data is stored while it is being processed or transferred, especially one used while streaming video or downloading audio (B…)

b. Make the pairs of words.

1)	operating	a)	architecture
2)	specialized	b)	system
3)	hardware	c)	tape
4)	file	d)	allocation
5)	memory	e)	allocator
6)	punched	f)	collection
7)	magnetic	g)	device
8)	storage	h)	handler
9)	resource	i)	card
10)	terminal	j)	system

LANGUAGE STUDY

Word Building

Interchange of Letters and/or Phones
Чередование букв / звуков

Чередование букв и **звуков** также является способом словообразования. Так, глагол и существительное могут выглядеть одинаково, но отличаться последним звуком – в глаголах он обычно является звонким, а в существительных – глухим. Но часто написание слова тоже меняется.

Примеры чередования конечного согласного звука

to use [ju:z] – употреблять	**use** [ju:**s**] – употребление
to excuse [ɪk`skju:z] – извинять	**excuse** [ɪk`skju:**s**] – извинение
to advise [əd`vaɪz] – советовать	**advise** [əd`vaɪ**s**] – совет
to believe [bɪ`li:v] – верить	**belief** [bɪ`li:**f**] – вера
to descend [dɪ`se**nd**] – спускаться	**descent** [dɪ`se**nt**] – спуск
to shelve [ʃelv] – ставить на полку	**shelf** [ʃel**f**] – полка

Бывает, что чередуется не конечный звук, а только конечная буква.

Примеры чередования конечных букв

to practise [`prækt**ɪ**s] – практиковать	**practice** [`prækt**ɪ**s] – практика
to license [`laɪ**s**ns] – разрешать	**licence** [`laɪ**s**ns] – разрешение

В некоторых случаях изменение последнего согласного звука сопровождается изменением корневого гласного звука, написание слова при этом также меняется.

Примеры изменения звуков с написанием слова

to choose [ʧu:z] – выбирать	**choice** [ʧɔɪs] – выбор
to live [lɪv] – жить	**life** [laɪf] – жизнь
to lose [lu:z] – терять	**loss** [lɒs] – потеря
to breathe [bri:ð] – дышать	**breath** [breθ] – дыхание
to prove [pru:v] – доказывать	**proof** [pru:**f**] – доказательство
to know [nəʊ] – знать	**knowledge** [`nɒlɪʤ] – знание

Иногда глаголы и существительные различаются чередованием корневых гласных звуков с изменением написания слова.

Примеры чередования гласных в корне с изменением написания слова

to sit [sɪt] – сидеть	**seat** [si:t] – сиденье, место
to tell [tel] – рассказывать	**tale** [teɪl] – рассказ
to sing [sɪŋ] – петь	**song** [sɒŋ] – песня
to feed [fi:**d**] – кормить	**food** [fu:**d**] – пища
to bleed [bli:**d**] – кровоточить	**blood** [blʌ**d**] – кровь
to shoot [ʃu:t] – стрелять	**shot** [ʃɒt] – выстрел

Образование слов при помощи изменения места ударения

Формы многих существительных совпадают с формами глаголов, но отличаются от них ударением – существительные имеют ударение на первом слоге, а соответствующие им глаголы на втором:

Существительное	**Глагол**
`export – экспорт	to ex`port – экспортировать
`suspect – подозреваемый	to su`spect – подозревать
`increase – увеличение	to in`crease – увеличивать
`insult – оскорбление	to in`sult – оскорблять

Ex. 8 Read the words. Pay attention to the interchange of phones. Translate them.

Accurate – accurately; to cease – cease – ceased; to grease – grease – greasing; decease – decease – deceased – deceasing; to delegate – delegate – delegation – delegator; to graduate – graduate – graduated – graduation; to increase – increase – increasing – increasingly; to associate – associate – associated – association; to moderate – moderate – moderation – moderately; to release – release – releasable – releasing – releasingly.

Ex. 9 Insert the given words in the sentences. Put the words in the right form. Pay attention to the word stress and meaning.

graduate	associate	moderate	increase	grease
to graduate	to associate	to moderate	to increase	to grease

1. The joint between the sections was 36.8 cm above the midsection and was sealed with silicon … .
2. Nonlinear confining and deconfining forces … with the interaction of laser radiation with plasma.
3. My friend is a physics … .
4. They asked him to … the debate at the conference.
5. I'd like you to meet a business … of mine.
6. Temperatures remained … throughout the day.
7. Gradually … the temperature to boiling point.
8. To prevent damages the workers … the above-ground part of the cylinder.
9. Any … in laser production would be helpful.
10. He … with a second-class honours degree in physics.

Translation Difficulties

Ex. 10 Translate the sentences. Pay attention to the prepositions due to, thanks to.

1. The scientists have perfected the operation of this system due to the application of new electronic equipment. 2. I ended up walking about a mile out of my way, thanks to following the instructions given. 3. Thanks to the radio it is possible to transmit the human voice across the globe. 4. Due to the latest achievements in electronics it has become possible to develop supercomputers. 5. Thanks to the development of radio telescopes radio astronomy has made great achievements. 6. A college is to carry out a complete repair of one of its rooms thanks to help from a grant. 7. Thanks to the methods of thermal analysis developed by Hedvall and Tamman, reactions between solid phases have been studied in some details. 8. These temperature fluctuations are supposed to be due to the transition of iron from one allotropic modification to another. 9. Due to the application of powerful relays, we will be able to televise programmes to vast territories. 10. The delay was due to a lack of computer equipment.

SPEAKING

Ex. 11 Read the following dialogue, try to act it out and translate it into Russian.

Secretary: Good evening, NewLink Company. My name is Mary. How can I help you?

David: Hi! Could I speak with your support manager, Thomas Black? Yesterday he promised me to solve the problem with my Internet connection, but it still doesn't work.

Secretary: Yes, just a second, I'll put you through. Could you give me your name?

David: My name is David, David Smith. My id number is #97327701.

Secretary: Thank you for calling, Mr Smith. Hold the line, please.

Thomas: Thomas speaking.

David: Good evening, Mr Black. My name is **D**avid Smith. I still have some problems with the computer connection. Could you help me?

Thomas: Good evening! Could you remind me some details of your problem?

David: Sure. About a week back, I just turned on my laptop and my Internet which usually connected automatically just didn't work. My routing gateway was also turned on and all cables were perfectly in order, but, unfortunately, I couldn't go online. So, when I tried to connect the net, it became impossible again and again. And when I wanted to diagnose it, I just saw «**T**he system couldn't find a failure». I took the power out for 10 minutes and plugged it back in. But it doesn't pick up a signal. Help me, please!

Thomas: Ok, Mr Smith. Plug the Internet cable into the laptop's connecter and check your Internet connection again by the command in prompt: «site». **D**oes it work now?

David: Yes, it finally works! Oh, God! What was the matter?

Thomas: I suppose that your routing gateway is broken and you should fix or change it. Can I do anything else for you?

David: No, that's enough. I'll leave positive feedback on your website. Many thanks!

Thomas: You are welcome! If you have any other problems with a new routing gateway, just call us and our support managers will help you to rectify it. Have a nice time! Goodbye.

Ex. 12 Comment on the following statements.

a. **Technology at home/office**

1. How often do you use electric appliances at home/office?
2. How do you think they help you with your housework?
3. Are there any other advantages?
4. Are there any drawbacks to using these appliances?
5. **D**o you think people should use electric appliances more often or less often than they do now?

b. Technology and work

1. Internet, fax and mobile phone technologies have revolutionized working life.
2. Workers can communicate via email, online networks and video conferencing.
3. Technology can connect workers in different countries.
4. It gives people more freedom.
5. It can also save time and money.
6. Some people believe that offices could disappear in the future. Virtual online offices may replace them.

Unit 19

Grammar. The Conditional Clause (2nd and 3d Conditionals)
Text. Networking and communication
Word building. Interchange of Letters and/or Phones

GRAMMAR

The Conditional Clause (2nd and 3d Conditionals)
Условные предложения второго и третьего типа

Тип предложения	If-part Придаточное предложение	Result part Главное предложение)
2nd (imaginary present / future) Conditional Малореальное условие, относящееся к настоящему или будущему времени	Past Simple / Continuous *If he worked hard,* Если бы он усердно работал,	Would + V *he would achieve great results.* он бы достиг значительных результатов.
3d (unreal past) Conditional Нереальное условие, относящееся к прошедшему времени	Past Perfect *If I hadn't missed the lectures,* Если бы я не пропустил лекции,	would have +V3/Ved *I wouldn't have got a bad test mark.* я бы не получил плохую оценку по тесту.

See Grammar Module

Ex. 1 Find the Conditional Clause. Translate the sentences.

1. If we had tested this material, we should have used it in our work. 2. If supercomputers had not been used for thermodynamic calculations, designers would have spent all their lives on computations. 3. If there were no computers, space flights would be impossible. 4. If the earth didn't rotate, it wouldn't have the shape of a ball. 5. The binary system is particularly appropriate to the nature of an electric machine; if it had not existed, designers would have had to invent it. 6. If the atmospheric conditions had been better, we should have used long radio waves. 7. If you didn't know the rules of operating this particular machine tool, I would explain them to you. 8. If extreme temperatures generated by atmospheric friction were not so high, a hypersonic craft would not require complicated cooling measures. 9. If we had been told about the lecture on programming languages, we should have come by all means. 10. If we had not been present at the lecture, we wouldn't have understood the new approach to the solution of the problem.

Ex. 2 Open the brackets using the verbs in the correct tenses.

1. If you (look) at the engine for a moment, you would have seen what was missing. 2. If programmers were not in great demand, good ones (get) earn a very high salary. 3. He would have had great trouble with his netbook if he (not to use) it correctly. 4. If the Internet wasn't slow and unreliable sometimes, users often (complain) of it. 5. If information technologies didn't advance so rapidly, we (cannot) call it advance itself. 6. If I had enough money, I (to buy) the latest laptop model. 7. It's obvious that if there were no computers, the progress of civilization (not to be) so rapid. 8. If they had more powerful electronic devices, they (to achieve) much better results. 9. If my calculator (not to crush) yesterday, I (to finish) my work. 10. If they (not to cut) off the electricity yesterday, I (to finish) my work. 11. If you (to save) the files yesterday, the computer (not to delete) them automatically. 12. If the spacecraft (to send) back more data about Jupiter's atmosphere, the research (to be) feasible. 13. We understand that if the system (to crash), we (to lose) all our latest data.

Ex. 3 Complete the following sentences.

1. I would work much better if ...
2. The company will install a new electronic system if ...
3. The information from the survey will be processed by computer if ...
4. I would have got the program to work on my laptop if ...
5. All children will learn Math while they are in school if ...
6. If all access devices were not hardware based ...
7. If the emergency services had been equipped properly ...
8. The rooms will be equipped with video cameras if ...
9. If the IT (information technology) industry continued to grow ...
10. If the students had practiced harder ...
11. If I were a genius ...
12. If my friend worked for an IT company ...
13. If my girlfriend were a hacker ...
14. If I had $ 100,000 to spend in three days ...
15. If somebody stole my laptop ...

VOCABULARY

1. **Networking** *(n.)* – объединение в сеть, подключение к сети

The demand for wireless **networking** is increasing rapidly.

2. **Communication** *(n.)* – связь, коммуникация, передача данных

Communication channel is fully operational.

3. **Include** *(v.)* – включать в себя

This dictionary **includes** both **B**ritish and **A**merican spellings of words.

4. **Analysis** *(n.)* – анализ

Sophisticated statistical **analysis** was employed to obtain these results.

5. **Design** *(n., v.)* – дизайн, конструирование; конструировать, разработать

Our students have **designed** and wrote the software.

6. **Implementation** *(n.)* – выполнение, исполнение

The keys to the successful **implementation** of the project have been simplicity and communication.

7. **Link** *(n.)* – указатель связи, ссылка

Do you want to know the best way to obtain inbound **links** to your web site?

8. **Feasible** *(adj.)* – осуществимый, выполнимый
With the extra resources, the project now seems **feasible**.
9. **Combination** *(n.)* – комбинация, объединение
To analyze the data, we employed a **combination** of qualitative and simple quantitative techniques.
10. **Allow** *(v.)* – позволять
You're not **allowed** to talk during the exam. This adjustment of the figures **allows** a fairer comparison.
11. **Receiver** *(n.)* – приемник
A speech signal is encoded using code excited linear prediction for use in transmitting the speech signal to a **receiver**.
12. **Store** *(n., v.)* – запас, резерв; хранить
Huge amounts of information can be **stored** on a single **CD-ROM**.
13. **Involve** *(v.)* – включать в себя, вовлекать
Research **involving** the use of new equipment will be used for scientific purposes.
14. **Layer** *(n.)* – слой
The ionization of the gas by the electrons removes the need to coat the sample with a **layer** of conductive material.
15. **Provide** *(v.)* – обеспечивать
Engineers also renovated the existing water system and **provided** a more reliable supply.
16. **Failure** *(n.)* – неисправность, отказ
Excessively high temperatures can even lead to a complete **failure** of the machine.
17. **Encode** *(v.)* – шифровать, кодировать
This work focuses on the problem of how best to **encode** the information a sender wants to transmit.

Ex. 4

a. Match the words with their definitions.

1) networking	a) detailed examination of the elements or
2) communication	structure of something
3) analysis	b) the process of putting a decision or plan into
4) design	effect; execution

5) implementation	c) the linking of computers to allow them to operate interactively
6) link	d) the action or process of transmitting something, or the state of being transmitted
7) transmission	e) lack of success
8) receiver	f) the part of a telephone apparatus contained in the earpiece, in which electrical signals are converted into sounds
9) layer	g) means of sending or receiving information, such as phone lines or computers
10) failure	h) a sheet, quantity, or thickness of the material, typically one of several, covering a surface or body
	i) a code or instruction which connects one part of a program or an element in a list to another
	j) a plan or drawing produced to show the look and function or workings of a building or any other object before it is made

b. Translate the terms with the word network.

Networkable, network analyser, network analysis, network appliance, network computer, network effect, network English, networker, network former, network's radio frequency signal strength, network abonent, network abstraction layer, network access, network access account, network access authentication, network access authorization.

READING

Networking and communication

The field of networking and communication includes the analysis, design, implementation, and use of local, wide-area, and mobile networks that link computers together. The Internet itself is a network that makes it feasible for nearly all computers in the world to communicate.

A computer network links computers together via a combination of infrared light signals, radio wave transmissions, telephone lines, television cables, and satellite links. The challenge for computer scientists has been to develop protocols (standardized rules for the format and exchange of messages) that allow processes running on host computers to interpret the signals they receive and to engage in meaningful "conversations" in order to accomplish tasks on behalf of users. Network protocols also include flow control, which keeps a data sender from filling a receiver with messages that it has no time to process or space to store, and error control, which involves transmission error detection and automatic resending of messages to correct such errors.

The standardization of protocols is an international effort. Since it would otherwise be impossible for different kinds of machines and operating systems to communicate with one another, the key concern has been that system components (computers) be "open." This terminology comes from the open systems interconnection (OSI) communication standards, established by the International Organization for Standardization. The OSI model specifies network protocol standards in seven layers. Each layer is defined by the functions it relies upon from the layer below it and by the services it provides to the layer above it.

OSI model for network communication established in 1983 by the International Organization for Standardization divides network protocols into seven functional "layers." This communications architecture enables end users employing different operating systems or working in different networks to communicate quickly and correctly.

At the bottom of the protocol lies the physical layer, containing rules for the transport of bits across a physical link. The data-link layer handles standard-sized "packets" of data and adds reliability in the form of error detection and flow control bits. The network and transport layers break messages into the standard-size packets and route them to their destinations. The session layer supports interactions between applications on two communicating machines. For example, it provides a mechanism with which to insert checkpoints (saving the current status of a task) into a long file transfer so that, in case of a failure, only the data after the last checkpoint need to be retransmitted.

The presentation layer is concerned with functions that encode data, so that heterogeneous systems may engage in meaningful communication. At the highest level are protocols that support specific applications. An example of such an application is the file transfer protocol, which governs the transfer of files from one host to another.

Notes to the Text

open systems interconnection (OSI) – взаимосвязь открытых систем
heterogeneous systems – разнородные системы
file transfer protocol – протокол переноса файлов

Ex. 5 Answer the following questions.

1. What does the field of networking and communication include and use? 2. What is the Internet itself? 3. How does a computer network link computers together? 4. What has the challenge for computer scientists been? 5. What do network protocols include? 6. The OSI reference model specifies network protocol standards in seven layers, doesn't it? 7. How many functional "layers" does the OSI model divide network protocols into? 8. What does the communications architecture enable end users? 9. What does the physical layer contain? 10. What does the data-link layer handle? 11. What protocols are at the highest level?

Ex. 6 True or false sentences.

1. Protocols allow processes running on host computers to interpret the signals and to engage in meaningful "conversations" in order to accomplish tasks on behalf of users.
2. The standardization of protocols is a European effort.
3. The key concern has been that system components (computers) should be "close".
4. This terminology comes from the closed systems interconnection (CSI) communication standards, established by the International Organization for Standardization.
5. Each layer is defined by the functions it relies upon from the layer below it and by the services it provides to the layer above it.
6. The OSI model was established in 1883.

7. The network and transport layers break messages into the standard-size packets and route them to their destinations.

8. The session layer supports interactions between applications on several communicating machines.

9. The presentation layer is concerned with functions that decode data.

10. The file transfer protocol (FTP) governs the transfer of files from one host to another.

Ex. 7

a. Find the words or phrases in the text that mean the same as the following expressions.

1. Comprise or contain as part of a whole (I…)
2. Share or exchange information, news, or ideas (C…)
3. Give something and receive something of the same kind in return (E…)
4. Let (someone) have or do something (A…)
5. Explain the meaning of (information or actions) (I…)
6. Be given, presented with, or paid (something) (R…)
7. Keep or accumulate (something) for future use (S…)
8. Have or include (something) as a necessary or integral part or result (I…)
9. Make available for use; supply (P…)
10. Convert into a coded form (E…)

b. Make the pairs of words.

1) infrared light	a) cable
2) radio	b) control
3) telephone	c) signal
4) television	d) protocol
5) satellite	e) scientist
6) computer	f) interconnection
7) host	g) line
8) network	h) detection
9) error	i) computer
10) open systems	j) link
11) error	k) wave

LANGUAGE STUDY

Word building

Interchange of Letters and/or Phones. Чередование букв / звуков.

Ex. 8 Read the words. Pay attention to the interchange of vowels. Translate them.

Nation, national, grave, gravity, to provoke, provocative, to occur, occurrence, supreme, supremacy, bit, beat, ill, eel, to fill, to feel, to live, to leave, pull, pool, ship, sheep, sit, seat, to slip, to sleep, stuff, staff, still, steel.

Ex. 9 Study other common prefixes in IT.

re-, co- (=do again)
com- (=with)
con-, over- (=too much)
up- (=at or to a higher level of activity)
e- (=electronic)
cyber- (=things related to computer world)

a. Read and translate the words:

update, upgrade, upload e-book, e-learning cyberspace, cybercriminal

b. Match the prefixes in column A to the correct endings in column B.

column A	column B
down-, re-, e-	-reader, -commerce, -mail, -time, -load -crime,
up-, cyber-	-space,
	-slacking, -write, -boot, -set, -usable, -grade, -date,
	-load.

Translation Difficulties

Ex. 10 Translate the sentences. Pay attention to the prepositions <u>because, because of.</u>

1. Because of the earth's rotation, there are days and nights on the earth. 2. Because of their long life, solar and atomic batteries are used

to supply power to transmitters in spacecrafts. 3. Our century can be called the «Space Age» because of the development of a new branch of science and technology – cosmonautics. 4. The problem of power generation from fusion reactors is very difficult because of the difficulty of containing plasma. 5. Because the neutron is neutral, the positive charge on the nucleus does not affect it. 6. The energy, which an object has because of its motion is called kinetic energy. 7. Galvanized iron is often used instead of aluminium because of its cheapness. 8. Because of the enormous surface exposed, this catalyst was thought to be a very active one, but when tested was found to be inactive. 9. We are planning to buy a new hard disk because this one is too old.

SPEAKING

Ex. 11 Read the following dialogue, try to act it out and translate it into Russian.

Meeting a Businessman

Smith: Good morning! My name is Smith. I'm from «Smith and Co». I've got an appointment with Mr Ivanov at 10.50.

Secretary: Good Morning, Mr Smith. Mr Ivanov is already expecting you. Will you take a seat, please?

Smith: Thank you. I think I'm a bit early.

Secretary: That's all right, Mr Smith.

Ivanov: Good morning, Mr Smith. It's nice to see you here again. How are you?

Smith: Fine, thanks. And you?

Ivanov: Pretty well too, thank you. Would you like a cup of coffee?

Smith: Yes, please. It is rather cold and very wet outside today.

Ivanov: Yes, the weather hasn't been very nice lately.

Smith: That's right, but it is usually warm here in October. Now, Mr Ivanov, how about our catalogues? Have you studied them?

Ivanov: Sure. We have studied them closely. The new models are certainly good.

Smith: Yes, they are of high quality. Our company has just started manufacturing these models and we have already got a lot of orders from different companies.

Ivanov: Your equipment meets our requirements and we are interested in purchasing it.

Smith: What model are you interested in? And how many machines would you like to buy?

Ivanov: Model CD0199 meets all our requirements. We would like to purchase ten machines by the end of this year. Mr Smith, have you seen our usual contract form?

Smith: Not yet.

Ivanov: Would you like to look through it?

Smith: I certainly would.

Ivanov: Here you are, Mr Smith. You have to study our terms and then we meet again next Friday.

Smith: All right, Mr Ivanov. Goodbye for now.

Ivanov: Goodbye, Mr Smith.

Ex. 12 Read the following dialogue and translate it into English.

Обсуждение нового контракта

Иванов: Давайте приступим к основному вопросу нашего сегодняшнего обсуждения. Я думаю, что Вы хотите обсудить наш новый контракт.

Уайт: Это верно. Вы видели наш последний прайс-лист?

Иванов: Да, видели. В нем лишь один момент, с которым наши стороны не могут согласиться. Это пятипроцентное увеличение цены.

Уайт: Хорошо, Вы должны постараться посмотреть на цену с нашей точки зрения. В течение последних трех лет цены на компьютерную технику возросли. Кроме того, вследствие принятия нового трудового договора мы увеличили заработную плату. Поэтому мы вынуждены были увеличить цену на наше оборудование.

Иванов: Да, мы учли это и все равно Ваши цены кажутся нам высокими. Мы сотрудничаем с Вашей компанией долгое время и надеялись, что Вы предложите нам лучшие условия.

Уайт: Я думаю, если Вы сможете принимать в текущем году частичные поставки груза, мы снизим цену на 2%.

Иванов: Это замечательно, большое Вам спасибо.

Уайт: Вы довольны новыми условиями нашего будущего контракта?

Иванов: Да, вполне.

Уайт: Тогда, я думаю, мы можем начать составление нашего контракта.

Ex. 13

Project Work

Work with the Internet

1. Ask your partner what Internet service he/she uses and why?

Example:

– Do you use e-mail?

– Yes, I sometimes send attachments by e-mail. And you?

– I just leave my e-mail while filling any application form. I prefer using ... to stay connected with my family or friends.

– Yes. It's very useful. Personally I ...

2. Work in groups.

Say which of the following ideas about the Internet may be considered as advantages and disadvantages. Think of any other pros and cons of the Internet.

public facility	visit many interesting websites
worldwide	wait for a long time to download web
expensive to buy computers	pages
make new friends	spend too much time playing games the
make free calls	information may not be true or correct
	downloading software may contain virus

Split into four groups and get ready to speak on one of the issues given below.

1. The definition of the Internet.
2. How the Internet works.
3. The origin of the Internet.
4. Major components of the Internet.

3. Presentation. You are a reporter in a local newspaper. Speak on the following: "Internet is conquering the world".

Unit 20

Grammar. Conjunctionless Conditional Clauses
Text. Software engineering
Word building. Interchange of Letters and/or Phones

GRAMMAR

Conjunctionless Conditional Clauses
Бессоюзные условные предложения

В условных придаточных предложениях союзы *if, provided* (при условии), *in case* (в случае), *on condition* (при условии) и т.д. могут быть опущены. В бессоюзных условных придаточных предложениях порядок слов обратный, т.е. сказуемое или часть сказуемого, вспомогательный глагол, выносится на место перед подлежащим.

	Условное придаточное предложение	**Главное предложение**
I тип	*Should any repair be required, (If any repair is required,)...* Если потребуется ремонт, (только при наличии should)	*it will be made immediately.* он будет произведен немедленно.
II тип	*Had we enough time to spare, (If we had enough time...)* Было бы у нас достаточно времени,	*we should attend the conference.* мы бы пошли на конференцию.
III тип	*Had we applied this method of work, (If we had applied ...)* Если бы мы применяли этот метод работы, (тогда)	*we should have had the desired results.* мы имели бы желаемые результаты.

See Grammar Module

Ex. 1 Translate the Conjunctionless Conditional sentences.

1. Should a large amount of data be processed, it may be better to read it from a data file. 2. Were one electron removed, a net positive charge would be left. 3. Had we all the necessary materials, we should complete this device in time. 4. Be the index of the instruction manual not so complete, you might put another page in it. 5. Should your work meet these conditions, it will be of great service to our industry. 6. Had he informed me in time, I would have sent this device. 7. Had you taken all safety measures, the machine would not have been broken. 8. Had the degree of evaporation been high, the salinity of water would have risen. 9. Had this warning been needed, the processing might have taken quite a different turn. 10. Had the spacecraft gone behind the Moon, it would have gone into an initial Lunar orbit. 11. Were there no ammeter, it would be much more difficult to carry on scientific work. 12. Were those experiments made, they would show us once again that very little attraction exists between the molecules of any gas. 13. Were the Earth not rotating, the satellite in 1-4 hours would cover 360 degrees in longitude. 14. The velocity of a particle would be continuously changing had that particle non-uniform motion. 15. Were the field winding in series with the armature, all the current to be generated would pass through it. 16. Should one computer fall, the other takes over its function.

Ex. 2 Match part A with part B. Pay attention to the Conjunctionless Conditional clauses. Translate the sentences.

1. Had silver been less cost,	a) I would give them my considerations about the capacity of that machine.
2. Were the wire of smaller diameter,	b) we would have found the ways to solve the problem.
3. Should we want to accelerate the motion,	c) the evaporation would be accelerated.
4. Were I there,	d) the research program would have been realized.
5. Had he taken into account the properties of the substance under investigation,	e) it would have been widely used as a conductor, its conductivity being very high.

6. Were the temperature raised,
7. Had they helped us,
8. Had he pointed out all the drawbacks,
9. Had he joined our expedition,
10. Had I more time,

f) I should get all that work finished long ago.
g) we should have to apply some force.
h) he could have learnt many interesting things.
i) he would have been careful when working with it.
j) its resistance would be increased.

Ex. 3 Finish the sentences. Pay attention to the Conjunctionless Conditional clauses. Translate the sentences.

1. Had I known it before, ... 2. Were I less tired, ... 3. Should I win, ... 4. Had I more time, ... 5. Were he here, ... 6. Should I see him tomorrow, ... 7. Were I free, ... 8. Had I seen him yesterday, ... 9. Had we enough time to spare, ... 10. Had we applied this method of work, ...

VOCABULARY

1. **Satisfy** *(v.)* – выполнять, исполнять, удовлетворять

This graduate satisfies all the requirements for the job of an engineer.

2. **Requirement** *(n.)* – требование, необходимое условие

The method could be taken further if specific **requirements** were needed and technical variety was introduced.

3. **Customer** *(n.)* – клиент, покупатель

Employers can access funding to improve the **customer** service skills of their workers.

4. **Measurement** *(n.)* – измерение

The machine makes thousands of **measurements** every day.

5. **Tool** *(n.)* – инструмент

The companies are working with developers to create software **tools** for programmers.

6. **Complicated** *(adj.)* – сложный, осложненный

The instructions were so **complicated** I just couldn't follow them.

7. **Reliability** *(n.)* – надежность

The choice of these products was based on safety, design, technology and **reliability**.

8. **Specification** *(n.)* – технические характеристики, спецификация

This is not a clear s**pecificatio**n of the problem.

9. **Construction** *(n.)* – конструкция, построение

There are currently four major housing projects under **construction** in the area.

10. **Validation** *(n.)* – легализация, подтверждение истинности, оценка корректности

This scientist saw this result as **validation** of his theory.

11. **Operation** *(n.)* – действие, работа

The company has eight power plants in **operation** and seven under construction.

12. **Maintenance** *(n.)* – поддержка в эксплуатации, сохранение

The network will be down for an hour for routine m**aintenance**.

13. **Time-consuming** *(adj.)* – время затратный, продолжительный

Editing these files is the most fun, but also the most **time-consuming** part of the process.

14. **Aid** *(n., v.)* – помогать, помощь

A thesaurus is a useful **aid** in writing reports.

15. **Automate** ['ɔ:təmeɪt] *(v.)* – автоматизировать

New technologies let you **automate** control of your home appliances.

16. **Incorporate** *(v.)* – применять, охватывать, внедрять

This project was **incorporated** into the factory's main wastewater treatment scheme.

17. **Enforce** *(v.)* – усиливать, принуждать, настаивать

Each of the new models **enforces** the little use of electricity.

18. **Eliminate** *(v.)* – уничтожать, ликвидировать

He supposes that the technological process will **eliminate** the problem of scarcity of resources.

19. **Complexity** *(n.)* – сложность, запутанность

Newer methods have revealed the **complexities** underlying the development of a new laser.

20. **Extensive** *(adj.)* – обширный, широкий

They carried out an **extensive** search of the area but nothing was found.

Ex. 4

a. Match the words with their definitions.

	a) a person who uses or operates something
	b) a person who buys goods or services from a shop or business
	c) a thing that is needed or wanted
1) requirement	d) detailed examination of the elements or structure
2) customer	of something
3) user	e) require the payment of (a specif ed sum of money)
4) aid	before it can be acquired or done
5) tool	f) a plan or drawing produced to show the look and
6) cost	function or workings of a building or other object
7) operation	before it is made
8) analysis	g) help, typically of a practical nature
9) design	h) the action of functioning or the fact of being active or in effect
	i) a piece of software that carries out a particular function, typically creating or modifying another program

b. Translate the terms with the word <u>engineering.</u>

Electrical engineering, engineering economics, engineering insurance, engineering physics, civil engineering, genetic engineering, agricultural engineering, chemical engineering, communication engineering, development engineering, power engineering, heat engineering, lightning engineering, management engineering, mining engineering, mechanical engineering, metallurgical engineering, radio engineering, social engineering, software engineering, system engineering, traffic engineering, thermal engineering, water engineering.

READING

Software engineering

Software engineering is the discipline concerned with the application of theory, knowledge, and practice to building reliable software systems that satisfy the computing requirements of customers and users. It is applicable to small-, medium-, and large-scale computing systems and organizations. Software engineering uses engineering methods, processes, techniques, and measurements. Software development, whether done by an individual or a team, requires choosing the most appropriate tools, methods, and approaches for a given environment.

Software is becoming an ever larger part of the computer system and has become complicated to develop, often requiring teams of programmers and years of effort. Thus, the development of a large piece of software can be viewed as an engineering task to be approached with care and attention to cost, reliability, and maintainability of the final product. The software engineering process is usually described as consisting of several phases, called a life cycle, variously defined but generally consisting of requirements development, analysis and specification, design, construction, validation, deployment, operation, and maintenance.

Regardless of the development methodology chosen, the software development process is expensive and time-consuming. Since the early 1980s, increasingly sophisticated tools have been built to aid the software developer and to automate the development process as much as possible. Such computer-aided software engineering (CASE) tools include a wide range of types, from those that carry out the task of routine coding when given an appropriately detailed design in some specified language to those that incorporate an expert system to enforce design rules and eliminate software defects prior to the coding phase.

Sophisticated techniques for testing software have also been designed. For example, unit testing is a strategy for testing every individual module of a software product independently before the modules are combined into a whole and tested using "integration testing" techniques.

Ex. 5 Answer the following questions.

1. What is software engineering? 2. What does software engineering use? 3. What does software development require? 4. Can one programmer develop sophisticated software? 5. What can be viewed as an engineering task? 6. How is the software engineering process usually described? 7. When were the first sophisticated tools built? 8. What tools include a wide range of types from those that carry out the task of routine coding to those that incorporate an expert system? 9. Have sophisticated techniques for testing software been designed? 10. What are the examples of sophisticated techniques?

Ex. 6 True or false sentences.

1. Software systems can satisfy the computing requirements of customers and users.
2. Software engineering is applicable to small-, medium-, and large-scale computing systems and organizations.
3. Software development can be done by an individual or a team.
4. Software is becoming an ever smaller part of the computer system.
5. Software has become complicated to develop, often requiring teams of programmers and years of effort.
6. The software engineering process is usually called a life cycle.
7. The software development process is cheap and time-consuming.
8. Since the late 1980s, increasingly sophisticated tools have been built to aid the software developer and to automate the development process as much as possible.
9. Reliability is a key goal of the finished software product.
10. Sophisticated techniques for testing software have also been designed.

Ex. 7 Complete the sentences using the correct form of the word.

1. Software engineering is the discipline concerned with the (to apply) of theory, knowledge, and practice.
2. Software systems satisfy the computing (to require) of customers and users.

3. Software engineering uses engineering methods, processes, techniques, and (to measure).

4. Software (to develop) requires choosing the most appropriate tools, methods, and approaches.

5. Software often requires teams of (programme) and years of effort.

6. The software engineering process is usually (to describe) as consisting of several phases (to call) a life cycle.

7. The software development process is expensive and time- (to consume).

8. Since the early 1980s, (increasing) sophisticated tools have been built.

9. Sophisticated techniques for (to test) software have also been designed.

10. Unit testing is a strategy for testing every individual module of a software product (independent).

Ex. 8 Make the pairs of words.

1) software	a) system
2) computer	b) software engineering
3) computing	c) coding
4) sophisticated	d) development
5) computer-aided	e) module
6) coding	f) methods
7) program	g) code
8) engineering	h) language
9) routine	i) phase
10) specified	j) tool

LANGUAGE STUDY

Ex. 9 Read the words. Pay attention to the interchange of phones. Translate them.

To advise – advice, to use – use, to house – house, to excuse – excuse, to devise – device, to lose – loose, to close – close, crisis – crises, basis – bases, analysis – analyses, thesis – theses, diagnoses – diagnoses.

Ex. 10 Study the 'Suffixes for jobs'.

Suffixes for jobs: *-er -or -ist -yst -ian -ant -eer.*

a. Read and translate the words.

Webmaster, manufacturer, computer animator, systems analyst, computer technician, IT consultant, software engineer.

b. Which IT professionals from exercise A are described here?

1. A person who designs and maintains software applications.
2. A person who gives expert, professional advice.
3. A person who uses graphics software to make or edit animated pictures.
4. A person or enterprise that produces goods in large numbers, using machines.
5. A person who manages and maintains a website.
6. A specialist in the technical details of computers.
7. A person who studies organizational systems and decides what action needs to be taken to maximize efficiency.

Translation Difficulties

Ex. 11 Translate the sentences. Pay attention to the word unless.

1. Isaac Newton stated that a body would continue moving unless some force was applied to stop it. 2. Space flights would be impossible unless special materials for space vehicles were produced. 3. We should have no radio, telephone, television or computers unless there were electricity. 4. The earth temperature would increase indefinitely unless heat were radiated. 5. Unless the temperature rises, the speed of the molecules will not increase. 6. It would have been impossible to send satellites into orbit unless Newton's laws of motion had been studied. 7. With the heat generated by the friction of the air on the aircraft surface, the temperature inside the cabin would increase to almost 1,000°C unless it were cooled by mechanical means. 8. A body in motion would continue to travel in a straight line forever unless some force was applied to stop it. 9. Unless the voltage were changed, the particles would not be accelerated. 10. You won't pass your exam in Information Science unless you study hard.

SPEAKING

Ex. 12 Read the following dialogue, try to act it out and translate it into Russian.

Job Interview

Interviewer: Good morning, Miss Jones. So you applied for a job in our team. Am I right?

Applicant: Yes, I did. I sent my CV for a position of IT engineer.

Interviewer: That's good. I'd like to know a bit more about you. Probably you could tell us about your education first.

Applicant: Well, I left school at 17 and then for the next five years I studied at Oxford University. I graduated from the Department of Computer Information Technologies with high honors and was qualified as an IT engineer.

Interviewer: Well. Your education sounds great, Miss Jones. And have you got any experience? Have you worked before?

Applicant: Certainly. First I worked as an engineer at a plant and then I decided to leave this position and find another one. Now I work as an analyst in an IT company.

Interviewer: That's very interesting. Why aren't you happy with your present job, Miss Jones? Why are you going to leave them?

Applicant: Well. The salary isn't so bad, I must admit. But the work schedule isn't convenient for me. And I often do a lot of overtime there. Besides, you have an excellent reputation and I hope to have more opportunity and growth potential in your company.

Interviewer: I see. Do you mind business trips? And are you fluent in Italian or German?

Applicant: Oh, foreign languages are my favorites. We did Italian and German at the University and I use them when I travel.

Interviewer: Very good. Can you tell me about your good points then?

Applicant: Well... I start my work on time. I learn rather quickly. I am friendly and I am able to work under pressure in a busy company.

Interviewer: OK. That's enough I think. Well, Miss Jones. Thank you very much. I am pleased to talk to you and we will inform you about the result of our interview in a few days. Goodbye.

Ex. 13 Read the following dialogue and translate it into English.

Обоуждение будущего сотрудничества

– Здравствуйте, Мистер Коллинз.

– Доброе утро, мистер Эванс.

– Итак, мы встретились, чтобы обсудить наши будущие совместные разработки.

– Да, наши бизнес разработки могут давать гораздо больше вместе, нежели сами по себе. Вы специализируетесь в области маркетинга, а мы специализируемся на производстве высококачественных товаров. Это обеспечит нам плодотворное взаимодействие.

– Я надеюсь, что так и будет. Вы уже видели контракт?

– Да. Мои адвокаты просмотрели его, и я готов подписать его и начать работать.

– Замечательно. Давайте тогда подпишем контракт в следующий понедельник.

– Это очень хорошая идея.

Ex. 14

Project Work

Sum up the most widely spread Internet applications. Make several groups and prepare a report about each Internet application with your own examples.

For example:

- Getting news from the Internet;
- Online shops;
- Internet travel agencies;
- Communication through the Internet.

Pre-task: While preparing make a list of advantages and disadvantages of using the Internet for these applications in comparison with the traditional ways of getting news, buying something in the shops, spending holidays, and communicating with each other. For example:

Group 1: Internet news

- What advantages has the group mentioned?
- Can you choose any news you like?
- Do you depend on time searching for news?
- What are the disadvantages?
- Is the Internet information always true?
- How about the yellow press? Is it available on the Internet?

Group 2: Internet shops

- What do you need to make a purchase?
- Are you able to buy anything you need?
- Are the goods always legal?
- Are the prices high?
- What is the advantage of a traditional shop in purchasing food and clothes?
- Are you able to get a piece of advice from the shop assistant?
- Are you able to ask for help in the consumer department?

Group 3: Internet travel agencies

- Do they provide their clients with more full information?
- Do the sites contain any information about the clients' impressions on the trip?
- Is it convenient for the clients?
- Is the agent's opinion/advice important to you?
- Are you able to get any compensation in the case of your dissatisfaction with the trip?

Group 4: Communication through the Internet

- What opportunities do these sites offer to the clients?
- Is it easy to find friends with common interests on the Internet?

– Is it possible to find additional information about the people you communicate with?
– Are you sure that your correspondence is confidential and nobody can read it?
– Do you lack visual contact in communication?

Post-task: Make your own prediction about the future. Will the Internet communication replace traditional one completely?

Module 8. Outstanding Scientists

Unit 21

Grammar. Subject and Predicative Clauses
Text. André-Marie Ampère
Word building. Abbreviations

GRAMMAR

Subject and Predicative Clauses
Придаточные предложения подлежащие и сказуемые

Subject clauses	Predicative Clauses
Подлежащее выражено придаточным предложением	Именная часть сказуемого выражена придаточным предложением, которая следует за глаголами *to be, to become, to grow*

Вводятся союзами *that, what, who, where, whether* и др.

What you said in your report was quite new.	*The decision of the conference committee was that the report was of great importance.*

See Grammar Module

Ex. 1 Read and translate the sentences. Find the Subject and the Predicative.

1. Whether or not this process will take place is not known. 2. Which method is preferred depends on the circumstances. 3. What they really mean is that their explanation of the phenomena fits in with all experiments. 4. The only difference between these two situations is whether the uncertainty is resolved in two stages or one. 5. A serious difficulty will be in that such compounds have not yet been considered. 6. The question remains whether this approach is applicable in all cases. 7. Whether these two phenomena are related has yet to be discovered. 8. Whether or not these cells interact with each other has to be checked. 9. Who will make a speech depends on the results of the discussion. 10. How it has been done does not matter. 11. One reason that such a tube has an extremely large bandwidth is that the velocity of propagation of the electromagnetic wave is constant. 12. The important point to remember is that the blower on a two-cycle engine is simply an air pump. 13. The biggest threat is that so far the device could cause a short circuit. 14. The biggest danger of water getting inside is that it can damage the circuit. 15. What we see is not steam at all, but fine water particles.

Ex. 2 Read the sentences. Make Subject clauses according to the model.

Model: It is easy to confuse these two notions. It is indicated by the example. (that) – That it is easy to confuse these two notions is indicated by the example.

1. This could be achieved with mechanization. It was to be determined. (whether) 2. The agreement will be signed. It is clear. (that) 3. This method is too complicated. It is obvious. (that) 4. It has been said above. It limits this method. (what) 5. It is easy to confuse these two notions. It is indicated by the example. (that) 6. It is necessary to apply enormous pressure to a liquid to get changes in volume. It is not difficult to prove. (whether) 7. Heat flows from a place of higher to one of lower temperature but never in the reverse direction. It should be kept in mind. (that) 8. The liquid state is the normal state of water. It is a well-known fact. (that) 9. Heat is transferred by conversion. It can be illustrated by a stove. (how) 10. There has been rapid development and

deployment of renewable energy sources. It seems very promising. (that) 11. The use of solar panels reduces fossil fuel consumption. It seems very promising. (that)

Ex. 3 Translate the Complex sentences.

1. Важной характеристикой излучения является то, что оно может распространяться в вакууме. 2. То, что при наличии давления любой газ может быть превращен (to turn into) в жидкость, известно каждому. 3. Недостатком этой цепи по сравнению с классической является то, что невозможно определить, когда произошло отключение. 4. Отличительной особенностью сухих трансформаторов является то, что магнитопровод (magnetic circuit) и обмотки не погружены в изолирующую жидкость. 5. Вопрос состоит в том, что такое дизельный двигатель, как он работает и чем отличается от газового. 6. Закон Ома заключается в том, что ток, текущий в цепи, изменяется в прямой зависимости от ЭДС. 7. То, что наша научная группа готовит к публикации две статьи, всех удивило. 8. Основной проблемой было то, как ученые смогут получить данные для дальнейшей работы. 9. То, что нам действительно было необходимо узнать – это в какой лаборатории будет проходить эксперимент. 10. Наше предложение заключалось в том, чтобы все измерительные приборы были проверены заранее.

VOCABULARY

1. **Determine** *(v.)* – определять, устанавливать
   Having **determined** the number of amperes and the number of volts, we can find the resistance of the coil by using **O**hm's law.
2. **Discover** *(v.)* – обнаруживать, открывать
   Polonium was **discovered** by Marie **C**urie in natural uranium.
3. **Interaction** *(n.)* – взаимодействие
   The **interaction** of microwave energy with materials depends not only on its frequency but also on the polarization of the radar beam.
4. **Visualize** *(v.)* – отчетливо представлять себе
   This invention designed to **visualize** a real object results from 3**D** scanning.

5. **Resultant** *(adj.)* – получающийся в результате
   The **resultant** digital image was subjectively similar to the real image viewed through the microscope.
6. **Coil** *(v.)* – свёртывать кольцом, спиралью
   The spring began to **uncoil**.
7. **Helix** ['hi:lıks] *(n.)* – спираль
   They termed the structure a "double **helix**".
8. **Repulsion** *(n.)* – отталкивание
   The nuclear force can overcome the electrical **repulsion** of the protons.
9. **Evidence** *(n.)* – доказательство
   These figures are being given as **evidence** of economic growth.
10. **Bar magnet** – стержневой магнит
    Knowing that the earth itself is like a giant **bar magnet** explains one of the most beautiful sights in the sky, the aurora.
11. **Spin** *(v.)* – вращаться
    It's the interaction of both these magnets which makes this motor **spin**.
12. **Molecule** ['mɒlıkju:l] *(n.)* – молекула
    The **molecules** of oxygen gas contain just two atoms.
13. **Assumption** *(n.)* – предположение
    Many scientific **assumptions** about Mars were wrong.

Ex. 4

a. Match the words with their definitions.

1) helix
2) attraction
3) assumption
4) direction
5) fluid
6) molecule

a) a force by which things are pulled towards each other
b) something that you accept as true without question or proof
c) a substance that flows and is not solid
d) the simplest unit of a chemical substance, usually a group of two or more atoms
e) a curve that goes around a central tube or cone shape in the form of a spiral
f) the position towards which someone or something moves or faces

b. Translate the terms with the word direction.

Airflow direction; antenna direction; automatic direction finder; automatic direction finder receiver; beam direction; beam scanning direction; change of direction; change the direction of radio-wave propagation; clockwise direction; direction control; direction control switch; direction measurement; field direction; opposite in direction; opposite rotational direction; required direction; vehicle direction.

READING

André-Marie Ampère (1775–1836)

André-Marie Ampère was born in Lyons, France, the son of a wealthy merchant. Ampère's education was determined by his father. At an early age, Ampère discovered a talent for mathematics, working out the early books of Euclid by himself. On finding that some of the books he wished to consult in the library in Lyons were in Latin, he taught himself the language.

In 1820 Hans Christian Oersted discovered electromagnetism. A report of Oersted's work was delivered before a sceptical meeting of the Académie des Sciences. Oersted's work was contrary to established ideas, based on Coulomb's work of the 1780s, that there could not be any interaction between electricity and magnetism. Ampère however, immediately accepted Oersted's discovery, and set to work, reading his first paper on the subject. Oersted's discovery suggested to Ampère, that two wires, each conducting current, might affect one another. Deducing the pattern of magnetic force around a current-carrying wire to be circular, Ampère went on to visualize the resultant force if the wire were coiled into a helix. One week later Ampère announced to the Académie, his discovery of the mutual attraction and repulsion of two helices. In doing so Ampère presented a new theory of magnetism as electricity in motion.

Ampère's research followed his own philosophy on the nature of science and scientific explanation. The phenomenon of electromag-

netism had been discovered by Oersted, and the relationship between two current-carrying wires by Ampère; what remained was the discovery of the causes of the phenomenon. In his first memoir on electrodynamics, Ampère investigated the phenomenon and provided factual evidence to show that magnetism was electricity in motion. He concluded that two electric currents attracted one another when moving parallel to one another in the same direction; they repelled each other when they were parallel but in opposite directions. Ampère felt that electrical phenomena could be explained in terms of two fluids, a positive one flowing in one direction and a negative fluid going in the other.

In 1821 Michael Faraday sent Ampère details of his memoir on rotary effects, provoking Ampère to consider why linear conductors tended to follow circular paths. Ampère built a device where a conductor rotated around a permanent magnet, and in 1822 used electric currents to make a bar magnet spin. Ampère spent the years from 1821 to 1825 investigating the relationship between the phenomena and devising a mathematical model, publishing his results in 1827. Ampère described the laws of action of electric currents and presented a mathematical formula for the force between two currents. However, not everyone accepted the electrodynamic molecule theory for the electrodynamic molecule. Faraday felt there was no evidence for Ampère's assumptions and even in France the electrodynamic molecule was viewed with scepticism. It was accepted, however, by Wilhelm Weber and became the basis of his theory of electromagnetism.

Ex. 5 Answer the questions.

1. What family is Ampère from? 2. Whose books did he study math by? 3. Why did he learn Latin? 4. Why wasn't Oersted's work accepted by Académie des Sciences? 5. What idea did Oersted's discovery suggest to Ampère? 6. What theory did Ampère represent to the Académie? 7. What was Ampère's conclusion on the behavior of two currents? 8. What did Ampère present in his work in 1827? 9. What theory did the electrodynamic molecule theory become the basis for? 10. Could you remember Ampère's law?

Ex. 6 Find the synonyms to the following words.

1) wealthy	a) proof
2) discover	b) rich
3) affect	c) influence
4) helix	d) find out
5) provide	e) spiral
6) spin	f) supply
7) evidence	g) rotate

Ex. 7 Finish the sentences using the information from the text.

1. At an early age, Ampère discovered
   a. the theory of magnetism
   b. a talent for mathematics
   c. the mistake in Euclid mathematics
2. Oersted's work was
   a. based on the ideas established in Coulomb's work
   b. contrary to established ideas, based on Ampère 's work
   c. contrary to established ideas, based on Coulomb's work
3. Ampère announced to the Académie
   a. his discovery of the mutual attraction and repulsion of two wires
   b. his discovery of the theory of relativity
   c. his discovery of the laws of motion
4. Ampère concluded that
   a. two electric currents don't attract one another when moving parallel to one another in the same direction
   b. two electric currents attract one another when moving parallel to one another in the opposite direction
   c. two electric currents attract one another when moving parallel to one another in the same direction
5. Ampère built a device where
   a. a conductor rotated around a permanent magnet
   b. a permanent magnet rotated around a conductor
   c. a conductor rotated around a variable magnet

LANGUAGE STUDY

Word Building

Abbreviations (Сокращения)

Графические	Используются в письменной речи	e.g., p., Mon., vol.
Лексические	Инициальные	dc, laser MPEI, NASA
	Слоговые	Uni (university) Edu (education)
	Усеченные	Phone (telephone) Airplane (plane)

Ex. 8 Translate the following abbreviations. Use the dictionary.
C, ac, dc, e.g., e.m.fi, etc., hp, i.e., kW, m, mm, rpm, p., sq., **T**, F.

Ex. 9 Read and translate the words with the same stem.
Determine – determinant – determination – determinative – determinately; discover – discovery – discoverer – discoverable – rediscovery; interact – interaction – interactive; visualize – visualizer – visualization; attract – attraction – attractive – unattractive – attractiveness; repulse – repulsion – repulsive; investigate – investigation – investigator – investigative; direct – misdirect – direction – director – directly – directional; assume – assumption – assumed.

Translation Difficulties

Ex. 10 Translate the sentences. Pay attention to the words <u>hence, therefore, indeed</u>.
1. Hence, the principal role in this field is played by experiment. 2. The atoms do not carry any electric charge; therefore, they only exert a minimal force on the electron. 3. **GPS** signals don't penetrate very deeply or at all in water and therefore can't be used by submarines. 4. Organic molecules indeed could open up new simple production

methods utilizing the self-organization of molecules. 5. Therefore, it is possible to distinguish between two different ionization processes. 6. Balancing energy flows via electricity storage can improve the capacity factors of power plants, hence optimising the energy flows. 7. Hence, the gas share of the power generating sector is bound to rise over the coming years. 8. Indeed, touchscreen devices and smartphones are making the Internet easily accessible. 9. If the gas pressure is reduced, the cooling effect will decrease, hence the equilibrium temperature of the wire will increase. 10. Therefore, energy efficiency is an important component for enhancing energy security. 11. Therefore, power electronics indeed depends upon all of the other areas of electrical engineering.

SPEAKING

Ex. 11 Using the Internet find out the names of the following physicists by their discoveries:

- Deemed as the most influential physicist of the 20th century, the German-born physicist was one of the greatest minds to have ever lived. Even his name is now synonymous with the term genius. The father of Modern Physics is credited with developing the theory of relativity and explaining the photoelectric effect. The latter won him the Nobel Prize.
- Inventor, engineer and futurist, he is best remembered for his contribution to the development of the modern alternating current (AC) electricity supply system. A prolific inventor, he had around 300 patents for his inventions.
- One of the most influential and popular scientists of all time, he played a prominent role in our understanding of natural phenomena. He formulated the law of universal gravitation and laws of motion. He also developed the telescope among other devices.
- Amongst the most notable scientists of her time, the first woman to win a Nobel Prize, the sole person to win two Nobel Prize in two different categories, and the first woman professor

at the University of Paris. Her list of achievements is incredible. She did extensive research in the field of radioactivity and discovered polonium and radium.

- An Italian astronomer, engineer, and physicist, he is widely regarded as the father of observational astronomy, the father of the scientific method, the father of modern physics, and the father of modern science. He is credited with popularizing the telescope, which changed the course of history.
- He was an English scientist known for his contribution to the study of electrochemistry and electromagnetism. Considered one of the most influential scientists ever, his inventions of electromagnetic rotary devices established the basis for electric motor technology. His research also helped to understand the concept of the electromagnetic field.

Ex. 12 Choose any person from Ex.11 and look for additional information about his/her discoveries and biography.

Unit 22

Grammar. Object Clauses. Adverbial Clauses (Elliptical Clauses)
Text. Nikola Tesla
Word building. Prefixes of Measure

GRAMMAR

Object Clauses
Дополнительные придаточные предложения

Следуют за сказуемым после союзов *that, if, whether* и др.
либо присоединяются бессоюзной связью

I think *(that) he will complete our research in time.*

See Grammar Module

Ex. 1 Read the sentences. Find the subject and the predicative in the main part of the sentence and the clause.

1. Scientists believe that hot springs are often due to the presence of magma near the surface. 2. The resulting images help the auditor determine whether insulation is needed. 3. If the state of a system is not changed in time, this is what is called an equilibrium system. 4. This work shows how a solar cell works. 5. Lab assistant must locate the origin of the short circuit and determine how the accident was caused. 6. To characterize the engine one has to state whether it is operated from petroleum or gas. 7. The researchers said a new type of spaceship had to be designed for transportation to Mars. 8. We find these values are directly proportional to the temperature. 9. Some investigations indicate the above described method is incorrect. 10. Do you know how a four-cycle diesel works? 11. Experiments show that there is very little attraction between the molecules of any gas. 12. We know the current is a directed, ordered movement of electric charges. 13. The question remains whether this approach is applicable in all cases. 14. The problem is whether the results of the test should be recorded.

Ex. 2 Change the sentences by the model.

Model: They say the changes are caused by pressure. – They said the changes were caused by pressure.

1. The researchers say it will be possible to mass-produce sheets of these semiconductor heterostructures. 2. They say that there is a break in the circuit, so, that electrons cannot bridge the gap. 3. We know that a piece of apparatus that has the ability to maintain one of its terminals at a higher potential than the other will develop an electromotive force. 4. Everyone knows that pure annealed copper has 100 per cent conductivity. 5. The publisher says that this device has been described in some earlier papers. 6. The lecture claims that radium is one and a half million times more radioactive than uranium. 7. We are sure that this type of engine will have many disadvantages. 8. The researchers assume that under such conditions laboratory testing will continue to expand rapidly. 9. We wonder why this new discovery was much spoken about. 10. We know that a direct current of unvarying magnitude is

obtained from an accumulator. 11. We are said that atomic power is transformed into electric power by means of a steam turbine. 12. Nobody can assume that this device may be the best for converting heat into work. 13. They report that the steam turbine will depend on its motive force almost entirely on the dynamic action of the steam.

Elliptical Clauses

Неполные обстоятельственные придаточные предложения

Эллиптическая конструкция – это неполное
придаточное предложение
с пропущенным подлежащим и глаголом *to be*

While (he was) working on the electrical phenomena, Ampère devised a mathematical model too.

See Grammar Module

Ex. 3 Read and translate the sentences. Find Adverbial clauses and Elliptical clauses.

1. When heating gases we find they act in exactly the same way as liquids. 2. Though capable of good performance, amplifiers of this type have a number of disadvantages. 3. The electron stream experiences the deflecting force when passing across a magnetic field. 4. Various theories, while used to express transmission equations, have provided valuable assistance in the experimental program. 5. Once set up, these machines will operate for a long time. 6. The equipment as described was used for experimental tests. 7. When used in a waveguide, this detector operates independently. 8. These materials were the conductors when under proper conditions. 9. Resistors when correctly applied are believed to be the most reliable of common components. 10. As Popov was making his experiments, he made a discovery which founded the basis of radar systems. 11. Since aluminium is light and strong it is widely used in the aircraft industry. 12. When pure, water is colourless liquid. 13. All the defects, if any, should be mentioned. 14. He made some notes while making the experiment. 15. The acceleration is zero only when the speed and direction of motion are both constant.

VOCABULARY

1. **Field** *(n.)* – поле, область

The **field** of this invention application relates to the engineering sector.

2. **Flash** *(n.)* – вспышка

The lightning **flash**ed and distant thunder rolled.

3. **Concept** *(n.)* – концепция, понятие, идея

Often the basic methods are supplemented with additional new data and methods; however, the basic **concept** remains the same.

4. **Alternating current motor** – электродвигатель переменного тока

The invention relates to **alternating** and **direct-current electric motors** and can be used in electrical drills for drilling wells, in particular oil and gas wells.

5. **Rely on** *(v.)* – надеяться, полагаться на

Committee members had to **rely on** the given information, although, of course, it needed filtering.

6. **Powerhouse** *(n.)* – электростанция

The **powerhouse** contains four 75 MW turbines, generating 300 MW of electricity.

7. **Apparatus** *(n.)* – аппарат, прибор

This physics laboratory has the best **apparatus I**'ve ever seen.

8. **Principle** *(n.)* – принцип, правило

The operating **principle** of a developed radio transmitter is as digital as possible; the signal is converted to the analog form at the final amplification stage.

9. **Innovation** *(n.)* – инновация, новшество

These experiments are drivers of **innovation** for a broad range of applications.

10. **Perpetual motion** [pə'peʧuəl] – вечное движение

Perpetual motion is the action of a device that, once set in motion, would continue in motion forever, with no additional energy required to maintain it.

11. **Distribution** *(n.)* – распределение

The last principal component of an electric power system to be discussed here is a **distribution** system.

12. **Discharger** *(n.)* – разрядник

One **discharger** is electrically connected to the lightning receiver, and the other is electrically connected to the grounding-system contact element.

13. **Achievement** *(n.)* – достижение

The fact that we know the answer to that question is one of the greatest **achievements** in science.

14. **Harness** *(v.)* – использовать энергию (воды, солнца, ветра и др.)

There is a great deal of interest in **harnessing** wind and waves as new sources of power.

15. **Radium** *(n.)* – радий

It was already known that **radium** was an intermediate product of the decay of uranium.

16. **Thorium** *(n.)* – торий

Uranium reacts with acids and water much more easily than **thorium**.

17. **Predict** *(v.)* – предсказывать

If the underlying mechanisms of such interactions were better clarified, it would be possible to **predict** the rate of boiling heat transfer.

18. **Electron microscope** – электронный микроскоп

Electron microscope is a device that sends electrons through objects that are too small to be seen easily under ordinary microscopes.

Ex. 4

a. Match the words with their definitions.

	a) to control something, usually in order to use its power
1) predict	b) to say that an event or action will happen in the future, especially as a result of knowledge or experience
2) distribute	
3) harness	
4) apparatus	c) to spread or supply something
5) innovation	d) a new idea or method
6) powerhouse	e) a factory where electricity is produced
	f) a set of equipment or tools or a machine that is used for a particular purpose

b. Translate the terms with the word distribution.

Air flow distribution, audio distribution amplifier, Boltzmann distribution law, cable distribution network, current distribution, current distribution noise, distribution density, electric distribution, electric distribution box, exponential distribution function, magnetic field distribution, Maxwell-Boltzmann velocity distribution law, primary distribution network, water distribution system.

READING

Nikola Tesla (1856–1943)

Nikola Tesla was an eccentric scientific genius whose inventions in the field of electrical apparatus stemmed from inspirations received in extraordinary visions of a paranormal character. Unlike most innovators in the fields of engineering and electricity, his inventions did not require patient experiments and trial-and-error testing of models. The ideas flashed into his mind as working units, complete to the final details of component design and size. For example, as a young student of electrical engineering and physics, at a time when the concept of alternating current was considered a fallacy of the perpetual motion type, he knew that he could solve this problem. After only a few years of consideration of the problem, the complete detailed vision of an alternating current motor using a rotating magnetic field came to him while he gazed at a sunset.

Tesla started his career as an inventor in Budapest, Hungary, in 1881. There he constructed a telephone repeater and engaged in various branches of engineering and manufacture. In 1884 he immigrated to the United States. For nearly a year he worked for inventor Thomas A. Edison, who was impressed by his skill and hard work, but the two men were diametrically opposed in temperament and method. Tesla was a visionary who solved problems in a flash of insight, whereas Edison relied on patient trial-and-error in practical experiments. Tesla insisted on the superiority of alternating current and its applications, whereas Edison believed it a dead end and championed direct current.

The Tesla system made it possible to supply electricity economically over distances of hundreds of miles, instead of the short distances of the Edison direct current powerhouses. Tesla's demonstrations made a great impression on another inventor, George Westinghouse of the Westinghouse Electric Company. Westinghouse paid Tesla $1 million for rights on his alternating current system, comprising some 40 patents.

Tesla went on to invent new apparatus involving original principles. He was responsible for many important innovations: the system of electricity conversion and distribution by oscillatory dischargers, generators of high frequency current; the Tesla coil or transformer, a system of wireless transmission of intelligence; mechanical oscillators and generators of electrical oscillation; research and discoveries in radiation, material streams, and emanations; and high-potential magnifying transmitting. One of his most spectacular achievements was harnessing the water power of Niagara Falls. In 1895 the Westinghouse Electric Company installed a gigantic hydroelectric project, using the Tesla polyphase system of alternating current.

Tesla opened up many important avenues of scientific development and has rarely been properly acknowledged by later historians. His experiments with electromagnetic waves formed the basis of the development of radio. He stated that cosmic rays were responsible for the radioactivity of radium, thorium, and uranium and predicted that other substances would be made radioactive by bombardment. He thus anticipated the basic principles of the X-ray apparatus and the electron microscope. In his work with wireless controlled automata, he anticipated radio-controlled rocket missiles.

Ex. 5 Answer the questions.

1. What is the distinctive feature of Tesla's inventions? 2. How did his inventions appear? 3. Where was Tesla born? 4. What was his first invention? 5. Where did Tesla move in 1884? 6. What famous scientist did Tesla work with in the USA? 7. What was the difference in their views on alternating and direct currents? 8. How much did Tesla earn on his alternating current system? 9. What important innovations is Tesla responsible for? 10. How was the water power of Niagara Falls

harnessed using Tesla's inventions? 11. What were his statements about the radioactivity of some substances?

Ex. 6 Complete the sentences using the correct form of the word.

1. Nikola Tesla was an eccentric (science) genius.
2. His (invent) did not require patient experiment and trial-and-error testing of models.
3. After only a few years of (consider) of the problem, the complete detailed vision of an alternating current motor came to him.
4. There he constructed a telephone (repeat).
5. The two men were (diametrical) opposed in temperament and method.
6. Tesla insisted on the (superior) of alternating current and its applications.
7. The Tesla system made it possible to supply electricity (economic) over distances of hundreds of miles.
8. Tesla went on to invent new apparatus involving (origin) principles.
9. One of his most spectacular achievements was (harness) the water power of Niagara Falls.
10. His experiments with (electromagnet) waves formed the basis of the development of radio.

Ex. 7 Decide if these statements are true or false.

1. Tesla's inventions were in the field of electrical apparatus.
2. Tesla designed an alternating current motor using a stationary magnetic field.
3. Tesla relied on patient trial-and-error in practical experiments.
4. Tesla received $1 billion for rights on his alternating current system.
5. Tesla was responsible for the system of electricity conversion and distribution by oscillatory discharges.
6. Tesla's most spectacular achievement was harnessing the water power of Victoria Falls.

7. Tesla developed radio.
8. Tesla anticipated the basic principles of X-ray apparatus and the electron microscope.

LANGUAGE STUDY

Word Building

Приставки количественной меры

mono-	единичное, неразделённое, единственное
multi-	многочисленное, неоднородное
mini-	минимальное
micro-	микроскопическое, крохотное (10^{-6})
macro-	большое
nano-	микроскопическое, крошечное (10^{-9})

Ex. 8 Translate the words paying attention to the prefixes.

Monopoly, monoenergetic, monologue, monochrome, monodirectional, monocrystal, monorail, monolayer, monocoil;

Multicharge, multi-access, multicrystal, multivoltmeter, multiterminal, multistage;

Minimal, minipark, minivan;

Microcomputer, micropack, microflora, microelement, micrometer, microscope, micron, microwaves;

Macrocosmos, macrolevel, macrograph, macroeconomic, macroscopic;

Nanomaterial, nanomechanical, nanosensor, nanowatt, nanolithography.

Ex. 9

A. Make the nouns from the following verbs. Use suffixes -(a)tion, -ment.

To connect, to miniaturize, to observe, to reduce, to integrate, to operate, to generate, to form, to navigate, to determine, to accelerate, to interact, to equip, to measure, to move, to require.

b. Make the adjectives from the following verbs. Use suffixes -able, -ful.
To connect, to reduce, to suit, to prove, to control, to process, to observe, to use, to understand, to move, to operate, to require, to fit.

Translation Difficulties

Ex. 10 Translate the sentences. Pay attention to the words in question, under consideration.

1. The microscope in question uses a beam of accelerated electrons as a source of illumination. 2. A molecule under consideration is homonuclear, that is, it consists of atoms of one chemical element. 3. Most molecules in question are far too small to be seen with the naked eye. 4. A considerable amount of heat is radiated by the body in question. 5. Chemical elements under consideration cannot be broken down into simpler substances by chemical means. 6. All elements under consideration have radioactive isotopes, although not all of these radioisotopes occur naturally. 7. If there are more electrons than protons in a piece of matter under consideration, it will have a negative charge, if there are fewer it will have a positive charge, and if there are equal numbers it will be neutral. 8. Magnetic fields in question are produced by moving electric charges and the intrinsic magnetic moments of elementary particles associated with a fundamental quantum property, their spin. 9. The reverse conversion of electrical energy into mechanical energy is done by an electric motor under consideration. 10. Smaller wind turbines in question are used for applications such as battery charging for auxiliary power for boats or caravans, and to power traffic warning signs.

SPEAKING

Ex. 11 Using the Internet find information about the following physicists and prepare a presentation:

- Alessandro Volta
- James Maxwell
- Georg Ohm
- Gustav Kirchhoff
- Andrey Geim
- Alexander Popov
- Lev Landau

Ex. 12 Work with a partner. Here are the tables with the main facts from the biography of two famous scientists. Ask each other the questions. Guess the name of the scientist.

Student A / Scientist 1

Date of birth	1834
Nationality	Russian
Fields	Chemistry Physics Metrology Geology
Place of work	St. Petersburg University
Number of publications	432
Famous for	metric system Periodic Table
Awards	Davy Medal, Copley Medal (British Royal Society)
Nobel Award	no

Student B / Scientist 2

Date of birth	1974
Nationality	Russian
Fields	Physics Nanotechnology
Place of work	Manchester University
Number of publications	320
Famous for	graphene
Awards	Dalton Medal, Carbon Medal, Knight Bachelor, Member of Royal Society
Nobel Award	2010

Test 1

Vocabulary test

1. Choose the correct translation of the word.

1)	attract	a)	подавать, поставлять
2)	repel	b)	хранить, сохранять
3)	connect	c)	иметь что-либо в результате
4)	develop	d)	отталкивать
5)	store	e)	высвобождать
6)	maintain	f)	увеличивать (-ся)
7)	increase	g)	поддерживать
8)	supply	h)	разрабатывать
9)	result in	i)	соединять
10)	release	j)	притягивать

2. Complete the following sentences with the verbs derived from the words in brackets. Make all necessary changes.

1. We're looking for ways to (simple) the process.
2. Education and health, as well as land, were (national).
3. The committee will (motive) the research group to conduct the investigation.
4. Last year she (research) into the effects of climate change.
5. Now they are (broad) the bridge to speed up the traffic.
6. The technology (origin) in Russia and is now popular throughout the world.
7. She (character) the whole historical era as a period of radical changes.
8. The company decided to (local) its plant in Kaluga.
9. She drove the car round the village trying to (charge) its batteries.
10. Some people were not (vaccine) because they refused.

Grammar test

3. Complete the sentences with the correct form of the verbs in brackets.

1. I (experienced, was experienced) a lot of difficulties on my way home.
2. This coat has a special surface that (repels, is repelled) water.
3. Very often Russia (associates, is associated) with cold weather.
4. The north and south of the country (separate, are separated) by a desert.
5. This program can (translate, be translated) your e-mail into other languages.
6. Smart houses must (accumulate, to be accumulated) solar energy.
7. The local people (opposed, were opposed) the building of a nuclear power plant in their region.
8. The two lakes (connect, are connected) by a narrow canal.
9. Accidents must (report, be reported) to a police officer.
10. We have (to maintain, maintain) standards.

4. Fill in the gaps with the construction both… and or nouns the former, the latter.

1. Silver and copper are good conductors. … is rather expensive, … is cheap.
2. The new equipment was … comfortable … economical.
3. The group has investigated … the properties of the substance … its structure.
4. Of the two answers, … is far better than …
5. … Igor … Ivan passed the exam.

Test 2

Vocabulary test

1. Choose the correct translation of the word.

1)	degree	a) железо
2)	equation	b) реле
3)	friction	c) сила, интенсивность

4)	iron	d)	1) степень, 2) градус
5)	strength	e)	энергия
6)	load	f)	мера
7)	relay	g)	трение
8)	power	h)	труба
9)	measure	i)	нагрузка
10)	pipe	j)	уравнение

2. Form the nouns from other parts of speech given in brackets and complete the sentences. Make all necessary changes.

1. Somebody has left a (to pack) for you on your table.
2. Can you state with (certain) that this is the same device you used yesterday?
3. Under (capital), people are motivated by the idea of personal profit and success.
4. A (library) is a professional trained in information science.
5. Some years ago (science) noticed that the climate in our region was slowly growing drier.
6. Using the new method, we can demonstrate either of the two (possible).
7. These measures were designed to improve car (safe).
8. You can make your (to pay) in any bank.
9. Aluminum has good heat (conductive).
10. I think, all living (to create) have certain rights.

Grammar test

3. Choose the proper form of the Participle.

1. A comet can (be naming, be named, having been named) after the person who discovered it.
2. When (speaking, spoken, having been spoken) about the new device, the engineer gave many interesting details.
3. (finishing, finished, having finished) the research, the scientist did an analysis of the collected data.
4. The engineer was working on the computer (making, made, having made) all necessary calculations.

5. Radioactivity (discovering, discovered, having discovered) by scientists made great progress in atomic physics.
6. The potential difference is maintained by an electrical generator, the current (flowing, flowed, having flowed) continuously from one point to the other.
7. The results (achieving, achieved, having achieved) depended on the method used.
8. Carbon (finding, found, having found) in nature has atomic weights of 12 and 13.
9. The substance (investigating, being investigated, having investigated) was first weighed.
10. (measuring, measured, having measured) with the right instruments the data were correct.

4. Fill in the gaps with the words very, the very, only, the only.

1. At that moment he was ….. person in the laboratory.
2. The situation is ….. serious.
3. We ….. arrived half an hour ago.
4. This is not ….. possible definition of the phenomenon.
5. She always leaves her homework to ….. last moment.

Test 3

Vocabulary test

1. Choose the correct translation of the words.

1)	load	a) охлаждение
2)	current	b) ток
3)	refrigeration	c) пар
4)	power range	d) отработанное тепло
5)	steam	e) водород
6)	waste heat	f) ядерный, атомный,
7)	nuclear	g) деление, расщепление
8)	fission	h) диапазон мощности
9)	particle	i) частица
10)	hydrogen	j) нагрузка

2. Use suffixes and fill in the gaps with adjectives

1. A unique aspect of thermoelectric energy conversion is that the direction of energy flow is (to reverse).
2. At the beginning of the twentieth century, steam was the main source of (mechanics) power.
3. However, as electricity became more (to control), many small "power houses" that produced steam realized they could also produce and use electricity.
4. (tradition) generating systems produce only heat or electricity by burning a fuel.
5. There are several reasons why cogeneration is a (benefit) technology.
6. The most important (environment) reason to cogenerate is that vast amounts of precious, non-renewable resources are being wasted by inefficient uses.
7. Only 16% of the energy used for (industry) processes creates (use) energy or products.
8. (Atom) bombs let this energy out all at once, creating an explosion.
9. The atoms of (difference) elements have (difference) numbers of particles.
10. For nuclear energy, uranium is the most (importance) element.

Grammar test

3. Read and translate the sentences, pointing out a) the Gerund, b) the Verbal Noun or c) the Gerundial Construction. Put G, VN or GC in the box.

1. [___] Lomonosov's having studied atmospheric electricity contributed to the development of science.
2. [___] The air after being compressed in the compressor is heated by burning fuel in it.
3. [___] It is difficult to solve some of the present day scientific and techno-logical problems without using supercomputers.
4. [___] Demonstrating the first law of motion on the Earth's surface is rather difficult due to tremendous forces of gravity.

5. [___] He went on studying the structure of the internal combustion engine.
6. [___] The first power station to produce electricity by using heat from successful splitting of uranium atoms began operating in the 1950s.
7. [___] Watt proceeded to develop his engine further and modified it to provide a rotary motion suitable for driving factory machinery.
8. [___] Rapid development of nuclear power technology has ensured quite efficient energy supply for human being.
9. [___] Everybody knows about these engineers' having worked at the nuclear station.
10. [___] We know of any object being prevented from moving at constant speed by air friction.

4. Fill in the gaps with the correct Gerund form.

1. Marie Sklodowska's (to make) numerous experiments resulted in (to isolate) two new elements.
2. Silicon resembles carbon in (to form) a series of volatile hydrates.
3. (to break) the circuit causes (to spark).
4. We knew of his (to read) his report on nuclear energy at the conference.
5. Many substances behave as amber does after (to rub).

5. Fill in the gaps with:

a) vice versa; b) in case; c) notwithstanding; d) the rest of; e) as a matter of fact

1. … there is a relation between electrisity and magnetism.
2. … it is necessary, a greater part of heat may be carried off.
3. A pulsating current varying periodically between maximum limits may be produced by adding d.c. to a.c. or …
4. The efficiency of the machine is 85%, … the power being lost in the resistance to friction.
5. … the availability of renewable sources, we still use fossil fuels.

Test 4

Vocabulary test

1. Choose the correct translation of the word.

1)	regenerate	a)	возобновлять
2)	supply	b)	собирать, накапливать
3)	operate	c)	ионизовать
4)	convert	d)	поглощать
5)	absorb	e)	преобразовывать
6)	ionize	f)	проводить
7)	conduct	g)	излучать, испускать
8)	collect	h)	работать
9)	emit	i)	воспроизводить
10)	renew	j)	поставлять

2. Fill in the gaps with an adjective or adverb.

1. None of these objects were visibly altered by the rubbing, yet they (definite/definitely) behaved (different/differently) than before they were rubbed.
2. If iron filings are placed near a magnet, they orient themselves along the lines of the field, (visual/visually) indicating its presence.
3. Field force and flux are (rough/roughly) analogous to voltage and current through a conductor.
4. The number of extra free electrons added to the conductor is (direct/directly) proportional to the amount of field flux.
5. Because capacitors store the (potential/potentially) energy of accumulated electrons in the form of an electric field, they behave quite (different/differently) than resistors.
6. The world's oceans are a vast and (practical/practically) untapped source of energy.
7. Photovoltaic systems are based on solar electric cells, which convert sunlight (direct/directly) to electricity.
8. The (subsequent/subsequently) annual low-grade heat flow to the surface averages between 50 and 70 milliwatts per square meter worldwide.

9. Such resources are (typical/typically) limited to parts of the world characterized by recent volcanic activity.
10. Probably the most (wide/widely) used set of applications involves the (direct/directly) use of heated water from the ground without the need for any specialized equipment.

Grammar test

3. Find the Participle or the Gerund. Put G or P in the box.

1. [___] The main point of a transformer is changing voltage.
2. [___] We know of the velocity of electromagnetic waves changing when the wave front crosses a boundary between two media.
3. [___] As the velocity of a falling body increases, the air resistance becomes greater.
4. [___] All tanks are devided into two independent groups, each supplying three motors.
5. [___] After introducing new technology, some changes must be made as soon as possible.
6. [___] The failure was due to the designer's having been somewhat careless.
7. [___] We know of valve transmitters being divided into two types.
8. [___] Knowing the landing speed and the load it is possible to calculate the necessary wing area.
9. [___] The beam travelled 800,000 km in space, its velocity approaching that of light.
10. [___] We were informed of a new record of a non-stop flight having been established.

4. Fill in the gaps with the correct pronoun (It, One, We).

1. … know the electric motor to drive machinery and various appliances.
2. … may notice those differences between substances.
3. … know an alternating current to be continually changing by rising, falling, and changing direction.

4. … has to be very careful while solving complex problems of designing electrical installations.
5. … is known that spontaneous combustion occurs when the rate of heat production exceeds the rate of heat loss.

Test 5

Vocabulary test

1. Choose the correct translation of the words.

1)	printed circuit board	a)	спутник
2)	sound waves	b)	примерно; приблизительно
3)	propagate	c)	рупорная антенна
4)	satellite	d)	распространять (-ся)
5)	approximately	e)	рамочная антенна
6)	handheld	f)	отражатель
7)	low-frequency	g)	низкочастотный
8)	reflector	h)	звуковые волны
9)	loop antenna	i)	печатная плата
10)	horn antenna	j)	портативный

2. Use prefixes from the box to fill the gaps

im, un, in (2x), en, inter, con, re (2x), de

1. The reason for graphene nitride 1_expected piezoelectricity was predicted by Sharma in some of his earlier theoretical work on the topic.
2. But for new technologies it would be 2_possible for digital radio to replace analogue short and medium wave broadcasting around the world.
3. Digital Radio is 3_dependent of the Internet and available to the listener free of charge.
4.These technologies and components include 4_novative audio 5_coding methods, as well as server solutions for coding and generating digital radio transmission signals and software components for radio receiver devices.
5. The signal they receive via the antenna in digital form is then 6_converted back into audible form, just like the principle used in every conventional radio.

6. Quantum particles can interfere 7_structively or 8_structively.
7. The laser pulse 9_acting with the atom could be tailored very precisely.
8. Using these pulses, the scientists could measure the quantum phase which the electron had inside the atom before it was 10_moved by the laser.

Grammar test

3. Fill in the blanks with the proper forms of the infinitive.

1. He allowed these data … in the article.
A. to use B. use C. to be used D. be used
2. The teacher made the students … the metal properties.
A. to study C. to have been studied B. to be studied D. study
3. The professor let the students … the experiment.
A. to change C. to be changed B. change D. to have been changed
4. The teacher supposed the text about engineering materials … by the students.
A. to be read C. to have been read B. read D. to have read
5. We expect them … this problem long ago.
A. to have investigated C. to be investigated B. investigate D. to investigate

4. Read and translate the sentences, pointing out a) Complex Subject, b) Complex Object. Put CS, or CO in the box.

1. [ ] We know cybernetics to be an important branch of modern technology.
2. [ ] The new type of fuel was thought to be very expensive.
3. [ ] We expect the results to change.
4. [ ] Gravity causes bodies to fall to the earth.
5. [ ] The atom is known to emit rays of different length.
6. [ ] The professor wanted them to repeat the experiment.
7. [ ] This value is expected to change.
8. [ ] The temperature in the furnace is likely to increase.
9. [ ] The discovery showed the atomic nucleus to be a vast source of energy.
10. [ ] We know this phenomenon to be very common.

Test 6

Vocabulary test

1. Choose the correct translation of the word.

1)	light-emitting diode (LED)	a)	электрическая лампочка
2)	indicator light	b)	оптический резонатор
3)	light bulb	c)	ядро
4)	emit	d)	светодиод
5)	optical cavity	e)	волоконная оптика
6)	conductor	f)	притяжение
7)	fiber optics	g)	индикаторный сигнал
8)	nucleus	h)	излучать
9)	particle	i)	проводник
10)	attraction	j)	частица

2. Make the new words with negative prefixes from the following words and complete the sentences.

accurate	complete	credible	developed	understanding
balance	adequate	legal	correct	formal

1. But it would be both … and unfair to paint too bleak a picture of education in England.
2. On the other hand, there is also another kind of gender … within higher education.'
3. Many of the events that take place seem implausible, even at times … .
4. Many people dislike his … style of leadership.
5. However the quality of the studies was … and more research is needed.
6. For this reason, every history of the Second World War is necessarily fractured and… .
7. It would be false and … to state in your book that I have not responded to your questions.
8. The central part of the old airfield remains… , home to six football pitches, a nature reserve and a model aircraft flying zone.

9. English law makes … a contract to indemnify a person in respect of liability for fraud.

10. 'We understand that the … arose from the use of different types of terminology, and apologise for any confusion caused,' she said.

Grammar test

3. Insert the phrases with the Attribute in the right sentence.

molecular electronics	consumer electronics computers	a key indicator	two external polarised electrolytic capacitors	thin copper wire
physical technologies	the simplest possible semiconductor device	a transmission electron microscope image	computer software	the field emission microscope

1. A key challenge in … is making electrical contacts to the fragile molecules, chemical chains that are easily damaged.

2. A diode is … , and is therefore an excellent beginning point if you want to understand how semiconductors work.

3. … of the high level of points being issued for the various offences is the fact that more than 7,000 drivers were issued with points last month alone.

4. Others were woven with … , creating a seductively shiny and semisolid surface.

5. The basic issue at hand is whether … can or should be entitled to a patent.

6. … provided unparalleled images of atomic structure.

7. … is an in-focus projection through the specimen.

8. The story of the transformation in … comes in two quite distinct stages.

9. The devices use … that can also be reconfigured to double the supply voltage.

10. Japan's major export industries include automobiles, … , semiconductors, and iron and steel.

4. Fill in the gaps with the correct relative pronouns (who, whom, whose, which, that).

1. A conference in Vienna … ended on Friday was very interesting.
2. At home, I sit down to reply to all the boys and girls … leave letters for me in my postbox.
3. After a few hours of working in silence I heard a sound … immediately awoke my mind.
4. People will now vote for … they are told, forced to vote by people who have a hold over them.
5. He's a workaholic … goal is to be the first man to put hackers permanently out of business.
6. She said other businesses to … she had spoken were willing to take the same action.
7. You really must have your own work area … can be cut off from the rest of the house.
8. The rain was pouring in, and we had some friends with us … had brought some seafood.
9. We all hear about things … go on and generally it is the same people involved over and over.
10. He was a street fighter … attraction to violence bordered on the pathological.

Test 7

Vocabulary test

1. Choose the correct translation of the word.

1)	operating system	a)	аппаратное обеспечение
2)	software	b)	сеть
3)	hardware	c)	сложность, запутанность
4)	application	d)	приемник
5)	transmission	e)	программное обеспечение
6)	network	f)	инструмент
7)	receiver	g)	подпрограмма, часть программы
8)	tool	h)	прикладная программа
9)	complexity	i)	передача (данных)
10)	subroutine	j)	операционная система

2. Insert the missing letters.

to practi_e – practi_e, to licen_e – licen_e, to choo_e – choi_e, to li_e – li_e, to lo_s – lo_e, to brea_ _e – brea_ _, to pro_e – proo_, to s_t – s_ _t, to t_ll – t_le, to s_ng – s_ng, to f_ _d – f_ _d, to bl_ _d – bl_ _d, to sh_ _t – sh_t.

Grammar test

3. Open the brackets using the verbs in the correct tenses.

1. If we had time enough, we (to repeat) our experiment.
2. Provided we (not to raise) the temperature, the pressure would not increase.
3. The measurements would always be correct, provided the necessary instruments (to be used).
4. The manned spaceships might not have been launched into the space unless scientists (to study) the information received from the space satellites.
5. If it (to rain), I won't go out.
6. You would learn more if you (to study) sometimes.
7. If he (to ask) me, I would have told him the answer.
8. You would have done well if you (to take) my advice.
9. I wouldn't phone you here unless it (to be) urgent.
10. She'll catch cold, if her feet (to get) wet in this weather.
11. Unless you apologize at once, I never (to speak) to you again.
12. If we (to have) nothing to do, life would be boring.

4. Match part A with part B. Pay attention to the conjunctionless conditional clauses.

1. Had I seen him yesterday,	a) he would not have gone there.
2. Had he known it,	b) he would help Antony.
3. Were I free,	c) we shall communicate with you again.
4. Were Steve in Cape Town,	d) I should have asked him about it.
5. Should need arise,	e) the subsequent history of the treaty might well have been quite different.
6. Had this policy been adopted,	f) I should go to the country.

Test 8

Vocabulary test

1. Choose the correct translation of the word.

1)	determine	a)	вращаться
2)	discover	b)	исследовать
3)	coil	c)	свёртывать кольцом
4)	investigate	d)	обнаруживать
5)	spin	e)	определять
6)	require	f)	распределять
7)	rely on	g)	преобразовывать
8)	supply	h)	снабжать
9)	convert	i)	надеяться
10)	distribute	j)	требовать

2. Fill in the gaps with the proper word.

monocrystals multiterminal monochrome monolayers minimal

1. Originally, all photography was done in …
2. One of the most used … is that of silicon in the semiconductor industry.
3. Nanoparticle … can be used to create functional surfaces that have for instance anti-reflective or superhydrophobic properties.
4. … system is a single computer which supports multiple independent local users at the same time.
5. The mean radius was calculated as the average of the maximal and … radius values.

Grammar test

3. Find the Subject Clause or the Predicative Clause. Put S or P in the box.

1. [ ] All that can be said with certainty is that the density of the gas is very low.
2. [ ] That man will someday visit Mars is quite clear for mankind.
3. [ ] When to start the experiment and how frequently it should be carried out will depend on the given equipment.

4. [ ] The question is what the density of this gas is.
5. [ ] Who made that discovery remained unknown.
6. [ ] That the coating material under discussion is heat-protective will be seen later.
7. [ ] The question is whether or not the angle of beam falling can be predicted.
8. [ ] The difficulty is that the initial velocity of the object is too low.
9. [ ] The trouble is that we have outdated equipment.
10. [ ] How this happened is not clear to anyone.

4. Find the sentences with Elliptical Clause.

1. Faraday's law can be used to show that the voltage induced in the circuit is sinusoidal.
2. This calculation shows how seriously noise can interfere with transmission.
3. The designer demanded that this experiment should be carried out in zero-gravity conditions.
4. If rising from the earth, the air is called a vertical current or thermal.
5. When heated, ice melts.

Keys to the tests

Test 1

1. Choose the correct translation of the word.

1) j
2) d
3) i
4) h
5) b
6) g
7) f
8) a
9) c
10) e

2. Complete the following sentences with the verbs derived from the words in brackets. Make all necessary changes.

1) simplify
2) nationalized
3) motivate
4) researched
5) broadening
6) originated
7) characterizes/ characterized
8) locate
9) charge
10) vaccinated

3. Complete the sentences with the correct form of the verbs in brackets.

1) experienced
2) repels
3) is associated
4) are separated
5) translate
6) accumulate
7) opposed
8) are connected
9) be reported
10) to maintain

4. Fill in the gaps with the construction 'both… and' or nouns 'the former', 'the latter'.

1) the former, the latter
2) both, and
3) both, and
4) the former, the latter/ the latter, the former
5) both, and

Test 2

1. Choose the correct translation of the word.

1) d
2) j
3) g
4) a
5) c
6) i
7) b
8) e
9) f
10) h

2. Form the nouns from other parts of speech given in brackets and complete the sentences. Make all necessary changes.

1) package
2) certainty
3) capitalism
4) librarian
5) scientists
6) possibilities
7) safety
8) payment
9) conductivity
10) creatures

3. Choose the proper form of the Participle.

1) be named
2) speaking
3) having finished
4) making
5) discovered
6) flowing
7) achieved
8) found
9) being investigated
10) measured

4. Fill in the gaps with the words 'very', 'the very', 'only', 'the only'.

1) the only
2) very
3) only
4) the only
5) the very

Test 3

1. Choose the correct translation of the word.

1) j
2) b
3) a
4) h
5) c
6) d
7) f
8) g
9) i
10) e

2. Use suffixes and fill in the gaps with adjectives

1) reversible
2) mechanical
3) controllable
4) traditional
5) beneficial
6) environmental
7) industrial; useful
8) atomic
9) different
10) important

3. Read and translate the sentences, pointing out a) the Gerund, b) the Verbal Noun or c) the Gerundial Construction. Put G, VN or GC in the box.

1. GC
2. G
3. G
4. G
5. G
6. G; VN; G
7. G
8. VN
9. GC
10. GC; G

4. Fill in the gaps with the correct Gerund form.

1) having made (Perfect Active); isolating (Indefinite Active)
2) forming (Indefinite Active)
3) breaking (Indefinite Active); sparking (Indefinite Active)
4) having read (Perfect Active)
5) being rubbed (Indefinite Passive)

5. Fill in the gaps with

1 e); 2 b); 3) a; 4) d; 5) c

Test 4

1. Choose the correct translation of the word.

1) i
2) j
3) h
4) e
5) d
6) c
7) fi
8) b
9) g
10) a

2. Fill in the gaps with an adjective or adverb.

1) definitely, differently
2) visually
3) roughly
4) directly
5) potential, differently
6) practically
7) directly
8) subsequent
9) typically
10) widely, direct

3. Find the Participle or the Gerund. Put G or P in the box. Two answers are possible.

1. G
2. G
3. P
4. P
5. G
6. G
7. G
8. P
9. P
10. G

4. Fill in the gaps with the correct pronoun (It, One, We).

1. We
2. One
3. We
4. One
5. It

Test 5

1. Choose the correct translation of the words.

1) i
2) h
3) d
4) a
5) b
6) j
7) g
8) f
9) e
10) c

2. Use prefixes from the box to fill the gaps

1) un- 2) im- 3) in- 4) in- 5) en- 6) re- 7) con- 8) de- 9) inter- 10) re-

3. Fill in the blanks with the proper forms of the infinitive.

1. C; 2. D; 3. B; 4. C; 5. A

4. Read and translate the sentences, pointing out a) Complex Subject, b) Complex Object. Put CS, or CO in the box.

1. [CO]
2. [CS]
3. [CO]
4. [CO]
5. [CS]
6. [CO]
7. [CS]
8. [CS]
9. [CO]
10. [CO]

Test 6

1. Choose the correct translation of the word.

1) d
2) g
3) a
4) h
5) b
6) i
7) e
8) c
9) j
10) f

2. Make the new words with negative prefixes from the following words and complete the sentences.

1) inaccurate
2) imbalance
3) incredible
4) informal
5) inadequate
6) incomplete
7) incorrect
8) undeveloped
9) illegal
10) misunderstanding

3. Insert the phrases with the Attribute in the right sentence.

1) molecular electronics
2) the simplest possible semiconductor device
3) a key indicator
4) thin copper wire
5) computer software
6) the field emission microscope
7) a transmission electron microscope image
8) physical technologies
9) two external polarised electrolytic capacitors
10) consumer electronics computers

4. Fill in the gaps with the correct relative pronouns (who, whom, whose, which, that).

1) which
2) who
3) that
4) whom
5) whose
6) whom
7) which
8) who
9) that
10) whose

Test 7

1. Choose the correct translation of the word.

1) j
2) e
3) a
4) h
5) i
6) b
7) d
8) f
9) c
10) g

2. Insert the missing letters.

To practise – practice, to license – licence, to choose – choice, to live – life, to lose – loss, to breathe – breath, to prove – proof, to sit – seat, to tell – tale, to sing – song, to feed – food, to bleed – blood, to shoot – shot.

3. Open the brackets using the verbs in the correct tenses.

1) would repeat
2) did not raise
3) were used
4) had studied
5) rains
6) studied
7) had asked
8) had taken
9) was
10) get
11) will never speak
12) had

4. Match part A with part B. Pay attention to the conjunctionless conditional clauses.

1-d, 2-a, 3-f, 4-b, 5-c, 6-e.

Test 8

1. Choose the correct translation of the word.

1) e
2) d
3) c
4) b
5) a
6) j
7) i
8) h
9) g
10) e

2. Fill in the gaps with the proper word.

1) monochrome
2) monolayers
3) monocrystals
4) multiterminal
5) minimal

3. Find the Subject Clause or the Predicative Clause. Put S or P in the box.

1. P
2. S
3. S
4. P
5. S
6. S
7. P
8. P
9. P
10. S

4. Find the sentences with Elliptical Clause.

4, 5

Appendix 3

GRAMMAR

Unit 1

Tenses in the Active Voice
Времена в действительном залоге

Глагол в действительном залоге изъявительного наклонения в английском языке имеет четыре группы времен: 1) неопределенные времена (Indefinite Tenses); 2) длительные времена (Continuous Tenses); 3) совершенные времена (Perfect Tenses); 4) совершенные длительные времена (Perfect Continuous Tenses, в данном пособии не рассматриваются). Каждая группа имеет три времени: настоящее (Present), прошедшее (Past); будущее (Future) и одно дополнительное – будущее в прошедшем(Future in the Past).

Indefinite Tenses (Неопределенные времена)

Indefinite Tenses употребляются для выражения обычных повторяющихся действий в настоящем (Present), прошедшем (Past) и будущем (Future) без указания на их длительность или завершенность.

В русском языке этим временам соответствуют времена глагола как совершенного, так и несовершенного вида в зависимости от смысла предложения: *I studied* – я изучал, я изучил.

The Present Indefinite Tense
(Настоящее неопределенное время)

Present Indefinite образуется от инфинитива глагола **без** частицы ***to*** для всех лиц единственного и множественного числа: *I (you, we, they) work.* В третьем лице единственного числа глагол принимает окончание ***–(e)s:*** *he (she, it) work**s***.

The Past Indefinite Tense
(Прошедшее неопределенное время)

По способу образования Past Indefinite все глаголы делятся на две группы: правильные и неправильные.

Past Indefinite правильных глаголов образуется от инфинитива глагола без частицы ***to*** путем прибавления к инфинитиву окончания ***–(e)d*** одинаково для всех лиц единственного и множественного числа: *he play**ed**, we live**d**.*

Past Indefinite неправильных глаголов приводится в специальных таблицах.

The Future Indefinite Tense
(Будущее неопределенное время)

Future Indefinite образуется с помощью вспомогательного глагола ***will*** и инфинитива смыслового глагола **без** частицы ***to*** для всех лиц единственного и множественного числа: *he (they) **will** work.*

Если сказуемое главного предложения стоит в будущем времени, в придаточных обстоятельственных предложениях времени и условия после союзов *If, before, after, when, as soon as* и других для выражения действий в будущем употребляется Present Indefinite. В технической литературе Future Indefinite часто употребляется безотносительно к будущему времени и переводится на русский язык настоящим временем. Например:

*If the angle is more than 59°, the drill **will** not **center** properly.*	Если угол больше 59°, сверло не центрирует правильно.

Continuous Tenses
(Длительные времена)

Continuous Tenses выражают действие, которое происходит, происходило или будет происходить в определенный момент (или отрезок) настоящего, прошедшего или будущего времени. Continuous Tenses выражают незаконченное действие и переводятся на русский язык всегда глаголами несовершенного вида. Continuous

Tenses образуются при помощи вспомогательного глагола ***to be*** (в форме *am/is/are, was/were, will be*) в соответствующем времени и Participle I смыслового глагола. Например:

*The students are busy now, they **are writing** their test paper.*	Студенты сейчас заняты, они пишут контрольную работу.
*We **were discussing** a very important question when he entered the room.*	Мы обсуждали очень важный вопрос, когда он вошел в комнату.
*The apparatus **will be working** when you come.*	Прибор будет работать, когда вы придете.

Perfect Tenses
(Совершенные времена)

Perfect Tenses образуются при помощи вспомогательного глагола ***to have*** в соответствующем времени (*have/has, had, will have*) и Participle II смыслового глагола. Perfect Tenses выражают действие, которое уже совершилось к определенному моменту в настоящем (Present Perfect), прошедшем (Past Perfect) или будущем (Future Perfect). Все времена группы Perfect обычно переводятся на русский глаголами совершенного вида, иногда глаголами несовершенного вида.

*We **have read** this book.*	Мы прочитали эту книгу.
*We **had discussed** a very important question when he entered the room.*	Мы уже обсудили очень важный вопрос, когда он вошел в комнату.
*He **will have finished** his work before you come.*	Он закончит работу, до того как вы придете.

Future-in the-Past
(Будущее время в прошедшем)

Future in the Past – это особый вид глагольных форм в английском языке, которые употребляются для выражения будущего действия относительно момента в прошлом. Форма Future in the

Past образуется так же, как остальные времена группы Future, причём для всех лиц и чисел вместо ***will*** используется ***would***.

Three years ago he said that we would establish our company in two years.	Три года назад он сказал, что мы создадим свою компанию через два года.

Глаголы во всех формах Future-in-the Past переводятся на русский язык глаголами будущего времени.

She knew that they would come in an hour.	Она знала, что они придут через час.

Unit 2

Tenses in the Passive Voice
Времена в страдательном залоге

Сказуемое, выраженное глаголом в страдательном залоге, указывает на то, что действие совершается над лицом или предметом, выраженным подлежащим.

В страдательном залоге употребляются времена групп: 1) Indefinite (Present, Past, Future); 2) Continuous (Present, Past); 3) Perfect (Present, Past, Future).

Времена в страдательном залоге употребляются в тех же случаях, что и соответствующие времена в действительном залоге. Страдательный залог образуется при помощи вспомогательного глагола ***to be*** в соответствующем времени и **Participle II** смыслового глагола.

Indefinite Tenses. Passive Voice **Неопределенные времена. Страдательный залог**		
Present Indefinite Passive	*Many new houses are built in city every year.*	Каждый год в нашем городе строится много новых домов.
Past Indefinite Passive	*They were invited to visit a new plant.*	Они были приглашены (их пригласили) посетить новый завод.
Future Indefinite Passive	*The work will be finished in two days.*	Эта работа будет закончена (эту работу закончат) через два дня.

Continuous Tenses. Passive Voice Длительные времена. Страдательный залог		
Present Continuous Passive	*Many automatic devices are being introduced at our plant.*	На нашем заводе вводится много автоматических устройств.
Past Continuous Passive	*The new design was being studied by this engineer the whole day yesterday.*	Новая конструкция изучалась этим инженером вчера весь день.
Perfect Tenses. Passive Voice **Совершенные времена. Страдательный залог**		
Present Perfect Passive	*This problem has been solved by the head engineer.*	Этот вопрос был решен главным инженером.
Past Perfect Passive	*All the questions had been discussed when you came.*	Все вопросы были обсуждены, когда вы пришли.
Future Perfect Passive	*All the materials will have been put in order when you come.*	Все материалы будут приведены в порядок, когда вы приедете.

Сказуемое, выраженное глаголом в страдательном залоге, переводится:

1. сочетанием глагола «быть» в нужной форме (кроме настоящего времени) с краткой формой причастия страдательного залога.

*The plan **is completed** in time.* План **выполнен** вовремя.

*The plan **was completed** in time.* План **был** выполнен вовремя.

*The plan **will be completed** in time.* План **будет** выполнен вовремя.

2. глаголом, оканчивающимся на **-сь, -ся**:

*The device **is** easily **switched on**.* Устройство легко **включается**.

3. неопределенно-личной формой глагола в действительном залоге в 3 л.мн.ч.

*Our students **were given** a new test.* Нашим студентам дали новый тест.

4. личной формой глагола в действительном залоге (при наличии дополнения с предлогом ***by***), причем дополнение часто переводится подлежащим:

*I was helped **by my friend**.* **Мой друг** помог мне.

Подлежащее со сказуемым в страдательном залоге, переводится:

1. существительным или местоимением в именительном или винительном падеже.

***The worker** was sent to the head engineer.* **Рабочий** был послан к главному инженеру. **ИЛИ Рабочего** послали к главному инженеру.

2. существительным (местоимением) в дательном падеже (после сказуемого стоит прямое дополнение).

***He** was sent all the necessary equipment.* **Ему** отправили все необходимое оборудование.

3. если в английском предложении после сказуемого в страдательном залоге стоит предлог, то перевод такого предложения следует начинать с предлога, относящегося к подлежащему, а сказуемое переводится неопределенно-личной формой глагола.

*A taxi was sent **for**.* **За** такси послали.

Особенности перевода страдательного глагола

В английском языке имеется ряд глаголов, которые требуют прямого дополнения, т.е. являются переходными, в то же время соответствующие глаголы в русском языке являются непереходными. Например, *to follow* – следовать (за). Такие глаголы в форме страдательного залога обычно переводятся на русский язык глаголами в действительном залоге, причем перевод, как правило, надо начинать с предлога.

*The conference **was attended by** many foreign scientists.* На конференции **присутствовало** много зарубежных учёных.

После ряда глаголов (например, *to listen to, to wait for*) относящийся к ним предлог не переводится.

*The lecturer **was** attentively **listened to**.* Лектора внимательно **слушали**.

Unit 3

Modal verbs and equivalents
Модальные глаголы и эквиваленты

Глаголы ***can (could), may (might), must (have to, be to), should, need*** относятся к группе так называемых модальных глаголов. Модальные глаголы не употребляются самостоятельно, а только в сочетании с инфинитивом смыслового глагола. Они обозначают возможность, способность, вероятность, необходимость совершения действия, выраженного смысловым глаголом.

Модальные глаголы имеют ряд отличительных особенностей:

- Не имеют окончания **–s** в 3-м лице единственного числа настоящего времени.
- Не имеют неличных форм (инфинитива, герундия и причастия).
- Не употребляются как отдельный член предложения.
- Вопросительная и отрицательная формы модальных глаголов образуются без вспомогательного глагола.
- Не имеют формы прошедшего времени. В случае необходимости вместо отсутствующих форм используются **эквиваленты** модальных глаголов.

Вместо недостающих неличных и аналитических форм модальных глаголов используют их эквиваленты: ***have to, be to (must), be able to (can), be allowed to, be permitted to (may)***.

Can

Can означает *мочь, обладать умственной или физической способностью.*

He can do this work.	Он **может** сделать эту работу.
Can *you do it?*	Вы **можете** это сделать?
I ***cannot (can't)*** *swim.*	Я **не умею** плавать

Эквивалентом глагола **can** является сочетание ***to be able*** с инфинитивом смыслового глагола с частицей ***to*** и используется для создания недостающих форм.

*He **is able to** speak English.*	Он может говорить по-английски.
***Will you be able to** do it?*	Вы сможете это сделать?
*I **am not able to** swim.*	Я не умею плавать.

Can означает теоретическую возможность, а ***could*** слабую вероятность того, что событие произойдет. ***Can't, couldn't*** означает уверенность в том, что событие не произойдет или не произошло.

*Some sounds **cannot** be detected by the human ear.*	Некоторые звуки **нельзя** распознать человеческим ухом.
*He has made a mistake! It **couldn't** be true.*	Он сделал ошибку! **Не может быть**, чтобы это было правдой.

May

May означает разрешение и возможность что-либо сделать и имеет форму прошедшего времени ***might***.

*You **may** do it tomorrow.*	Вы **можете** сделать это завтра.
***May** I come in?*	**Можно** мне войти?
*You **may** not stay here.*	Здесь **нельзя** (не разрешено) оставаться.

May, may not означает вероятность (около 50%) того, что событие произойдет или не произойдет. **Might, mightn't** означает слабую вероятность того, что событие произойдет.

*They **may** be in the laboratory.*	Они, **возможно**, в лаборатории.
*They **might** be in the laboratory.*	**Маловероятно,** что они в лаборатории.

Эквивалентом глагола **may** является сочетание **to be allowed** с инфинитивом смыслового глагола с частицей **to** и используется для создания недостающих форм.

*You **are allowed to** come later.*	Вам можно приходить позже.
***Will** he **be allowed to** stay here?*	Ему можно будет здесь остаться?
*It **was not allowed to** stay here.*	Здесь нельзя (не разрешено) было оставаться.

Must

Глагол ***must*** означает необходимость, моральную обязанность и переводится как *должен, нужно, надо.* Глагол ***must*** имеет только одну форму настоящего времени:

*He **must** do it himself.*	Он **должен** сделать это сам.
***Must** he do it?*	Он **должен** (обязан) делать это?
*You **mustn't** do it!*	Этого **нельзя (запрещено)** делать!

Глагол ***must*** имеет два эквивалента: ***to have*** (*должен в силу обстоятельств*) и ***to be*** (*должен в силу договоренности, по плану)*, после которых идет инфинитив с частицей **to:**

*He **had to** do it himself.*	Он **должен** (вынужден) был сделать это сам.
*Does he **have to** do it?*	Он **должен** (обязан) делать это?
*You **don't have to** do it!*	Ты **не обязан** этого делать!
*He **is to** do it himself.*	Он **должен** (по плану) сделать это сам.
***Was** he **to** do it?*	Он **должен был** (по плану) сделать это?

Need

Need может употребляться как в качестве модального глагола, так и правильного глагола. Как модальный глагол ***need*** имеет только одну форму и употребляется в отрицательных предложениях:

*He **needn't** come here.*	Ему **не нужно** (нет необходимости) приходить сюда.

Should

Should в качестве модального глагола употребляется для выражения желательности выполнения действия, дает рекомендацию или совет. На ***should*** переводится как *следует, должен, обязан:*

*You **should** do it.*	Вам **следует** (обязан) сделать это.

Modal Verbs and their equivalents with Passive Infinitive

Все модальные глаголы и их эквиваленты могут использоваться в пассивных конструкциях с инфинитивом глагола **to be** без частицы ***to*** и причастием прошедшего времени смыслового глагола.

*It **must be done** on time.*	Это **должно быть сделано** вовремя.
May** it **be done** later**?	Это **можно** сделать позже?
*The experiment **couldn't be carried out**.*	Эксперимент **не смогли** провести.
*Children **shouldn't be allowed** to play in the street.*	Детям **не следует разрешать** играть на улице.

Вопросы на повторение к Модулю 1:

1. *Сколько групп времён имеет глагол в действительном залоге в английском языке?*
2. *Когда употребляются, как образуются и как переводятся на русский язык времена группы Indefinite?*
3. *Когда употребляются, как образуются и как переводятся на русский язык времена группы Continuous?*
4. *Когда употребляются, как образуются и как переводятся на русский язык времена группы Perfect?*
5. *Как образуется, когда употребляется и как переводится на русский форма Future-in-the Past?*
6. *Как образуется страдательный залог? Что он выражает?*
7. *Времена какой группы не употребляются в страдательном залоге?*
8. *Как переводится на русский язык глагол-сказуемое в страдательном залоге?*
9. *Как переводится на русский язык подлежащее в предложении со сказуемым в страдательном залоге?*
10. *Как переводится на русский язык предложение со сказуемым в страдательном залоге, за которым следует предлог? С чем этот предлог соотносится? С чего надо начинать перевод?*

11. Как переводятся на русский язык глаголы типа to follow и т.д. и глаголы типа to listen to, to wait for в страдательном залоге?

12. Что выражают модальные глаголы?

13. Какие глаголы относятся к модальным?

14. Какие значения передает глагол ***can (could)*** *в сочетании с Active Indefinite Infinitive, с Passive Indefinite Infinitive?*

15. Какое сочетание используется в качестве эквивалента глагола ***can****?*

16. Какие значения передает глагол ***may (might)*** *в сочетании с Active Indefinite Infinitive, с Passive Indefinite Infinitive?*

17. Какое сочетание используется в качестве эквивалента глагола ***may****?*

18. Какие значения передает глагол ***must*** *в сочетании с Active Indefinite Infinitive, с Passive Indefinite Infinitive?*

19. Какие сочетания используется в качестве эквивалента глагола ***must****? В чем их различие?*

20. Какие значения передает глагол ***should*** *в сочетании с Active Indefinite Infinitive, с Passive Indefinite Infinitive?*

21. Что выражает глагол ***need*** *в сочетании с Active and Passive Indefinite Infinitive?*

Unit 4

Participle I
Причастие I

Причастие – это неличная форма глагола, совмещающая в себе свойства глагола, прилагательного и наречия. В современном английском языке имеются два причастия: причастие I (Participle I) и причастие II (Participle II).

Participle I образуется от инфинитива (без частицы to) с помощью прибавления суффикса *–ing: to sit – sitting, to read – reading* и т.д. Perfect Participle образуется из вспомогательного глагола *have* в форме Participle I ***(having)*** и Participle II (третьей формы глагола): *having sat, having done*.

Participle I имеет простую и сложные формы в действительном и пассивном залогах.

Participle I Indefinite (Active и Passive) выражает действие одновременное с действием глагола-сказуемого. Например:

He spent all his spare time in his workshop studying electrical phenomena.	Он проводил все свободное время в своей мастерской, изучая электрические явления.

Participle I Perfect (Active и Passive) выражает действие, предшествовавшее действию сказуемого. Например:

Having been made carelessly, the experiment proved useless.	Так как опыт был выполнен небрежно, он оказался бесполезным.

Функции Participle I в предложении

Participle I может выполнять в предложении функции определения и обстоятельства. Participle I вместе с относящимися к нему словами (дополнением и обстоятельством) образует определительный или обстоятельственный причастный оборот. Такой оборот рассматривается как один член предложения.

Определение. В функции определения Participle I может стоять 1) перед или 2) после определяемого слова.

1. Перед определяемым словом

He oiled the moving parts of the machine carefully.	Он тщательно смазал движущиеся части машины.

На русский язык Participle I Indefinite Active переводится причастием действительного залога настоящего времени с окончанием на ***-щий***, а также причастием прошедшего времени с окончанием на ***-вший***, если сказуемое стоит в прошедшем времени: *asking* – а) спрашивающий, б) спрашивавший.

2. После определяемого слова

После определяемого слова обычно употребляется определительный причастный оборот, который переводится на русский язык причастным оборотом или придаточным определительным предложением. Например:

The engineer examining the new machine works at this plant.	Инженер, осматривающий (который осматривает) новую машину, работает на этом заводе.

Participle I Indefinite Passive переводится причастием страдательного залога с окончанием на ***-мый, -щийся***: *being used* – а) применяемый, б) применяющийся.

Along with carbon all steels being used (which are being used) contain other impurities.	Наряду с углеродом, все применяемые стали (которые применяются сейчас) содержат другие примеси.

Обстоятельство. В функции обстоятельства могут употребляться все формы Participle I. В этой функции причастие или причастный оборот может стоять как в начале, так и в конце предложения. Например:

Continuing the exploration of space Russian scientists have launched a lot of space ships.	Продолжая исследование космоса, русские учёные запустили множество космических кораблей.
He spent the whole day preparing for his exams.	Он провел весь день, готовясь к экзамену.

В функции обстоятельства Participle I Indefinite Active соответствует русскому деепричастию на ***-а(сь)*** или ***-я(сь),*** а иногда придаточному предложению. Например:

Comparing these two machines, we may observe that they are very different in design.	Сравнивая эти две машины (если мы сравним эти две машины), мы можем заметить, что они очень различны по конструкции.

Participle I Indefinite Passive следует переводить придаточным предложением. Например:

Being repaired recently, the tool was in good condition.	Так как инструмент ремонтировался недавно, он был в хорошем состоянии.

Participle I Perfect Active может переводиться деепричастием совершенного вида на ***-в*** и ***-я*** или придаточным предложением. Например:

Having worked as an electrician for many years, he knew his speciality very well.	Проработав (так как он проработал) электриком в течение многих лет, он знал свою специальность очень хорошо.

Participle I Perfect Passive в функции обстоятельства переводится, как правило, придаточным предложением. Например:

Having been used for a long time, the instrument partly lost its former efficiency.	Так как инструментом пользовались длительное время, он частично утратил свою прежнюю эффективность.

Когда Participle I выполняет функцию обстоятельства времени, перед ним могут стоять союзы *when (когда), while (когда, в то время как)*. Сочетание Participle I с этими союзами переводится либо деепричастием, либо обстоятельственным придаточным предложением, начинающимся с союза «когда» или «в то время как», либо существительным с предлогом «при». Например:

While reading he used to make notes.	Читая (когда он читал, при чтении), он обычно делал заметки.
While translating a scientific article, he met with many difficulties.	Переводя научную статью (Когда он переводил статью.../ При переводе статьи...), он встретился с многими трудностями.
When measuring the voltage we use a voltmeter.	Измеряя напряжение, (Когда мы измеряем.../При измерении...) мы используем вольтметр.

Participle I Indefinite Active также входит в состав времен Continuous, Perfect Continuous и вместе с глаголом *to be* образует простое глагольное сказуемое. Например:

He is working at the problems of electricity now.	Сейчас он работает над вопросами электричества.

Unit 5

Participle II
Причастие II

Participle II правильных глаголов образуется путем прибавления к глаголу в форме инфинитива суффикса ***-ed*** (или ***-d***, если глагол оканчивается на «немое» e):

discuss + ed – discussed

use + d – used

Participle II неправильных глаголов образуется путем изменения корневой гласной или другими способами, которые можно найти в любой таблице неправильных глаголов:

speak – spoken	*begin – begun*
take – taken	*put – put*

Participle II имеет только одну форму. Participle II переходных глаголов соответствует русскому причастию страдательного залога. Например:

The text translated yesterday was very difficult.	Текст, переведенный вчера, очень труден.

Функции причастия II в предложении

Определение. В этой функции причастие II употребляется либо перед определяемым словом (слева от него), либо после (справа). В последнем случае, если нет относящихся к нему слов, при переводе причастие переносится влево. На русский язык причастие II обычно переводится причастием страдательного залога на ***–мый, –щийся, –нный, –тый, –вшийся.***

The equipment used in our shop is similar to that demonstrated at the exhibition.	Оборудование, применяемое (которое применяется) в нашем цехе, подобно оборудованию, демонстрируемому на выставке.

Иногда в предложении Participle II в функции определения стоит после определяемого слова и употребляется без относящихся к нему слов. В этом случае Participle II при переводе на русский язык следует ставить перед определяемым словом. Например:

The equipment tested requires further improvement.	Испытываемое оборудование требует дальнейшего усовершенствования.

Обстоятельство. В функции обстоятельства Participle II может стоять как в начале, так и в конце предложения. Перед Participle II в функции обстоятельства могут стоять союзы *if (если), unless (если не), when (когда), as (как, когда, так как)* и др.

В функции обстоятельства Participle II может переводиться обстоятельственным придаточным предложением, существительным с предлогом «при» или страдательным деепричастием. Например:

Given the speed and the time, it is easy to calculate the distance.	Если даны скорость и время, легко вычислить расстояние.
The glass cube breaks into pieces if heated and cooled rapidly.	Стеклянный куб раскалывается на мелкие куски, если его нагреть и быстро охладить.

В составе сказуемого. Participle II в сочетании с глаголом-связкой образует именное составное сказуемое; в этом случае оно выражает состояние и обычно переводится кратким страдательным причастием. Например:

Water is heated.	Вода нагрета.

Participle II входит в состав времен группы Perfect и страдательного залога. Например:

The text has been published in a foreign scientific journal.	Текст был напечатан в иностранном научном журнале.

Unit 6

Participle Constructions
Причастные обороты

Обстоятельственный причастный оборот, который относится к существительному или местоимению в именительном падеже, стоящему перед причастием, называется независимым причастным оборотом (the Absolute **Par**ticip**l**e **C**onstruction**)**. Например:

The resistance being very large,	*the current in the circuit was small.*
Так как сопротивление было очень высоким,	ток в цепи был слабым.

Независимый причастный оборот может стоять как в начале, так и в конце предложения. Как правило, независимый причастный оборот отделяется от остальной части предложения запятой. В таких оборотах могут употребляться все формы причастия.

При переводе независимого причастного оборота на русский язык существительное в общем падеже или местоимение в именительном падеже становится подлежащим, а стоящее за ним причастие – сказуемым.

Когда независимый причастный оборот стоит в начале предложения (до запятой), он переводится на русский язык обстоятельственным придаточным предложением:

а) причины с союзами «так как», «поскольку»,
б) времени с союзами «когда», «после того как»,
в) условия с союзом «если».

The problem being very simple,	*everybody understood it at once.*
Так как вопрос был очень простым,	все поняли его сразу.
The temperature of a conductor being raised,	*the random motion of the electrons in the conductor increases.*
Когда температура проводника повышается,	произвольное движение электронов в проводнике увеличивается.

Когда этот оборот стоит после запятой, то есть в конце предложения, его можно переводить самостоятельным предложением с союзами «а», «и», «причём», «при этом» (иногда придаточным предложением с союзами «так как», «если»):

New machines were brought to the plant,	***all of them being in good order.***
Новые машины были привезены на завод,	причем все они были в хорошем состоянии.
The car stopped,	***there being no fuel in the tank.***
Машина остановилась,	так как в баке не было горючего.

Независимый причастный оборот может вводиться предлогом *with*:

The nucleus of an ordinary hydrogen atom consists of one proton, ***with*** *one electron moving round it.*	Ядро обычного атома водорода состоит из одного протона, а вокруг него движется один электрон.

Вопросы на повторение к Модулю 2:

1. *Как образуется Participle I?*
2. *Какие функции выполняет в предложении Participle I Indefinite (Active и Passive)?*
3. *Какие функции выполняет в предложении Participle I Perfect?*
4. *Как переводятся Participle I (Active и Passive) и Participle I Perfect (Active и Passive) в функции определения?*
5. *Как переводятся Participle I (Active и Passive) и Participle I Perfect (Active и Passive) в функции обстоятельства?*
6. *Как образуется Participle II?*
7. *Какие функции выполняет в предложении Participle II?*
8. *Как переводится Participle II в функциях определения и обстоятельства?*
9. *Какой оборот называется независимым причастным оборотом?*

10. *Как образуется независимый причастный оборот. Что является его подлежащим?*
11. *В каком падеже употребляется существительное или местоимение, выступающее в роли подлежащего независимого причастного оборота?*
12. *Какое причастие может выполнять роль сказуемого в независимом причастном обороте?*
13. *Какое место может занимать независимый причастный оборот в предложении?*
14. *Как переводится независимый причастный оборот, стоящий в начале предложения, в конце предложения?*

Unit 7

Gerund: Forms and Functions. Verbal Noun
Герундий: Формы и функции. Отглагольное существительное

Герундий. Формы и функции

Герундий – это неличная форма глагола, обладающая свойствами существительного и глагола. Герундий обозначает действие, представляя его как название процесса.

Подобно глаголу герундий имеет временные (**Ind**efinite и **P**erfect) и залоговые (**A**ctive и **Pass**ive) формы.

	Active	**Passive**
Indefinite *Одновременность*	V+-ing *Heating*	being + V3 *being heated*
Perfect *Предшествование*	having + V3 *having heated*	having been + V3 *having been heated*

Отрицательная форма герундия образуется при помощи частицы *not* (ставится перед герундием):

Not lying is the best thing to do. – Не врать – самое лучшее, что можно сделать.

Функции герундия в предложении

В предложении герундий может быть подлежащим, частью сказуемого, дополнением (прямое и предложное), определением, обстоятельством.

Функция в предложении	Примеры	Перевод
Подлежащее	***Splitting*** *the atom is a difficult task.*	*Расщепление* атома является трудной задачей/ *Расщепить* атом – трудная задача. (инфинитив, существительное).
Часть сказуемого	*The main task is* ***switching off*** *the system in time.*	Главная задача – *выключить* систему вовремя / *выключение* системы вовремя. (инфинитив, существительное).
Прямое дополнение	*The equipment allows* ***increasing*** *the temperature.*	Оборудование позволяет *повысить* температуру / допускает *повышение* температуры. (инфинитив, существительное)
Косвенное (предложное) дополнение	*The students succeeded in* ***testing*** *this chemical reaction.*	Студентам удалось *протестировать* эту химическую реакцию / Студенты добились успеха *в тестировании* этой химической реакции. (инфинитив, существительное с предлогом)
Определение (обычно с предлогом ***of, for*** после существительного)	*Many solids have the power* ***of,absorbing*** *gases on their surfaces.*	Многие твердые вещества обладают способностью *абсорбировать* газы *(абсорбирования* газов) на своей поверхности. (существительное в родительном падеже, инфинитив, существительное с предлогом)

Обстоятельство (всегда после предлогов: *in* – при, в то время как, *on (upon)* – по, после, *after* – после, *before* – перед, *by* – творит. падеж, *instead of* – вместо того что-бы, *for* – для.	*The operator examined the machine without* ***diminishing*** *its speed.*	Оператор осмотрел машину **без** *уменьшения (не уменьшая)* ее скорости. (существительное с предлогом, деепричастие несовершенного или совершенного вида)

Сложные формы герундия – пассивный и перфектный герундий переводятся, как правило, придаточным предложением.

Verbal Noun
Отглагольное существительное

V + -ing

Verbal **N**oun (отглагольное существительное, ОС) – это существительное, которое образовано от глагола путем прибавления к основе глагола *-ing*.

По форме такое отглагольное существительное совпадает с герундием (Indefinite Active) и причастием настоящего времени (Indefinite Active), но в отличие от герундия и причастия отглагольное существительное не имеет признаков глагола.

Отглагольное существительное выполняет все функции, присущие обычному существительному.

Признаки	**Примеры**
1. **П**еред ОС может стоять артикль или указательное местоимение	***The*** *meeting starts at 10.*
2. ОС может иметь форму множественного числа	*All these repairings are useless.*

3. После ОС может стоять только косвенное дополнение с предлогом ***of***	*The constructing* ***of the tool*** *didn't take long.*
4. ОС может определяться прилагательным	***Heat*** *engineering is of great importance in the modern world. They were very upset about the cancelled meeting.*

Основные отличия между герундием и отглагольным существительным:

Герундий	**Отглагольное существительное**
Выполняет функции: 1) Подлежащее, 2) Часть составного именного сказуемого, 3) Дополнение, 4) Определение, 5) Обстоятельство.	Выполняет функции: 1) подлежащее, 2) часть составного именного сказуемого, 3) дополнение.
Не может употребляться с определителями (артикли, указательные местоимения)	Может употребляться с определителями (артикли, указательные местоимения). *She made a* ***drawing*** *of my house.* – Она сделала чертеж моего дома.
Может употребляться с притяжательными местоимениями *(my, his, your)* и существительными в притяжательном падеже *(David's, teachers')* только если употребляется в составе герундиальной конструкции: *Do you mind my using your pen?* – Вы не возражаете, если я воспользуюсь вашей ручкой?	Может употребляться с притяжательными местоимениями *(my, his, your)* и существительными в притяжательном падеже *(David's, teachers')*: *teachers' meeting* – собрание учителей *my doings* – мои поступки.

Герундий	Отглагольное существительное
Не имеет множественного числа.	Может стоять во множественном числе. *New York City has many high* ***buildings****.* – В Нью-Йорке много высоких зданий.
После герундия может стоять прямое дополнение (без предлога). *He received so many letters that he had given up* ***reading*** *them.* – Он получал так много писем, что перестал их читать.	После существительного может стоять только предложное дополнение с предлогом *of*. *The family attended the* ***reading*** *of her will.* – При чтении её завещания присутствовали члены семьи.
Может употребляться сразу после предлога. *Water expands on heating.* – Вода расширяется при нагревании.	Употребляется после предлога только в некоторых случаях, например, если употребляется во мн.ч. Но чаще между предлогом и отглагольным сущ. употребляется артикль.
Может определяться наречием. *For musicians, regularly* ***practicing*** *an instrument is essential.* – Музыкантам необходимо регулярно играть на инструменте.	Может определяться прилагательным. *For musicians, the regular* ***practicing*** *of an instrument is essential.* – Музыкантам необходимы регулярные занятия на инструменте.
Имеет временные и залоговые формы (Perfect, Active/Passive).	Не имеет временных и залоговых форм.

В одном и том же предложении иногда можно употребить и герундий, и отглагольное существительное, но при этом нужно помнить грамматические различия между ними. В примерах ниже представлено одно и то же предложение: «Превосходное написа-

ние эссе принесло победу на конкурсе». В первом случае употреблено отглагольное существительное, а во втором – герундий.

Отглагольное существительное:

A (определитель) *brilliant* (прилагательное) *writing of the essay* (дополнение) *won the competition.*

Герундий:

Brilliantly (наречие) *writing the essay* (прямое дополнение) *won the competition.*

Unit 8

Gerundial Constructions
Герундиальные обороты

Герундиальные обороты можно разделить на две группы: зависимые и независимые.

Зависимый герундиальный оборот – это оборот, в котором перед герундием (после предлога) нет слова, обозначающего действующее лицо или предмет.

Предлог	+	Герундий
On		*Writing*

I insist ***on writing*** *a new letter immediately.*	Я настаиваю на том, чтобы написать письмо немедленно.

При переводе зависимого герундиального оборота придаточным предложением обычно повторяется подлежащее английского предложения (если нужно, используется соответствующее местоимение), а герундий становится сказуемым.

Независимые герундиальные обороты – обороты, в которых указывается субъект или объект действия, передаваемого герундием. Этот субъект или объект действия может быть выражен притяжательным местоимением или существительным в общем или притяжательном падеже и стоит между предлогом (если он есть) и герундием.

(Предлог)	+	Притяжательное местоимение / Существительное в притяжательном или общем падеже (-*'s*)	+	**герундий**
Придаточное предложение:		**Подлежащее**		**сказуемое**

На русский язык независимый герундиальный оборот обычно переводится придаточным предложением, вводимым союзами **то (тем), что (чтобы), как** и т.д. При переводе притяжательное местоимение или существительное, стоящее перед герундием, становится подлежащим, а герундий – сказуемым придаточного предложения. Например:

*We know **of Mendeleev's having stated** the Periodic Law.*	Известно, что Менделеев сформулировал периодический закон химических элементов.
*There was no hope **of their finishing** the experiment on time.*	Не было никакой надежды, что они закончат эксперимент вовремя.

Функции герундиального оборота в предложении

Герундиальный оборот представляет собой один сложный член предложения и выполняет функции: **подлежащего, дополнения** (беспредложного или предложного), **определения** или **обстоятельства**.

Если независимый герундиальный оборот выполняет функцию подлежащего (нет предлога, стоит в начале предложения), то перевод нужно начинать со слов **То, что …**

Mendeleev's having stated the Periodic Law was very important.	**То, что** Менделеев сформулировал периодический закон химических элементов было очень важно.

Unit 9

Set expressions. Derivative, Compound and Composite Prepositions

Устойчивые выражения
Производные, сложные и составные предлоги

Устойчивые выражения – это сочетания двух и более слов, которые употребляются как единое целое. Устойчивые выражения включают идиомы, фразовые глаголы, клише:

Уст. Выр-е	**Перевод**	**Уст. Выр-е**	**Перевод**
as a matter of fact	на самом деле, фактически	*in (one's) turn*	в свою очередь
at any rate ...	в любом случае, так или иначе	*(in) so far ...*	на данный момент (пока)
at the expense of	за счет, ценой	*no matter what*	независимо от того, что
at least	по крайней мере	*just as*	точно так же, как; подобно тому, как;
the rest of	остаток	*on the contrary*	напротив, в отличие от
in case ...	в случае	*compared with*	по сравнению
to deal with	иметь дело, рассматривать	*vice versa*	и наоборот
as a result	в итоге, в результате	*as a rule*	обычно, как правило
a great many	несметное кол-во, очень много	*a number of*	ряд, много
for all we know	насколько нам известно	*in a sense*	в некотором смысле

Предлоги в английском языке подразделяются на четыре группы: простые, производные, сложные и составные.

Производные (образованы от другой части речи):

Предлог	Перевод	Предлог	Перевод
barring	исключая, кроме	*excluding*	за исключением
concerning	относительно	*failing*	за неимением
considering	учитывая	*following*	после, вслед за
depending	в зависимости	*including*	включая
during	в течение, во время	*past*	за, после, мимо
granted	при условии	*pending*	в продолжение, плоть
excepting	за исключением	*regarding*	относительно

Сложные предлоги – это такие предлоги, которые образуются путем словосложения, предлог + предлог, предлог + существительное, прилагательное или наречие и пишутся слитно:

Предлог	Перевод	Предлог	Перевод
alongside	около, рядом	*throughout*	через
notwithstanding	не смотря на, вопреки	*underneath*	под
onto	на, в	*upon*	на, у, после, в
outside	вне, за пределами	*wherewith*	чем, посредством
into	в, на	*within*	в течение

Составные предлоги, которые также называют фразовыми, образуются методом «составления» предлога (одного или двух) с другой частью речи:

Предлог	Перевод	Предлог	Перевод
according to	согласно	*in connection with*	в связи с
ahead of	до, в преддверии	*in consequence of*	вследствие, в результате
apart from	несмотря на	*in front of*	впереди
as far as	до	*in spite of*	несмотря на
as for	что касается	*in the back of*	сзади, позади
as of	на день, на дату	*in the course of*	в течение
as per	согласно	*in the event of*	в случае, если
as regards	что касается	*in the middle of*	посередине
aside from	помимо	*inside of*	за, в течение
as well as	кроме, наряду	*instead of*	вместо

away from	от, в отсутствие	*in view of*	ввиду
because of	из-за	*near to*	рядом,
by force of	в силу	*next to*	поблизости
by means of	посредством	*on account of*	по причине
by virtue of	в силу, на основании	*on top of*	на вершине
close to	рядом с	*opposite to*	против
contrary to	против, вопреки	*out of*	из, изнутри
due to	благодаря, из-за	*outside of*	вне, помимо
except for	кроме	*owing to*	из-за, благодаря
far from	далеко не	*thanks to*	благодаря
for the sake of	ради	*up to*	вплоть до
in accordance with	в соответствии с	*with regard to*	относительно
in addition to	в дополнение, кроме	*with respect to*	относительно
in case of	в случае		

Части составных предлогов образуют единое целое и не могут изменяться и меняться местами. Подобно простым предлогам, сложные и составные предлоги стоят перед существительными.

Вопросы на повторение к Модулю 3:

1. Что такое герундий? Какие формы имеет герундий?

2. Какие функции в предложении выполняет герундий?

3. По каким признакам можно отличить отглагольное существительное от герундия?

4. Какие бывают герундиальные обороты?

5. Из каких частей состоит независимый герундиальный оборот?

6. Какие функции в предложении выполняют герундиальные обороты?

7. Как переводят независимый герундиальный оборот?

8. Как называют предлоги, которые образуются путем словосложения, (предлог + предлог, предлог + существительное, прилагательное или наречие) и пишутся слитно? Приведите пример такого предлога.

9. Приведите пример составных предлогов.

Unit 10

Participle I and Gerund
Сравнение Причастия I и Герундия

Функция в предложении

Герундий может быть любым членом предложения. **Причастие** только частью сказуемого, обстоятельством или определением.
Внимание! Если предложение начинается с *-ing* формы глагола, это может быть либо герундий в функции подлежащего (далее следует сказуемое), либо причастие в функции обстоятельства (далее следует подлежащее).

Participle I	**Gerund**
Heating the gas, we increase the speed of its molecules.	*Heating the gas increases the speed of its molecules.*

Наличие предлога. В функции обстоятельства и определения перед **Герундием** часто стоит предлог.

Participle I	**Gerund**
***Describing** the process, the researcher made several references.*	*In **describing** the process, the researcher made several references.*

Наличие местоимения или существительного. **Перед Герундием** может стоять притяжательное местоимение или существительное в притяжательном или общем падеже.
Пример: *Lodygin's having produced the first incandescent lamp is a generally recognized fact.*

В функции определения (в позиции слева) **Герундий** отличается от **Причастия** только по смыслу, который определяется из контекста.

Participle I	**Gerund**
*The **operating** boiler is in the next room.* Работающий котел находится в соседнем помещении. *(operating – причастие)*	*What is the **operating** principle of a pressure pump?* Каков принцип функционирования нагнетательного насоса? *(operating – герундий)*

Unit 11

Impersonal and indefinite personal sentences
Безличные и неопределенно-личные конструкции

В научной и технической литературе часто принято вести изложение не от первого, а от третьего лица и для этого используются неопределенно-личные и безличные предложения.

Безличные предложения

В английском языке подлежащее в предложении всегда необходимо. В безличных предложениях в качестве формального подлежащего служит местоимение **it**. На русский язык оно не переводится.

It appears that... – Оказывается, что…
It seems that... – Кажется, что…
It has been suggested that... – Было предположено, что…
It is found that electrical communication systems make use of several different kinds of motion. – Обнаружено, что электрические системы связи используют несколько различных видов движения.

Сказуемое в таких предложениях может быть: 1) составным именным сказуемым, состоящим из глагола-связки *to be* и именной части, выраженной прилагательным или существительным. В качестве глагола-связки могут употребляться также глаголы *to become, to get, to grow* в значении становиться, делаться; 2) простым сказуемым, выраженным глаголами, обозначающими состояние погоды: *to snow, to rain, to freeze* и т.д.

Неопределенно-личные предложения

В предложениях такого типа в качестве подлежащего служат местоимения **one, you, we, they,** обозначающие неопределенное лицо. На русский язык такие предложения следует переводить неопределенно-личными или безличными предложениями без подлежащего.

One believes that... – Считают, что…
One knows that... – Известно, что…
One must expect that... – Следует ожидать, что…

One cannot see a reactor itself, only its cover.	Нельзя увидеть сам реактор, можно увидеть только его корпус.
They say that carbon resistors are better suited for this purpose.	Говорят, что углеродистые резисторы лучше подходят в этом случае.
Under these conditions we may usually expect a steady oscillation	При данных условиях можно часто ожидать устойчивое колебание.

Вопросы на повторение к Модулю 4:

1. *Какие функции в предложении может выполнять Причастие I?*
2. *Какие функции в предложении может выполнять Герундий?*
3. *Перед Герундием или Причастием в предложении ставится предлог?*
4. *Перед Герундием или Причастием в предложении может стоять местоимение?*
5. *Как отличить Герундий от Причастия в функции определения?*
6. *Какое местоимение используется в качестве формального подлежащего в безличных предложениях?*
7. *Какие правила перевода неопределенно-личных предложений на русский язык вы знаете?*

Unit 12

Infinitive
Инфинитив

Инфинитив – это неличная форма глагола. Инфинитив имеет свойства глагола и имени существительного. Инфинитив отвечает на вопросы «что делать? что сделать?». Формальным признаком инфинитива в английском языке является частица *to*,

которая не имеет самостоятельного значения и не принимает ударения. Частица *to* опускается, если перед инфинитивом стоит модальный глагол или глаголы чувственного восприятия.

Глагольные свойства инфинитива: 1) инфинитив может иметь прямое дополнение (*He decided to raise the temperature.* – Он решил поднять температуру); 2) инфинитив может определяться наречием (*They wanted to start at once.* – Они хотели начать немедленно); 3) Инфинитив имеет залоговые и временные формы.

Infinitive Forms (Формы инфинитива)

Переходные глаголы в английском языке имеют четыре формы инфинитива в действительном залоге и две – в страдательном:

	Active	**Passive**
Indefinite	*to charge*	*to be charged*
Continuous	*to be charging*	—
Perfect	*to have charged*	*to have been charged*
Perfect Continuous	*to have been charging*	—

Именные свойства инфинитива проявляются в функциях, которые он выполняет в предложении:

Infinitive Functions (Функции инфинитива)

Функция в предложении	**Примеры**	**Перевод**
1. Подлежащее	***To provide*** *three pulverizers is necessary for the efficient operation of the furnace.*	*Обеспечить* три распылителя необходимо для эффективной работы топки.
2. Именная часть сказуемого *(после глагола-связки "to be" с существительными "aim", "purpose", "idea" и т.д.)*	*Their aim is* ***to improve*** *the equipment.*	Их цель – *(состоит в том, чтобы) усовершенствовать* оборудование.

Функция в предложении	**Примеры**	**Перевод**
3. Часть составного глагольного сказуемого после глаголов, выражающих *начало, продолжение или конец действия (to begin, to continue, to end, to stop) или отношение* к действию, обозначенному инфинитивом *(to want, to decide, to intend* и модальных глаголов (*to be+to, to have+to* и др.)	*You have **to improve** the equipment.*	Вы *должны усовершенствовать* оборудование.
4. Дополнение	*The operator prefers **to use** the new equipment.*	Оператор предпочитает *использовать (использование)* новое оборудование.
5. Определение (стоит после определяемого слова)	*They have the possibility **to use** this system.* *The new equipment **to be used** at our power plant has just arrived.*	У них есть возможность *использовать* эту систему. (Инфинитив, существительное). Новое оборудование, *которое должно быть (будет) использовано* на нашей электростанции, только что прибыло.
6. Обстоятельство цели (после союзов *in order, so as чтобы, для того чтобы)* и следствия	***To design** a good turbine, you must have knowledge of its construction.*	*Чтобы спроектировать* хорошую турбину, вы должны иметь знания о ее конструкции.

Unit 13

Complex Object
Сложное дополнение

Конструкция **сложное дополнение** представляет собой сочетание **существительного в общем** падеже **или личного местоимения в объектном** падеже **и инфинитива**.

Подлежащее	**Сказуемое (в действительном** залоге)	**Существительное в общем** падеже **или личное местоимение в объектном** падеже **+ инфинитив**
Scientists Ученые	*expect* ожидают, что	***lasers to solve*** *the problem.* **лазеры решат** проблему.

При переводе конструкции на русский язык используется придаточное предложение.

Объектный **инфинитивный** оборот употребляется:

1) после глаголов, обозначающих **умственную деятельность**: *to know, to think, to consider, to believe, to suppose, to expect, to imagine, to find, to trust, to assume* **и др. в действительном** залоге. Например: *He considers* ***this question to be*** *of great importance.* **Он** считает **этот вопрос очень важным** (=что **этот вопрос является** очень важным);

2) после глаголов со значением **заявления**: *to pronounce, to declare заявлять, to report.* Например: *The professor pronounced* ***experiment to be*** *a successful one.* Профессор сказал, что **эксперимент успешный** (=**эксперимент является** успешным);

3) после глаголов, обозначающих **чувства и эмоции**: *to like, to dislike, to love, to hate, cannot bear* **и т.д.** Например: *I hate* ***you to talk*** *in this way.* Я терпеть не могу, когда **вы** так **говорите** (**вы говорите** таким образом);

4) после глаголов, обозначающих **приказ или разрешение, принуждение**: *to order, to allow, to permit, to suffer* (зд. неохотно позволять), *to have* (распоряжаться), *to make, to have, to get,*

to force, to cause и др. в **действительном** залоге. Например: *He ordered **the experiment to be finished**.* – Он приказал, чтобы **эксперимент закончили** (=был закончен).

Запомните:

1) после глаголов **to let, to make** (в активном залоге), **to have** инфинитив другого глагола употребляется без частицы **to.** Например: *Let **me describe** what happened.* Позвольте **мне описать**, что произошло. *Make **them work** harder.* Заставьте **их работать** усерднее;

2) после глаголов **чувственного восприятия**: *to hear, to see, to watch, to feel, to observe, to notice* и др. в **действительном залоге** инфинитив употребляется без частицы ***to***. Например: *The students heard **the professor speak** about recent discoveries.* **С**туденты слышали, как **профессор рассказывал** о последних открытиях;

3) после глаголов **чувственного восприятия** используется только **Simple Infinitive Active**. Чтобы выразить действие в страдательном залоге, можно использовать причастие II. Например: *I saw **the fire** slowly **conquered**.* Я видел, как **пожар** постепенно **потушили**;

4) в форме повелительного наклонения глагол ***to let*** в сочетании с 3-м лицом часто на русский язык переводится словом «пусть». Например: *Let **him explain** why he added this substance.* Пусть **он объяснит**, зачем он добавил это вещество.

Unit 14

Complex Subject
Сложное подлежащее

Предложения со сложным подлежащим (**Complex Subject**) выражают мнение (суждение или предположение) группы неопределенных лиц о каком-то факте или понятии.

Конструкция **Сложное подлежащее** (субъектный инфинитивный оборот) состоит из **подлежащего** (существительного в общем падеже или местоимения в именительном падеже) и **инфинитива**, стоящего после **сказуемого** (глагола в страдательном или действительном залоге):

Подлежащее	Сказуемое	Инфинитив
a) глагол в страдательном залоге		
The atom Атом,	***is known*** ***как известно,***	***to emit*** *rays of different length.* испускает лучи различной длины.
(Известно, что атом испускает лучи разной длины.)		
b) глагол в действительном залоге		
Heavy water	***proved***	***to freeze at about 4°C.***
Тяжелая вода,	как оказалось,	замерзает при температуре около 4°С.
(Оказалось, что тяжелая вода замерзает при температуре около 4°С.)		

Субъектный инфинитивный оборот используется:

1) после некоторых глаголов в страдательном залоге: *is/was assumed* – допускают, допускали; *is/was believed* – полагают, считают; полагали, считали; *is/was considered* – считают, полагают, полагали; *is/was expected* – ожидают, ожидали; *is/was known* известно, было известно; *is/was proved* – доказано, было доказано; *is/was reported* – сообщают, сообщалось; *is/was said* – говорят, говорили; *is/was supposed* – полагают, полагали; *is/was thought* – думают, думали, полагают, полагали; *is/was understood* – считают, считали;

2) после ряда глаголов в действительном залоге: *seems/seemed* – кажется, казалось, по-видимому; *appears/appeared* – по-видимому; *proves/proved* – оказывается, оказалось; *turns out/turned out* – оказывается, оказалось;

3) после словосочетаний: *is likely* – вероятно, по всей вероятности; *is unlikely* – маловероятно; *is sure* – обязательно, наверняка, несомненно; *is certain* – наверняка, несомненно, безусловно.

Предложение с субъектным инфинитивным оборотом принято переводить на русский язык:

1) сложноподчиненным предложением, в котором главное предложение представлено неопределенно-личным *'Известно, что… ', 'Находят, что… ', 'Считается, что… '* и т.д.; в придаточ-

ном предложении первый элемент сложного подлежащего (именная часть) переводится подлежащим придаточного предложения, а второй (инфинитив) – сказуемым: ***This value*** *is expected* ***to change.*** Ожидается, что эта величина изменится.

2) сложноподчиненным предложением с придаточным дополнительным после союза 'что': ***This plant*** *is said* ***to be making*** *good progress.* Говорят, что этот завод делает большие успехи;

3) простым предложением с вводными словами: ***The production at this plant*** *is likely* ***to increase.*** По всей вероятности, производство на этом заводе увеличится.

Перфектные формы инфинитива выражают действие, предшествовавшее действию глагола-сказуемого, и переводятся на русский язык глаголом в прошедшем времени: ***He*** *is said* ***to have passed*** *his exams successfully.* Говорят, что он успешно выдержал экзамен.

Вопросы на повторение к Модулю 5:

1. *Что такое инфинитив? Какие формы имеет инфинитив?*
2. *Какие функции в предложении выполняет инфинитив?*
3. *Какие обороты бывают с инфинитивом?*
4. *Из каких частей состоит сложное подлежащее?*
5. *Из каких частей состоит сложное дополнение?*
6. *Как переводят сложное подлежащее?*
7. *Как переводят сложное дополнение?*

Unit 15

The Attribute. Ways of expressing the attribute

Определение

Определение – это второстепенный член предложения, обозначающий признак предмета, который определяет существительное, местоимение или иную часть речи, имеющую номинальный характер.

Определение в английском предложении отвечает на следующие вопросы: *what? what kind of?* – какой? *which?* – который? *whose?* – чей? *how much? how many?* – сколько? и выражается:

Часть речи	**Пример**
Прилагательное	*Yesterday the researcher made an* ***important*** *experiment.* – Вчера исследователь провел **важный** эксперимент.
Числительное	*Her office is on the* ***fortieth*** *floor.* – Ее офис на **сороковом** этаже. **Twenty kilos** of gold were found in Alaska. – **Двадцать килограмм** золота было найдено на Аляске.
Местоимение	*Are you satisfied with* ***your*** *results?* – Вы довольны **своими** результатами?
Существительное:	
Существительное в общем падеже	*The water in this place is very cold because of the* ***ocean*** *current.* – Вода в этом месте очень холодная из-за **океанического** течения.
Существительное в притяжательном падеже	*George found* ***his teacher's*** *textbook in the library.* – Джордж обнаружил учебник **своего преподавателя** в библиотеке.
Существительное с предлогом	*Where is the key* ***to the locked door*** *in the warehouse?* – Где ключ от **запертой двери** на складе?
Наречие	*The woman* ***there*** *is my employer.* – **Вон та** женщина – мой работодатель.
Инфинитив:	
После определяемого существительного в конце или середине предложения, как в активном, так и пассивном залоге	*This is a device* ***to measure*** *voltage.* – Это прибор **для измерения** напряжения. *Here are the papers* ***to be signed****.* – Вот бумаги, которые **необходимо подписать**.
После местоимений *somebody, something, anybody, anything, nobody, nothing,* как в активном, так и пассивном залоге	*There is nothing* ***to argue*** *about.* – **Спорить** здесь не о чем. *There is nothing* ***to be surprised*** *at.* – В этом нет **ничего удивительного**.

После порядковых числительных *the first, the second* и прилагательного *last*, как в активном, так и пассивном залоге	*He was the first* ***to recognize*** *this scientist.* – Он первым **узнал** этого ученого. *He was the first* ***to be recognized*** *by the students.* – Он был первым, **кого узнали** студенты.
Причастие:	
Participle I	
Present Participle Active Обозначает действие, одновременное с действием, выраженным глаголом в личной форме. Present Participle Active в функции определения употребляется тогда, когда существительное, к которому оно относится, совершает действие, отвечает за него или вызывает определенное состояние.	
Перед существительным	*They were looking at the* ***flying*** *plane.* – Они смотрели на **летевший** самолет.
После существительного	*The student* ***reading*** *the article is my friend.* – Студент, **читающий** статью, – мой друг.
Present Participle Passive. Обозначает длительное действие, совершающееся в настоящий момент или в настоящий период времени.	
После определяемого существительного	*The question* ***being discussed*** *at the meeting now is very important.* – Вопрос, ***обсуждаемый*** сейчас на собрании, очень важен.
В начале предложения	***Being invited*** *too late Dr. Smith could not attend the conference.* – **Так как доктора Смита пригласили** очень поздно, он не смог посетить конференцию (**Будучи приглашенным** ...)
Participle II	
Past Participle Passive Употребляется в функции определения тогда, когда существительное, к которому оно относится, испытывает действие или состояние.	
Перед существительным	*The* ***broken*** *part of the machine should be replaced immediately.* – **Сломанная** деталь машины должна быть заменена немедленно.
После существительного	*The letter* ***written*** *by him is very short.* – **Написанное** им письмо очень короткое.

Герундий	
После существительных абстрактного характера с предлогами *for* или *of, the use of, the idea of, the habit of, the pleasure of, the intention of, the aim of, the reason for* и др., как в активном, так и пассивном залоге	*Everybody recognizes the importance of,* ***learning*** *foreign languages.* – Все признают важность **изучения** иностранных языков. *He has no objection to* ***being sent*** *there.* – Он не возражает против того, чтобы **его послали** туда.

Unit 16

The Attributive Clauses
Определительные придаточные предложения

Attributive Clause – определительные придаточные предложения в английском языке выполняют функцию определения и отвечают на вопросы what? / which? — какой? / который?

Attributive Clause следует непосредственно за тем существительным в главном предложении, которое определяет, и соединяются с главным предложением следующими союзными словами:

Относительные местоимения (relative pronouns)	**Наречия** (adverbs)
who – который **whom** – которого **whose** – чей, которого **which** – который **that** – который	**when** – когда **where** – где, куда **why** – почему

Примеры:

He was a kind man <u>who</u> was always ready to help others.	**Он** был добрым человеком, который всегда был готов помочь другим.
The cousin <u>whom</u> we met in London is coming to visit.	Кузен, которого мы встретили в Лондоне, приезжает в гости.

The man whose daughter won the tournament is a coach.	Человек, чья дочь выиграла турнир, работает тренером.
Lisa read the textbooks which she had bought in London.	Лиза читала учебники, которые она купила в Лондоне.
The car that Jason bought runs on electricity and gas.	Машина, которую купил Джейсон, работает на электричестве и газе.
A library is a place where they keep books.	Библиотека – это место, где хранятся книги.
The original question, why he did it at all, has not been answered.	На первоначальный вопрос, почему он вообще это сделал, ответа не последовало.

Правила употребления относительных местоимений who, which, that.

THAT: Ограничительные определительные придаточные предложения большей частью вводятся относительным местоимением ***that***, которое употребляется как с одушевленными, так и с неодушевленными существительными.

WHICH: Только с неодушевленными существительными употребляется местоимение ***which***.

WHO: С одушевленными существительными необходимо употреблять местоимение ***who***.

Примеры:

The man that (who) lives in the neighboring street, is an Internet addict.	Человек, который живет на соседней улице, зависим от интернета.
The gadget that (which) connects your computer to the Internet is called a modem.	Устройство, которое связывает ваш компьютер с интернетом, называется модемом.
This is one of the few really good devices that have been developed this year.	Это одно из немногих хороших устройств, которые были разработаны в этом году.

В последнем предложении сказуемое придаточного предложения согласуется в числе с определяемым существительным и

that относится к слову *devices,* стоящему во множественном числе, поэтому сказуемое придаточного предложения выражено формой глагола во множественном числе – *have been developed.*

Определительные причастные обороты

Определительные причастные обороты стоят, как правило, после определяемого существительного и отвечают на вопрос *какой?* На русский язык они переводятся причастным оборотом с соответствующей формой причастия или определительным придаточным предложением:

Phenomena ***occuring during solar flares*** *are thoroughly investigated.*
The equipment ***needed for the experiment*** *was carefully checked.*

Явления, ***происходящие во время вспышек на солнце*** **(*которые происходят во время вспышек на солнце*)**, тщательно исследуются.
Оборудование, **необходимое (которое необходимо) для опыта**, было тщательно проверено.

Причастные обороты могут выполнять функцию определения при заместителях существительных *that (those), one (ones).* В этом случае они переводятся по общим правилам: вместо местоимения *that (those)* и слова-заместителя *one (ones),* стоящих перед причастием, повторяется существительное, которое они заменяют (*that, those* можно переводить *тот, который*).

This substance is more valuable than ***that obtained*** *by other researchers.*

Это вещество более ценно, чем **вещество, полученное (то, которое было получено)** предшествующими исследователями.

Если причастный оборот, являясь определением к подлежащему, стоит после сказуемого, то перевод предложения следует начинать со сказуемого:

A graph is given ***showing the dependence*** *of pressure on temperature.*

Приводится график, иллюстрирующий зависимость давления от температуры.

Наречия *so* – так, *so far (thus far)* – до сих пор (таким образом) и другие, стоящие перед причастием и входящие в определительный причастный оборот, при переводе ставятся после него:

*The substance **thus obtained** was pure.*	Вещество, **полученное таким образом**, было чистым.

Перед Participle II, входящим в определительный причастный оборот, может стоять союз *as*, который или не переводится на русский язык, или переводится, используя слова *в том виде, как; так, как.*

***As** ordinarily **obtained** iron contains some admixtures.*	Железо в **том виде, как оно обычно получается** (**так, как его обычно получают**), содержит примеси.

Ограничительные определительные предложения

Ограничительные определительные предложения содержат информацию, уточняющую значение слова, к которому они относятся. Они выбирают из класса предметов, обозначаемых определяемым словом, только те, которые отвечают определенным характеристикам. Опущение ограничительного придаточного предложения часто ведет к неясности или не правильности главного предложения, к изменению его смысла. Ограничительные определительные придаточные предложения не выделяются запятыми.

Do you remember the name of the library where we took books?	Ты помнишь название библиотеки, в которой мы брали книги?

Придаточное предложение *where we took books* относится к слову *library*, и без него нам не понятно, о какой библиотеке идет речь, так как их может быть много. Это – придаточное ограничительное предложение. В английском предложении они не выделяются запятыми. *He phoned the girl who he met at the university library.* Он позвонил девушке, (какой именно?) с которой встретился в университетской библиотеке.

При опущении придаточного главное предложение тоже изменяет смысл: *He phoned the girl.*
People who do sports live longer. Люди, (какие именно?) которые занимаются спортом, живут дольше.

При опущении придаточного, фраза главного предложения тоже изменяет смысл: *People live longer.*

Описательные определительные придаточные предложения

Описательные определительные придаточные предложения в английском языке предоставляют дополнительную интересующую информацию, которая не является обязательной для понимания смысла главного предложения. Они сообщают нам больше описательных сведений о ком-либо или о чем-либо, но не выделяют сам предмет или человека из множества других. В отличие от ограничительного, описательные придаточные и вовсе могут быть вынесены в отдельное предложение, при этом главное не понесет никакого смыслового ущерба.
Например:

Bulk carriers, which are intended to carry bulk cargoes, mostly are very big ships.	Сухогрузы, которые предназначены для перевозки сыпучих грузов, в основном являются очень большими судами.

В данном предложении речь идет о сухогрузах вообще, то есть не выделяется какая-то конкретная категория или группа. Поэтому придаточное предложение здесь является описательным.

Bulk carriers that are full of bulk cargoes are ready to depart.	Сухогрузы, которые наполнены сыпучими грузами, готовы к отправлению.

В этом же примере придаточное предложение говорит о том, какие именно сухогрузы имеются в виду, поэтому оно является ограничительным.

Знаки препинания

В отличие от ограничительного придаточного, описательное придаточное предложение принято выделять на письме запя-

тыми. Когда оно употреблено в середине главного предложения, запятая ставится с двух сторон: перед относительным местоимением и в конце самого придаточного. Когда же придаточное идет в конце главного предложения, то запятая ставится только перед относительным местоимением.

Например:

My best friend Alex, who studied at the same university as me, has recently developed a software program.	Мой лучший друг Алекс, который учился в том же университете, что и я, недавно разработал программу.
In the university yard I met some girls, who helped me to find the way.	В университетском дворе я встретил несколько девушек, которые помогли мне найти дорогу.

В описательных определительных придаточных предложениях в английском языке используются следующие относительные местоимения:

- Как подлежащие: *who* (если описывает человека), *which* (если описывает предмет).
- Как дополнение: *who/whom* (человек), *which* (предмет), *where* (место).
- Как притяжательное местоимение: *whose* (человек).

Примечание: в описательных придаточных предложениях местоимение *that* не может заменять местоимения *which / who / whom*.

Относительное местоимение в описательных предложениях не может быть опущено даже в том случае, когда оно является дополнением глагола в определительном придаточном предложении.

Например:

She gave me the book, which was in a red envelope.	Она дала мне книгу, которая была в красной обложке.
She gave me the book, which I began to read immediately.	Она дала мне книгу, которую я начал читать сразу.

Описательные придаточные предложения в английском языке могут начинаться с выражений типа *all of, each of, both of, all of, any of,* и других, следом за которыми идет относительное местоимение *whom* (если речь идет о людях) или *which* (о предметах).
Например:

There were a lot of students at the conference, many of whom I knew.	На конференции было много студентов, многих из которых я знал.
Mike was carrying two books, both of which were from the library.	Майк нес две книги, обе из библиотеки.

Относительное местоимение *which*, идущее в начале описательного придаточного предложения, чаще ссылается на всю информацию, представленную в предыдущей части предложения, нежели на одно конкретное слово.

Unit 17

The Conjunctionless Subordinate Attribute Clause
Бессоюзное придаточное определительное предложение

Бессоюзное присоединение определительных (ограничительных) придаточных предложений может иметь место в тех случаях, когда относительные местоимения ***who, which*** не являются подлежащим данного определительного придаточного предложения:

The building (which) our institute occupies is big.	Здание, которое занимает наш институт, большое.
I'll translate the article (which) you have given me.	Я переведу статью, которую вы мне дали.

Бессоюзное соединение невозможно, когда союзное слово является подлежащим определительного придаточного предложения:

The house which is occupied by the office is big.	Дом, который занят нашим учреждением, большой.
The man who is reading a magazine is our monitor.	Человек, который читает журнал, наш староста.

В тех случаях, когда *which* или *whom* предшествует предлог, при бессоюзном соединении этот предлог ставится после сказуемого или дополнения (если таковое имеется), но всегда перед обстоятельством:

The house in which we live is new. The house we live in is new.	Дом, в котором мы живем, новый.
The young engineer with whom I am working graduated from the MPEI. The young engineer I am working with graduated from the MPEI.	Молодой инженер, с которым я работаю, окончил МЭИ.
The invention about which he spoke at the last lecture is very interesting. The invention he spoke about at the last lecture is very interesting.	Изобретение, о котором он говорил на прошлой лекции, очень интересное.

Вопросы на повторение к Модулю 6:

1. Что такое определение?

2. Какие способы выражения определения существуют?

3. Какую функцию в предложении выполняют определительные придаточные предложения?

4. Чем отличается определительное придаточное предложение от ограничительного?

5. С какими частями речи употребляются относительные местоимения: who, which, that?

6. Какую роль в предложении играют определительные причастные обороты?

7. Какую функцию в предложении выполняют that (those), one (ones)?

8. Когда в предложении могут употребляться бессоюзные придаточные определительные предложения?

Unit 18

The Conditional Clause (0 and 1st Conditionals)
Условные предложения нулевого и первого типа

Zero Conditional – условные предложения нулевого типа

Zero (0) Conditional используется, когда мы говорим о факте или ситуации, происходящей в настоящее время, как результат выполнения условия.

Этот тип показывает условие, которое всегда будет правдой: научные факты, законы природы, общепринятые или очевидные утверждения. Обычно предложения с Zero Conditional переводятся настоящим временем, поскольку они всегда являются правдой. Zero Conditional образуется по следующей схеме:

Условие	Результат
If + Present Simple, *If you cut your finger with a knife,* Если порезать палец ножом,	Present Simple *it hurts.* он болит.

Zero Conditional также используется для того, чтобы дать указания или инструкции. В этом случае в результате будет использоваться повелительное наклонение, а не Present Simple.

Условие	Результат
If + Present Simple, *If you don't want to be late,* Если не хочешь опоздать,	Imperative mood *hurry up.* поторапливайся.

Take a nap if you feel tired. – Вздремни, если ты устал.

Часто в таких предложениях используется слово ***always***.

If (если), как правило (но не всегда), можно заменить на ***When*** (когда).

If / When *you buy in bulk, we* ***always*** *give a discount.*	Если / Когда вы покупаете оптом, мы всегда даем скидку.
If you want to become an engineer, you have to pass a very difficult exam.	Если ты хочешь стать инженером, тебе нужно сдать очень сложный экзамен.

В основной части предложения (результате) можно использовать **Повелительное наклонение / Imperative** или **Модальный глагол / Modal verb**:

Don't change *the price if we haven't discussed this.*	Не меняй цену, если мы это не обсуждали.
You ***should call*** *us if your computer crashes.*	Вам следует позвонить нам, если ваш компьютер сломается.

First Conditional – условные предложения первого типа

Real (1) Conditional используется, когда мы говорим о событиях или ситуации, которая очень вероятно произойдет в будущем, как результат условия.

Условное предложение первого типа называют еще «реальным» условным, ведь оно показывает действие, которое с большой вероятностью случится, если выполнить условие. Такие предложения описывают ситуацию, которая произойдет в будущем времени.

При построении подобных предложений в русском языке мы используем в условии и в результате будущее время, но в английском только в результате будет будущее время, а в условии – настоящее.

Условие	**Результат**
If + Present Simple, *If the weather is good,* Если погода будет хорошей,	Future Simple *we'll walk in the park.* мы пойдем гулять в парке.

Также First Conditional часто используется, если мы хотим предупредить или предостеречь от чего-либо.

You will get into trouble If you continue to hang out with her.	Ты попадешь в неприятности, если продолжишь общаться с ней.
If you drink much coffee, you won't sleep at night.	Если ты будешь пить много кофе, то не будешь спать ночью.

В отличие от русского языка, в условной части используется настоящее, а не будущее время.

*If you **buy** in bulk, we **will give** you a discount.*	Если вы купите оптом, мы дадим вам скидку.

В основной части можно также использовать **Повелительное наклонение / Imperative** или **Модальный глагол / Modal verb** со значением будущего.

*If they arrive early, **show** them our new equipment.*	Если они приедут раньше, покажи им наше новое оборудование.
*If you order it now, we **can give** you a discount.*	Если вы закажете сейчас, мы сможем дать вам скидку.

Вместо if (если) в Conditionals можно также использовать другие слова:

As long as / provide that = only if / **только если**

Unless = except if / **если не**

In case = to avoid a possible problem later / на **случай, если**.

Unit 19

The Conditional Clause (2nd and 3d Conditionals)
Условные предложения второго и третьего типа

Second Conditional – условные предложения второго типа

Этот тип условных предложений называется «нереальным настоящим». Он показывает маловероятную или воображаемую ситуацию, которая относится к настоящему или будущему времени. Такая ситуация обычно не соответствует фактам в настоящем. То есть шанс того, что это действие произойдет, невелик, но не исключен совсем.

Условие	Результат
If + Past Simple, *If I lived in the countryside,* Если бы я жил за городом,	would + глагол без to *I would walk in the forest every day.* я бы гулял в лесу каждый день.

Также этот тип предложений используется для того, чтобы дать совет.

I would never do this If I were you.	Я бы никогда этого не сделал, (если бы был) на твоем месте.
If I were in a tricky situation, I would take this opportunity.	Если бы я попал в сложную ситуацию, я бы воспользовался этой возможностью.

Обратите внимание на одну особенность, связанную с глаголом *to be*. В условных предложениях используется форма *were* как для единственного, так и множественного числа. *Was* – это разговорный вариант, он часто встречается в повседневной речи. *If I were in your shoes, I would make up with her and start speaking again. = If I was in your shoes, I would make up with her and start speaking again.* Если бы я был тобой, я бы помирился с ней и начал снова разговаривать.

Third Conditional – условные предложения третьего типа

Третий тип называется «нереальным прошлым». Всю его суть можно выразить одной фразой: сожаление о прошлом. Когда-то в прошлом что-то произошло, мы об этом сожалеем, но изменить событие уже не можем. Это единственный тип условных предложений, который относится к прошедшему времени.

Условие	Результат
If + Past Perfect, *If I hadn't missed the bus,* Если бы я не опоздал на автобус,	would have + past participle *I wouldn't have been late for work.* я бы не опоздал на работу.

If he had been more diligent, Если бы он был более ответственным,	*he would have been promoted long time ago.* его бы давно повысили.

Также Third Conditional используется, когда мы критикуем какие-то действия, которые произошли в прошлом и которые мы не можем уже изменить.

If you had listened carefully, you wouldn't have made so many mistakes.	Если бы ты внимательно слушал, ты бы не допустил так много ошибок.
If you hadn't left your car opened, it wouldn't have been stolen.	Если бы ты не оставил машину открытой, ее бы не угнали.

Third Conditional показывает не только негативное прошлое. Мы также используем его, когда хотим сообщить о хороших событиях, которые произошли в прошлом и положительно повлияли на наше настоящее.

He wouldn't have made this discovery if he hadn't done precise calculations.	Он не совершил бы это открытие, если бы не сделал очень точные расчеты.

Unit 20

Conjunctionless conditional clauses
Бессоюзные условные предложения

Союз *if* может быть опущен в условных предложениях всех трех типов.

1. В условных предложениях первого типа союз *if* может быть опущен, когда сказуемое придаточного предложения выражено сочетанием *should* с инфинитивом. В этом случае *should* ставится перед подлежащим:

Should he come, ask him to wait. = If he should come, ask him to wait.
Если он придет, попросите его подождать.

2. В условных предложениях второго типа союз *if* может быть опущен, когда в придаточном предложении имеются глаго-

лы *had, were, should*. В таких случаях эти глаголы ставятся перед подлежащим:

Had I time, I should prepare for my exam. = If I had time, I should prepare for my exam. Если бы у меня было время, я подготовился бы к экзамену.

Were he here, he would help us with our homework in Information Science. = If he were here, he would help us with our homework in Information Science. Если бы он был здесь, он помог бы нам с нашей домашней работой по информатике.

Should I see him tomorrow, I should ask him about the new experiment. = If I should see him tomorrow, I should ask him about the new experiment. Если бы я увидел его завтра, спросил бы его о новом эксперименте.

3. В условных предложениях третьего типа при пропуске союза *If* глагол *had* ставится перед подлежащим:

Had I seen him yesterday, I should have asked him about the new experiment. = If I had seen him yesterday, I should have asked him about the new experiment. Если бы я видел его вчера, я спросил бы его о новом эксперименте.

Вопросы на повторение к Модулю 7:

1. Как образуются условные предложения нулевого и первого типа?

2. Когда употребляются условные предложения нулевого и первого типа?

3. Как образуются условные предложения второго типа?

4. Когда употребляются условные предложения второго типа?

5. Как образуются и как употребляются условные предложения третьего типа?

6. Когда употребляются условные предложения третьего типа?

7. Когда могут употребляться бессоюзные условные предложения?

Unit 21

Subject and predicative clauses
Придаточные предложения – подлежащие и сказуемые

В английском языке сложноподчиненное предложение образовано главным предложением и одним или несколькими придаточными предложениями, выступающими в тех же функциях, что и члены простого предложения. К главному предложению придаточное предложение присоединяется при помощи союзов (*that, whether*) или союзных слов (*who, whose, what, which, when, where, why, how*). Возможен бессоюзный способ присоединения, однако, при переводе союз восстанавливается. **П**ридаточные предложения подлежащие и сказуемые **не отделяются запятой** от главного предложения.

Придаточные предложения – подлежащие

В предложениях такого рода в качестве подлежащего используется придаточное предложение с собственными подлежащим и сказуемым. Отвечает на вопросы *кто?* или *что?*

That his answer was correct is not surprising. То, что его ответ был правильным, не удивительно.

Придаточное предложение – подлежащее может стоять и после сказуемого, причём в этом случае главное предложение начинается формальным подлежащим *it*. Соединение придаточной части предложения с основной частью может быть и бессоюзным.

It is a pity you have missed the lecture. Какая жалость, что вы пропустили лекцию.

Придаточные предложения – сказуемые

В предложениях такого рода в качестве именной части сказуемого используется придаточное предложение, которое, как правило, следует за глаголом *to be, to get, to become* и характеризует подлежащее.

The problem was how quickly we could receive spare parts. **П**роблема заключалась в том, насколько быстро мы сможем получить запасные детали.

Безличные предложения с придаточными предложениями в роли части сказуемого после *to seem, to appear, to look, to happen* также относятся к придаточным предложениям сказуемым.
It seems that the experiment has finished successfully. Кажется, эксперимент закончился удачно.

Unit 22

Object clauses
Дополнительные придаточные предложения

Дополнение, как и все другие члены предложения, может быть выражено придаточным предложением, которое следует за сказуемым и вводится союзами *if, whether, that* и союзными словами *who, whom, which, what* и др. Возможно бессоюзное соединение.

We know (that) physical changes were caused by heating.	Известно, что физические изменения были вызваны нагреванием.
I wonder if this value is changeable.	Интересно, является ли данное значение переменным.

В случае, если сказуемое главного предложения стоит в прошедшем времени (Past Simple), необходимо соблюдать правило согласования времен.

1. Если сказуемое придаточного предложения стоит в Past Simple или Past Continuous, то на русский язык оно переводится настоящим временем.
   They thought (that) the substances differed. Они решили, что вещества различаются.
2. Если сказуемое придаточного предложения стоит в Past Perfect, то на русский язык оно переводится прошедшим временем.
   They concluded (that) the test had been done successfully. Они пришли к выводу, что тест выполнен успешно.
3. Если сказуемое придаточного предложения стоит в Future in the Past, то на русский язык оно переводится будущим временем.
   The supervisor wondered if I would finish the report in time. Руководитель поинтересовался, закончу ли я отчет вовремя.

Elliptical clauses
Неполные обстоятельственные придаточные предложения

Придаточные обстоятельственные предложения указывают на обстоятельства, при которых совершается действие. Они подразделяются на придаточные места, времени, причины, условия и т.д.

В случае если в составе сказуемого придаточного предложения присутствует глагол *to be*, а подлежащее совпадает с подлежащим главного предложения, либо используется местоимение *it*, то в придаточном предложении возможен пропуск подлежащего и глагола *to be* с последующим восстановлением при переводе, в случае необходимости.

If (it is) necessary, the current in the circuit can be changed.	При необходимости в цепи можно изменить ток.
Although (it is) efficient, the method has not been applied this time.	Хотя метод и эффективен, в этот раз он не использовался.

Вопросы на повторение к Модулю 8:

1. Как образовано сложноподчиненное предложение?

2. Какие союзы и союзные слова используются для присоединения всех типов придаточных предложений к главному предложению?

3. Дайте определение придаточным предложениям в роли подлежащего и сказуемого.

4. Что такое дополнительное придаточное предложение?

5. В чем заключается правило согласования времен?

6. Какие придаточные обстоятельственные предложения вы знаете?

7. Что такое эллиптические конструкции?

Appendix 4

WRITING FILE
Guide to presentation

Порядок подготовки презентации:

1. Выберите тему, которая вам интересна.
2. Сформулируйте тему презентации.
3. Осуществите поиск информации с использованием интернет ресурсов.
4. Обработайте собранную информацию.
5. Подготовьте грамотное, логически законченное выступление.
6. Подберите иллюстрационный материал.
7. Прорепетируйте свое выступление.

Общие требования к презентации:

1. Презентация не должна быть меньше 5 слайдов.
2. Первый лист – это титульный лист, на котором обязательно должны быть представлены, например, название проекта, полное название учреждения; фамилия, имя, отчество автора.
3. Второй слайд – это содержание.
4. Последние слайды презентации должны содержать список литературы/источников.
5. Эргономические требования: сочетаемость цветов, ограниченное количество объектов на слайде, цвет текста.

Не рекомендуется размещать на слайдах большое количество текстового материала (цитаты, ссылки, определения и т.д.), так как это образцы письменной речи, и они не воспринимаются на слух.

На протяжении всей презентации, особенно во время основной части, необходимо использовать визуальные средства, например, слайды в Power Point, графики, таблицы, схемы и другие. Слайды могут содержать различные рисунки или схемы (столбчатая диаграмма (bar chart), таблица (table), технический чертеж (technical drawing), схема последовательности процесса (flow chart), карта (map), диаграмма, график (graph), секторная диа-

грамма (pie chart), органиграмма (блок-схема организационной структуры системы) (organigram) и другие.

Во время выступления применяйте невербальные средства общения (жесты, мимику, голосовые модуляции). Следите за наличием обратной связи с аудиторией (eye contact). Нельзя скрещивать руки на груди или класть их в карманы пиджака или брюк. Иногда в руках может находиться указка или ручка.

Ваша презентация будет успешной, если вы будете говорить в естественном для вас темпе.

Если после вашего выступления у аудитории возникли вопросы, и вы смогли на них полно ответить, то цель вашей презентации достигнута.

Необходимо научиться обеспечивать максимальное спокойствие во время выступления. Это получается путем хорошей подготовки.

Речевые формулы в рамках структуры презентации

Компоненты структуры презентации		**Речевые формулы**
Введение	Приветствие	Good morning/afternoon, …(ladies and gentlemen); First of all, let me thank you all for coming here today; It's a pleasure to welcome you today; It's so good to see you here.
	Представление себя	Let me introduce myself; Let me start by introducing myself. My name is...; I'm a first-year student of the faculty …
	Представление темы	Today's topic is…; The topic of my presentation is…; In my presentation I would like to report on…; In my talk I'll tell you about…; Today I'm going to talk about…
	Объяснение актуальности темы	The topic of presentation is important because…Today's topic is of particular interest to those of you who…; My talk is particularly relevant to those of us who…; I chose this topic because …

Продолжение табл.

Компоненты структуры презентации		Речевые формулы
	Ознакомление с организацией и структурой презентации	My presentation is divided into three main parts; In my presentation I'll focus on three major issues; Point one deals with…, point two…, and point three…
	Ознакомление с продолжительностью выступления	My presentation will take about 7 minutes; It will take about seven minutes to cover these issues
	Привлечение внимания аудитории	Do you know that…?; I'd like to share an amazing fact with you … According to …
Основная часть	Обобщение информации после каждого пункта	Before I move on, I'd like to recap the main points; Let me briefly summarize the main issues; I'd like to summarize what I've said so far…
	Завершение каждого пункта	This brings me to the end of my first point; So much for point two …
	Переход к следующему пункту	This leads directly to my next point; This brings us to the next question …
	Возвращение к уже сказанному	As I said/mentioned earlier, …; Let me come back to what I said before; As I pointed out in the first section …
	Подчеркивание важной информации	I'd like to stress/highlight/emphasize the following points; I'd like you to focus your attention on…; Let me point out that…; I'd like to start by drawing your attention to…
	Комментирование визуальных средств	The biggest segment indicates…; You can see that different colours have been used to indicate…; First, let me explain the graph…; As you can see here, …; You can see the test results in this table; According to this graph …; The problem is illustrated in the next bar chart; Here is a slide that shows…; The chart on the following slide shows…; To illustrate this, let's have a closer look at…; Let's now look at the next slide that shows…

Продолжение табл.

Компоненты структуры презентации		Речевые формулы
Заключение	Подведение итогов	In conclusion, I'd like to…; To sum up, we…
Обратная связь	Уточнение вопроса	Sorry, I didn't catch the question (the end of the question), could you repeat your question? / Do you mean to say that…? / I don't quite follow what you mean to say? / Am I right to understand that…?/ Can you prove it? / I don't quite get the idea, I think …/ I am sure you didn't mean that … /Pardon…?
	Отсрочивание ответа на вопрос	Well…, Just …, Now …, You see …, You know…, Just a moment/minute …, Let me see …, It's on the tip of my tongue …; How can/shall I put this?
	Признание того, что выступающий не знает ответ на вопрос	I'm afraid I don't know the answer to your question; Well, I think that goes beyond the scope of today's presentation; Sorry, I don't know; I am very sorry, I really don't know; I am afraid, I don't know; I must confess, I don't know; I wish I knew but …

Appendix 5

Структура делового электронного письма

В наше время электронная почта – основной источник связи между деловыми партнерами, коллегами, с руководством, заказчиками и клиентами. Если вы пишете деловое электронное письмо, то его стиль должен быть близок к официальному письму.

Заголовок электронного письма может состоять из ряда полей, варьирующихся в зависимости от почтового адреса:

TO (КОМУ): адрес(а) получателя(ей)

FROM (ОТ КОГО): адрес отправителя (может заполняться почтовой программой)

COPY (КОПИЯ): адрес(а) получателя(ей) копии сообщения

SUBJECT (ТЕМА): краткое содержание текста письма, которое отображается в списке входящих сообщений получателя и таким образом дает общее представление о содержании сообщения. Поскольку в интернете много нежелательной рекламы, многие получатели удаляют ненужные им входящие сообщения без чтения. Таким образом, чтобы ваше сообщение было прочитано, важно написать хорошую тему. Так как обычно в папке "INBOX (Входящие)" отображаются только первые 25–35 символов, содержание темы должно быть коротким и давать ключ к пониманию сообщения, например:

SUBJECT: *AIP Conference Proceedings, Pittsburgh, Sept. 2–4.*

Если ваше сообщение является ответом на другое электронное письмо, почтовое программное обеспечение, как правило, предваряет строку темы обозначением *Re:* или *RE:* (от латинского **res** – дело, обстоятельство), за которым следует тема сообщения, на которое дается ответ, например:

SUBJECT: *RE: AIP Conference Proceedings, Pittsburgh, Sept. 2–4.*

Не смешивайте обсуждение разных вопросов в одной переписке. Если в ходе переписки поднимается другой вопрос и тема изменилась, начните новую цепочку сообщений и введите новую тему для этой переписки.

Вложения (Attachments)

Вложения – это файлы, которые относятся к данной теме переписки и отправляются вместе с сообщением электронной почты. Существуют различные программы для обработки файлов, поэтому убедитесь, что у получателя есть возможность открыть предлагаемый вами тип файла. Лучше вырезать необходимую информацию и вставить ее в текст сообщения электронной почты, чтобы получатель не столкнулся с этой проблемой. Всегда лучше вместо файла размещать большие документы в Интернете и отправлять по электронной почте URL-адрес. Если такой возможности нет, спросите своих корреспондентов, могут ли они обработать вложение такого объема.

Приветствия (Greetings)

Первые слова в текстовой области сообщения могут быть приветствием. Как и в официальном письме, начните своё деловое письмо с обращения следующим образом:

Dear Mr/Mrs/Miss/Ms + фамилия (Ms используется в том случае, если вы не знаете, замужем обладательница фамилии или нет)

Dear Dr/Professor + фамилия

Dear Sir (используется, когда вы не знаете фамилии мужчины)

Dear Madam (используется, когда вы не знаете фамилии женщины)

Dear Sir or Madam (используется, когда вы не знаете, является ли адресат женщиной или мужчиной)

To Whom it may Concern (используется в том случае, если вы не знаете имени адресата)

Если вы обращаетесь к группе людей, можно использовать наименование их общего вида профессиональный деятельности, например:

Dear Project Managers

В британском варианте после обращения ставится запятая, в американском – двоеточие. Следует помнить о культурных различиях: в ряде стран обращение более формально, и даже хорошо знакомые люди не обращаются друг к другу по имени.

Содержание письма (Contents of a Letter)

Деловое письмо – короткий жанр. Не пишите ничего, что не относится к решению вопроса – сразу переходите к сути сообщения. Не пишите в письме или теме слова типа "*High-priority*", "*Top urgent*", а лучше укажите точное время или дату, когда вы ждете ответа или результата. Текст письма должен быть максимально ясным во избежание двоякого толкования. Будьте вежливы и деликатны, не затрагивайте темы, не относящиеся к работе.

Подписи (Signatures)

Обычное завершение письма – это подпись. Лучше использовать свое полное имя, перед которым написать:

Yours truly (используется в американском варианте)

Yours sincerely (используется в британском варианте, когда вам известно имя адресата)

Yours faithfully (используется в британском варианте, когда вам неизвестно имя адресата, например:

Yours truly,

Helen P. Petrova

Точку после своего имени в конце письма ставить не требуется.

Многие почтовые программы позволяют настроить подпись, которая будет включаться в конце каждого сообщения по умолчанию. Здесь же можно указать другие способы связи, например:

Helen P. Petrova
Project manager, ABC Publishing House
+7 (959) 123-4567 mobile phone

Помните о том, что при изменении какой-либо контактной информации следует обязательно пересмотреть и обновить настройки своей автоматической подписи.

TO: Nelson2992@eurotravel.com
FROM: PetrovaHP@abc.com
COPY:
SUBJECT: Latest catalogue of ABC Publishing House

Dear Mr. Nelson,

Further to our meeting at the conference in Moscow I confirm that a sample of our recent catalogue is being sent for your consideration as requested.

Yours sincerely,
Helen P. Petrova
Project manager, ABC Publishing House
+7 (959) 123-4567 mobile phone

TO: PetrovaHP@abc.com
FROM: alexwrong@eurotravel.com
COPY:
SUBJECT: RE: Latest catalogue of ABC Publishing House

Dear Ms. Petrova,

Let me inform you that Mr. Nelson has moved to another position inside "Eurotravel Inc" and now I am dealing with his duties. I am looking forward to cooperating with you.

Yours sincerely,
Alex Wrong,
Sales Manager, "Eurotravel Inc"

Appendix 6

Abbreviations

A.C.	Ante Christum	*лат.* до нашей эры
ac	alternating current	переменный ток
a.m.	ante meridiem	*лат.* до полудня
B.C.	before Christ	до нашей эры
bit	binary digit	двоичная цифра
bps	bits per second	бит в секунду, двоичных единиц в секунду
BTU	British Thermal Unit	Британская тепловая единица
C	Centigrade	стоградусный (шкала Цельсия)
cc	cubic centimetre	кубический сантиметр
cckw	counter clockwise	против движения часовой стрелки
CD	Compact Disk	компактный диск
CU	Control Unit	управляющий блок
cwt	hundredweight	центнер; в Англии = 50,8 кг, в США - 45,3 кг
dc	direct current	постоянный ток
deg.	degree	градус
DVD	Digital Versatile Disc or Digital Video Disc	цифровой многоцелевой диск, цифровой видео диск
e.g.	exsempli gratia	*лат.* например
e.m.f.	electromotive force	электродвижущая сила
etc	et cetera	*лат.* и т.д.
Fahr. (F)	Fahrenheit	шкала Фаренгейта
f.p.s.	feet per second	футов с секунду
ft.	foot; feet	фут(ы)
gal.	gallon	галлон
GIF	Graphic Interchange Format	формат графического обмена
gr	gram (me)	грамм
h (hr)	hour	час
HDTV	High-definition Television	телевидение высокой четкости
hp.	horsepower	лошадиная сила

i.e.	id est	*лат.* то есть
I/O	Input/Output	ввод/вывод
kv	kilovolt	киловольт
kva	kilovolt-ampere	киловольт-ампер
kw	kilowatt	киловатт
LAN	Local Area Network	локальная сеть
Laser	Light Amplification by Simulated Emission of Radiation	лазер
lb.	libra pound	*лат.* фунт
LED	Light emitting diode	светодиод
m	metre	метр
m	mile	миля
m	minute	минута
mm	millimetre	миллиметр
m.p.h.	miles per hour	миль в час
OS	Operating System	операционная система
p.	page	страница
p.c.	pro centum *лат.* per cent	процент
PC	Personal Computer	персональный компьютер
p.m.	post meridiem	*лат.* после полудня
psi	pounds per square inch	фунтов на квадратный дюйм
RAM	Random Access Memory	оперативная память
ROM	Read Only Memory	постоянная память
r.p.m.	revolutions per minute	оборотов в минуту
r.p.s.	revolutions per second	оборотов в секунду
sq.	square	квадратный
t.	temperature	температура
t.	ton	тонна
viz.	videlicet	*лат.* а именно
vs	versus	*лат.* против
v.v.	vice versa	*лат.* наоборот
USB	Universal Serial Bus	универсальная последовательная шина
w	watt	ватт

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