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МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ  
ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ  
УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

Пятигорский институт (филиал) СКФУ

## Методические указания

по выполнению практических работ

по дисциплине «ИНОСТРАННЫЙ ЯЗЫК В ПРОФЕССИОНАЛЬНОЙ СФЕРЕ»

для студентов направления подготовки 13.03.02 Электроэнергетика и электротехника

Передача и распределение электрической энергии в системах электроснабжения

(ЭЛЕКТРОННЫЙ ДОКУМЕНТ)

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Методические указания по выполнению практических работ рассмотрены и утверждены на заседании кафедры лингвистики и межкультурной коммуникации

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## ВВЕДЕНИЕ

Дисциплина «Иностранный язык в профессиональной сфере» ориентирована на

- развитие навыков понимания устной речи общей и профессиональной тематики, включая понимание речи носителей языка и восприятие речи с медиа-источников;
- понимание особенностей стилей общения в рамках деловых ситуаций и ситуаций повседневного общения;
- преодоление языкового барьера и улучшение навыков разговорного французского языка;
- повышение грамотности устной и письменной речи;
- расширение активного словарного запаса по тематике общего и делового французского языка;
- повышение общего уровня владения языком.

Таким образом, целью освоения дисциплины «Иностранный язык в профессиональной сфере» является формирование у студентов компетенции УК-4 как средства, позволяющего обеспечить свои коммуникативно-познавательные потребности в сферах академической, профессиональной и социально-гуманитарной деятельности.

Процесс изучения дисциплины направлен на формирование таких компетенций как: овладение монологической, диалогической и письменной речью; основами самооценки уровня сформированности языковой, речевой и социокультурной компетенции и формирования потребности языкового самообразования.

В результате освоения дисциплины обучающийся должен знать:

- лексику профессиональной направленности;
- нормы употребления лексики английского языка в профессиональной сфере;
- особенности грамматики профессионального английского языка;

уметь:

- осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке;
- читать и переводить специальную литературу для пополнения профессиональных знаний;

владеть:

- навыками профессионального общения на английском языке;
- способами пополнения профессиональных знаний из оригинальных источников на английском языке.

## СОДЕРЖАНИЕ ПРАКТИЧЕСКИХ ЗАНЯТИЙ

### Раздел 1. From the History of Electricity / Из истории электричества

#### Практическое занятие № 1 – 2.

Тема занятия: **The First Discoveries:**

**Newton's Scientific Interests. Ernest Rutherford. /**

**Первые открытия:**

**Научные интересы Ньютона. Эрнест Резерфорд.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### Теоретическая часть:

1. When Newton was twenty-one years old he came under the influence of an old man named Isaac Barrow. Professor Barrow had been recently appointed to the university's famous Lucasian Chair of Mathematics, named after Henry Lucas who provided the money **to endow the professorship**. Barrow soon saw that Isaac Newton showed unusual talent as a scientist—or "natural philosopher" as scientists were called in Newton's time. Barrow befriended and encouraged young Newton.

2. Barrow was astonished at the young man's quick progress. Later, when Barrow was to publish his lectures on optics, he turned to his brilliant student for help. It was also Barrow who saw that Newton had a genius for mathematics, and urged him really to study Euclid's geometry.

3. Isaac's mind was also busy with refraction or the bending of light. He was experimenting with his lenses and thinking about things Professor Barrow told him. Ever since his school days, Isaac had been an experimenter, who liked to put his thoughts to proof. He wanted particularly to understand the events that took place naturally in the world around him – motions of planets and comets, the changing of the tides, the beautiful colours in soap bubbles, the resistance of the air, the laws of motion, and the transmitting or changing of one metal into another.

4. Things in nature behaved either in certain ways, or they didn't, Isaac decided. If one thing didn't work, perhaps another would. Supplied with books and scientific equipment at **Trinity** Newton began experimenting. And for relaxation, he always turned to alchemy – the recombining of one natural substance into another – which, while it was not a science, was the forerunner of modern chemistry.

5. Cambridge at this time was not considered the most advanced centre of English mathematics. Scientists – or "Natural philosophers" – felt that more progress was being made by scholars in London and at Oxford. In a short time, however, the quiet student from Woolsthorpe was to bring the highest mathematical honour to his own university.

6. Early in the year 1665, just a few months before he was to take his Bachelor of Arts degree, Isaac worked out a basic formula, or rule, which has been used ever since in mathematics. Today we call it "the binomial theorem". A binomial is any two numbers connected by the plus ( + ) sign or minus (–) sign.

7. Sometimes, in figuring scientific or mathematical problems, binomials have to be multiplied by themselves many, many times. Multiplications like this – of which Newton had to do many – are very complicated. They could cover sheets and sheets of paper **were it not for** Isaac Newton's rule. It looks difficult, but scientists with an understanding of mathematics substitute the numbers they have for the letters, and follow the multiplication signs and the plus and minus signs of the formula. By so doing, they can get correct answers to their problems simply and quickly – without covering all those sheets of paper.

8. The binomial theorem works for all numbers (**as long as they are in a binomial**) and it may be used not just in multiplying a number in itself, but in multiplying anything – the number of stars in a galaxy, the number of atoms in a molecule. Moreover, it may be employed to reach answers beyond our understanding, their numbers are so large.

### Примечания

1 to endow the professorship – учредить должность профессора

2 Trinity – колледж Св. Троицы в Кембридже

3 Bachelor of Arts degree – ученая степень бакалавра в области гуманитарных и математических наук

4 were it not for – если бы не

5 as long as they are in a binomial – входящих в бином

### Vocabulary

binomial	бином
comet	комета
formula	формула
geometry	геометрия
lens	объектив
substance	вещество
to figure	чтобы понять
motion	движение
multiplication	умножение
to multiply	умножить
to substitute	заменить
honour	честь
colleague	коллега
enthusiasm	энтузиазм
merit	заслуга
nucleus, <i>pl.</i> nuclei	ядро, мн.ч. ядра
physics	физика
radioactivity	радиоактивность
scholarship	ученость
strength	прочность
transmute	превращать
science	наука
research	исследовательская работа

artificial	искусственный
disintegration	дезинтеграция
to investigate	исследовать
to penetrate	проникнуть

### Вопросы и задания:

- а) Закройте правую колонку и прочитайте английские слова. Переведите их на русский и проверьте ваш перевод.  
б) Закройте левую колонку и переведите русские слова обратно на английский.
- Прочтите и переведите текст и уточните разницу в употреблении слов scholar и scientist.
- Прочтите четвертый абзац текста и скажите, какие проблемы интересовали Ньютона (используйте слова tide, light, soap, air, metal, comet).
- Прочтите шестой абзац текста и скажите, какому университету принес Ньютон славу в области математики.
- Прочтите седьмой абзац и дайте определение «the binomial theorem».
- Прочтите седьмой и восьмой абзацы, определите функции глаголов to be (to) и to have (to) и скажите, какая информация передана этими глаголами.
- Прочтите восьмой и девятый абзацы и скажите, как математики работали с цифрами до того, как Ньютон вывел «basic formula».
- Расскажите о Ньюtone как о талантливом математике, используя следующие слова и выражения: unusual, to work out a formula, to receive a degree и др.
- Расскажите о любознательности Ньютона, используя следующие слова и выражения: to understand, event, natural optics, to experiment, motion.
- Расскажите о применении бинома Ньютона, используя следующие слова и выражения: a number, to substitute for, a sign, to multiply, correct.
- Прочтите и переведите текст, в первых двух абзацах найдите информацию о начале научной деятельности Резерфорда.
- Ernest Rutherford, whose work on the structure of atoms laid the foundation of the study of atomic science, was born in New Zealand. Educated at Nelson College at the Canterbury College of the University of New Zealand, his talents were soon noticed and he was awarded a research scholarship to study experimental physics at Cambridge University.
- Rutherford's interest in radioactivity and the structure of the atom began when he was working under Professor J. J. Thompson in the Cavendish Laboratory. His use of X-rays (discovered by Rontgen in 1895) led him to his own discovery of two other types of rays – alpha and beta rays – made up of tiny particles; and distinguished by their penetration strengths.
- In 1898 Rutherford became Professor of Physics at the University in Montreal and in the following year he published his first paper on radioactivity. He returned to England in 1907 to become Professor of Physics at Manchester University. He was burdened with many teaching or administrative duties and in his well-equipped laboratory, helped by younger physicists from all over the world, including Geiger, Nils Bohr and Henry Moseley, he made his greatest discoveries. An atom, he found, was made up of a positively-charged nucleus surrounded by revolving electrons. By 1919 he was able to produce definite evidence that when an atom was bombarded by radioactive substances there was a reaction between this ray and the nucleus, causing artificial disintegration of the atom, that is, "splitting" it.
- In 1919 Rutherford succeeded his old Professor, J. J. Thompson, as Cavendish Professor of Experimental Physics. He then began to study how other elements were transmuted by the penetration of rays. This work was extended in 1921 when he and Dr. J. Chadwick began to investigate the properties of the neutron – a particle discovered by Chadwick which had no electric charge and which could penetrate the nuclei of atoms and transmute them.
- Rutherford was given numerous honorary degrees and as well as his peerage (received in 1931) he was awarded the Nobel Prize for Physics in 1908 and the Order of Merit in 1925. His immense

enthusiasm transmitted itself to the students and colleagues who worked with him. His many lecture tours and over 150 papers and published addresses spread the influence of his ideas all over the world.

13. Из первых двух абзацев дайте примеры употребления существительных в роли определения.

14. Выпишите из текста термины, относящиеся к разделу атомной физики.

15. Во втором абзаце текста найдите описание свойств альфа и бета лучей и их отличительных особенностей.

16. Прочтите второй и третий абзацы текста и скажите с именами каких ученых связаны названия X-rays, alpha and beta rays.

17. Прочтите третий абзац и скажите, как устроен атом.

18. Прочтите третий и четвертый абзацы и скажите, на какую область физики указывают такие слова, как splitting, neutron, particle, atom, transmute.

19. Прочтите текст еще раз и скажите, кому принадлежит авторство в открытии Резерфорда; используйте в ответе слова the structure of the atom, to lead to one's discovery, penetration strength, well-equipped laboratory, a positively-charged nucleus, to bombard, artificial disintegration.

20. Прочтите текст еще раз и скажите, кому принадлежит авторство в открытии нейтрона; расскажите о свойствах нейтрона.

### Практическое занятие № 3 – 4.

#### Тема 2. Faraday's Experiments and Knowledge of Electricity:

#### Michael Faraday – English Physicist and Chemist.

#### Faraday's experiment. / Эксперименты Фарадея и знания об электричестве:

#### Майкл Фарадей – английский физик и химик. Эксперимент Фарадея.

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### Теоретическая часть:

1. Faraday (1791 – 1867) was one of the ten children of a blacksmith, who moved with his family to London. It is a rare labouring family with ten children that is rich, so there was no question of an education for young Faraday and **he was apprenticed to a bookbinder.**

2. This, as it happened, was **a stroke of luck**, for he could read books there. Faraday's second stroke of luck was that his employer was sympathetic to the young man's desire for learning and allowed him to read books and to attend scientific lectures.

3. In 1812 **a customer** gave Faraday tickets to attend the lectures of Humphry Davy at the Royal Institution. Young Faraday **took careful notes** which he further elaborated with coloured diagrams and these, sent to president of the Royal Society in the hope of getting a job that would bring him into closer contact with science. Getting no answer he sent others to Davy himself along with an application for a job as his assistant. Davy was enormously impressed by the clear ability of the youngster. When an opening as his assistant occurred, he offered the young man the job. Faraday took it in 1813, at the age of twenty-two – at a salary that was smaller than the one



he had been earning as a bookbinder. Almost at once Davy left for his grand tour of Europe and took Faraday with him as a secretary.

4. Faraday became director of a laboratory in 1825, and in 1833 the one-time bookbinder's apprentice became professor of chemistry at the Royal Institution.

5. In chemistry Faraday made his first mark in 1823, when he devised methods for liquefying gases under pressure. He was the first to produce temperatures in the laboratory that were below the zero mark of the Fahrenheit scale. He may just be viewed as a pioneer in the modern branch of physics called cryogenics (the study of extreme cold).

6. In 1825 occurred his greatest single contribution to organic chemistry. He discovered benzene, a compound that was to play a key role in the development of a means of representing molecular structure.

7. In 1833–1834 Faraday further reduced **the matter of** electrolysis to quantitative terms by announcing what are now called Faraday's laws of electrolysis. Faraday's laws put electrochemistry on its modern basis. In his honour the quantity of electricity required to liberate 23 grams of sodium, or 108 grams of silver or 32 grams of copper (that is, to liberate an "equivalent weight" of an element) is called a farad. Also, the unit of electrostatic capacitance is the farad, in his honour.

8. In later years Faraday made more discoveries in connection with electromagnetism and its interaction with light.

9. When he was eventually offered the presidency of the Society by Tyndall, however, he declined it and he also declined an offer of knighthood. **He was intent on being** plain Michael Faraday.

### **Примечания**

1 he was apprenticed to a bookbinder – его отдали в ученики к переплетчику

2 a stroke of luck – большая удача

3 a customer – постоянный покупатель

4 took careful notes – вел тщательные записи

5 the matter of – проблема

6 He was intent on being – Он стремился быть....

### **Vocabulary**

benzene	бензол
capacitance	емкость
compound	соединение
cryogenics	физика низких температур
diagram	диаграмма
liquefy	сжижать
molecule	молекула
molecular	молекулярная
quantitative	количественный
quantity	количество
weight	вес
zero	нуль
interaction	взаимодействие
structure	структура
view	Посмотреть
to decline	снижаться
to elaborate	разработать
application	применение

### **Вопросы и задания:**

1. Прочтите и переведите текст, выберите 10 определений, выраженных разными частями речи.
4. Прочтите первый–четвертый абзацы текста и скажите, какую карьеру сделал Фарадей.
5. Расскажите о Фарадее как о человеке, стремящемся к науке с юных лет.
6. Используя слова first, the first, a pioneer, расскажите об одном из важнейших открытий Фарадея.
7. Прочтите текст с пятого по восьмой абзацы и выпишите слова и словосочетания, относящиеся к областям химии и физики.
8. Прочтите шестой и седьмой абзацы текста и скажите, о каких достижениях Фарадея вы узнали.
9. Прочтите текст и скажите, каким периодам жизни Фарадея относятся слова и словосочетания a bookbinder, a stroke of luck, attend scientific lectures; grand tour of Europe; methods for liquefying gases, cryogenics, a key role, electrochemistry; knighthood.
10. Прочтите седьмой абзац текста и скажите, как отмечены достижения Фарадея в области электрохимии.
11. Скажите, основы каких современных исследований в области физики и химии заложил Фарадей в начале XIX века.
12. Прочтите и переведите Текст 2; найдите описание модели электромагнитного аппарата, используйте слова small, inch-long, copperwire в ответе. Найдите значения терминов и запомните их: copper, core, defect, external, feed, inch, induce, insulation, layer, leakage, link, oscillate, rod, switch on, voltaic, turn, current.

#### Текст 2

1. Faraday knew from his long study of electricity that magnetism should be able to produce a current, as well as vice versa. In spite of his various failures, the idea of producing a current directly by magnetic action **remained firm in his** thoughts. One of his friends said later how at this period of his long life Faraday used to carry about with him in his pocket a small rough model of electro-magnetic apparatus. This consisted simply of an inch-long straight iron rod, or core, with some turns of copper wire wound round it.
2. The basic idea he had in mind was this: if an electric current in a wire can produce a magnetic effect, why should not a magnet near a conducting wire produce an electric current? It was really a simple reversal of Oersted's 1820 discovery.
3. On August 29 1831, Michael Faraday made his first successful experiment. **By a happy choice**, he decided to work not with a straight bar or even a horseshoe magnet, but with a ring. He made a soft iron ring, nearly an inch thick and six inches in external diameter. On opposite sides of this ring he had wound long coils of fine copper wire, separating each turn by string and each layer by calico, for insulation purposes. The ends of the left-hand coil he connected to his galvanometer **three feet away**, while the ends of the right-hand coil were connected up to a battery. When he switched on the battery circuit, there was immediately a slight reaction on the magnetic needle connected to the other coil. In his own words: "It oscillated and settled at last in its original position". On switching off the battery again, there was "a deflection of the needle", but while the so-called voltaic current was flowing through the wire there was no reaction on the galvanometer. This happened many times: each time the battery current came on, the needle linked to the opposite, unconnected coil deflected and then came to rest; each time the circuit was broken, the same effect was noticed.
4. Faraday was a little disappointed, having expected to get a positive deflection of the needle all the time his battery current was switched on. Instead he got it only when the magnetic field in the iron ring was changing – either switching on or switching off.
5. Nevertheless, he had produced electricity through magnetism, which had never been done before. There was no connection between the left-hand coil on the ring and the right-hand coil fed from the battery, nor was there any leakage of current from one side to the other. Yet as the galvanometer needle showed, electricity, however weak, had flowed momentarily each time through

the left-hand coil. It was new electricity where none existed before, and it had been produced, or induced, by electromagnetism.

### **Примечания**

1 remained firm in his thoughts – не оставляла его мысли

2 by a happy chance – по счастливой случайности

3 three feet away – расположенный на расстоянии трех футов

13. В чем был убежден Фарадей на основе своего длительного и глубокого изучения электричества? Используйте слова magnetism, produce, current.

14. В каком абзаце текста говорится о главной мысли, которая не давала покоя Фарадею?

15. Используйте следующие слова для описания устройства, которое использовал Фарадей для своего эксперимента: a ring, inch, in external diameter,

to wind, coil, copper, wire, to separate, turn, string, layer, insulation, to connect, ends, battery.

16. Прочтите текст еще раз и расскажите, как Фарадей проводил свой эксперимент.

17. Используя слова to get, to produce, electricity, weak, to flow, to exist, расскажите о результатах опыта.

18. Расскажите, почему Фарадей чувствовал разочарование при проведении своего опыта.

19. На основании прочитанного скажите, какие знания об электричестве стали известны благодаря опытам Фарадея.

## **Практическое занятие № 5 – 6.**

### **Тема 2. Development of Electrical Engineering:**

#### **James Maxwell and his Electromagnetic Theory. Electromagnetic Mechanisms /**

#### **Развитие электротехники: Джеймс Максвелл и его электромагнитная теория.**

#### **Электромагнитные механизмы.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### **Теоретическая часть:**

1. In the decade 1860–1870, James Maxwell formulated his classical electromagnetic theory. He showed that light was a form of wave motion travelling with a speed dependent on the electric and magnetic properties of the medium through which it is transmitted. He also predicted that waves longer than those of light could exist.

2. Even before Maxwell advanced the theory that electromagnetic waves should exist, men were making use of them for other purposes besides vision. For instance, the short ultraviolet rays in sunlight provided suntans; and the heat of the sun – provided by the long infra-red rays – was often concentrated by means of a lens to start fires. After the existence of electromagnetic waves had been proved by Hertz it was discovered that they range in length from hundreds of miles down to less than a billionth of an inch. The long waves could be used to carry sounds through space; as a consequence radio was developed.

3. A more recent development, which is related to radio, is television. Not only sounds but pictures can be transmitted at a distance because of electromagnetic waves.

4. Another modern device, developed to send out electromagnetic waves and to receive the echoes when they return, is radar, since the speed of electromagnetic waves is known, the time it takes for an echo to return to the radar set can tell the operator how far away a plane is from his set. Radar is given the credit for saving Great Britain during World War II, for it warned of enemy planes. Thus James Maxwell had made discoveries that later protected his homeland. Today with radio, television, radar, and communication with outer space making use of these waves, it is easy to realize why James Maxwell is now considered one of the great scientists of all time.

### Vocabulary

consequence	следствие
echo	эхо
length	длина
medium	средний
radar	радиолокационный
realize	понимать
scientist	ученый
theory	теория
ultraviolet	ультрафиолетовый
warn	предупреждать
light	свет
speed	скорость
electromagnetic	электромагнитный
existence	существование
discovery	открытие
communication	связь
wave motion	волновое движение
the long infra-red rays	длинные инфракрасные лучи
the short ultraviolet rays	короткие ультрафиолетовые лучи
to range in length	варьироваться по длине
to carry sounds through space	проводить сквозь пространство
because of electromagnetic rays	из-за электромагнитных лучей
to give the credit for	отдать должное

### Вопросы и задания:

1. Прочтите второй абзац и скажите, кому принадлежит доказательство существования электромагнитных волн.
2. Расскажите об инфракрасных и ультрафиолетовых лучах, используя следующие слова и словосочетания: electromagnetic waves, the short rays, the long rays, to discover, an inch, to carry sounds, as a consequence.
3. Прочтите последний абзац текста и скажите, каким образом научные открытия Дж. Максвелла помогли Великобритании вовремя второй мировой войны; обратите внимание на значения слова for.
4. Прочтите второй абзац и обратите внимание на функцию слова provided в объяснении свойств ультрафиолетовых и инфракрасных лучей.
5. Прочтите текст и скажите, какие разработки стали возможными после научных открытий, сделанных Дж. Максвеллом.
6. Выпишите из текста существительные с определениями, относящиеся к открытиям, сделанным за период 1860–1870 гг. Дж. Максвеллом.
7. Прочтите текст и скажите, к каким разработкам (согласно тексту) относятся следующие словосочетания: dependent on, making use of, by means of, related to, to send out, far away.

8. Прочтите текст и скажите, какое изобретение послужило источником изучения для Дж. Максвелла, используйте в ответе словосочетания *tidewave, heatwave, lightwave, soundwave, seawave, wavemotion*.

9. Прочтите и переведите текст 2; расскажите о назначении *galvanic battery* и *copper-iron machine*. Переведите и запомните следующие слова и словосочетания: *discovery, application, development, property, limitation, superconductor, convenience, programming; copper-iron machine, electromagnetic machine, electrical- power applications, magnetic fields, dominant factor, power/ weight ratio, automatic washing machine, method of producing mechanical power, different set of limits*.

#### Текст 2

1. Before Faraday's discoveries the only usable source of electricity was the galvanic battery, and it made possible some practical applications, including the electric light and the electric telegraph. But the practical supply of electricity on a large scale was only possible by the development of electromagnetic machines, generators and transformers.

2. For the use of electricity to produce mechanical power where it is wanted, another electromagnetic machine – the electric motor – still remains the most effective method.

3. What made all this possible? It needed not only the discovery and understanding of the basic laws (by Faraday), but also the discovery of materials with suitable properties. It is really very fortunate that high magnetic fields can be sustained in a material as cheap as iron. Without iron, the whole economics of electromagnetic machines and of electrical-power applications would be quite different.

4. The electromagnetic machine is still developing in other respects. Using iron, it is cheap to produce the magnetic field, but an important limitation is imposed by saturation. This limit can be overcome by using superconductors at very low temperatures to carry very high currents and produce much stronger magnetic fields – without using iron. This development opens up a new field for machine designs and applications, and it offers a different set of limits from those of the copper-iron machine.

5. Nevertheless, the copper-iron machine is so simple and reliable that it is likely to continue for a very long time as the main method of producing mechanical power.

For many applications, the dominant factors are not efficiency and **power/weight ratio**<sup>1</sup> but convenience and cleanliness, and with electricity one is really buying convenience rather than power. It seems likely that the main advances in domestic applications will be by developments of control and programming to give even greater convenience, a good present example being the automatic washing machine.

6. The electric motor is a superb machine to provide power, and its applications must expand for that reason alone.

#### Примечание

1 power/weight ratio – мощность на единицу веса (двигателя)

10. Назовите основные причины использования железа в электротехнике.

11. Расскажите о недостатках в использовании железа при создании electromagnetic machine и их преодолении, употребите слова *limit, overcome, superconductor, temperature, current*.

12. Прочтите пятый и шестой абзацы текста и скажите, почему, по вашему мнению, имеют широкое применение *copper-iron machines*.

13. Прочтите текст еще раз и расскажите об электромагнитных механизмах; употребите в ответе следующие слова и словосочетания: *practical supply, to produce, materials with suitable properties, fortunate, iron, quite different, limitation, saturation, nevertheless; to continue for a long time, convenience and cleanliness, the main advances, a superb machine*.

14. На основании прочитанного расскажите о развитии электрической машины, используя слова и выражения to overcome, low, superconductors, temperature, stronger, to carry, high currents и др.

15. Выскажите свое мнение о преимуществах и недостатках электромагнитной машины, употребив слова и выражения, данные в скобках (effective, reliable, iron, to make possible, magnetic fields, limitation, saturation, to produce).

16. Сообщите кратко о главных факторах в применении домашних электрических приборов, используя слова и словосочетания, предложенные в скобках (efficiency, rather than, main, convenience, cleanliness, advantage, power/weight ratio).

### Практическое занятие № 7 – 8.

#### Тема 4. Generating an Electric Current: The History of Electrical Engineering.

##### Some Facts of the History of Electrical Engineering in Russia /

##### Происхождение электрического тока: История электротехники.

##### Некоторые факты из истории электротехники в России.

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### Теоретическая часть:

1. The first method used in producing an electric current was chemical in nature. **Credit for its discovery is given**<sup>1</sup> to an Italian physician named Aloisio Galvani (1737–1798). One day while engaged in dissecting a frog, Galvani noticed the leg muscles contract whenever a nearby electric machine was in operation. Further investigation showed the same **twitching effect**<sup>2</sup> to be obtained by simply connecting the nerve and muscle of the leg to dissimilar metals. But no such result was obtained if only one metal was used or if non-conductors were employed.

There were obviously two possible sources of the phenomenon. Either the current was set up at the junction of the two metals or it was a property of the **animal tissues**.<sup>3</sup> Galvani favoured the latter view and in 1791 announced his discovery, attributing the current to what he called "animal electricity" or as it came to be known, "galvanism". Galvani is an excellent example of a scientist who behaved most unscientifically with regard to a hypothesis which he himself had advanced. He became so prejudiced in favour of his animal magnetism theory that it was quite impossible for him to view objectively later evidence which definitely contradicted it and finally caused it to be discarded.

2. Another Italian, Alessandro Volta (1745–1827), a professor of physics in the University of Pavia, established the true source of the electric current. He demonstrated that it could be produced by (the action of dissimilar metals without the presence of animal tissue of any sort.

3. In the course of his experiments in 1800 he developed the first electric battery, a device known as **a voltaic pile**.<sup>4</sup> Although he tried a number of different materials he found that the best results were obtained when he used silver and zinc as the two metals. The pile consisted of a series of small discs of these and of cardboard, the latter having been soaked in a salt solution. Then he piled the discs up one on another in the order silver, zinc, cardboard, and so forth, ending

with zinc. By connecting wires to the top and bottom discs he was able to get continuous electric currents which were of substantial size.

4. All the essentials of a modern electric cell or battery were present in the voltaic pile. Developments since that time have been largely directed toward making cells more convenient to use and toward eliminating various undesirable chemical reactions.

### **Примечания**

1 Credit for its discovery is given – честь его открытия принадлежит

2 twitching effect – эффект сокращения мышц

3 animal tissue – живая ткань

4 a voltaic pile – вольтов столб (гальваническая батарея)

### **Vocabulary**

advance	продвижение
attribute	причина
cause	химическая
chemical	контракт
contract	предметы первой необходимости
essentials	доказательства
evidence	благоприятствовать
favour	соединение
junction	машина
machine	решение
solution	свойство
property	гипотеза
hypothesis	доказательства
evidence	мускул
muscle	

### **Вопросы и задания:**

1. Прочтите и переведите текст; из первого абзаца выпишите слова с отрицательными приставками, относящиеся к открытию, совершенному А. Гальвани.
2. Из четвертого абзаца текста выпишите причастия, относящиеся к истории разработки первой электрической батареи.
5. Прочтите первый абзац и скажите об отношении Гальвани к своему изобретению, какое явление происходило на самом деле во время опытов с лягушкой.
6. Прочтите текст и скажите, кто из двух экспериментаторов, А. Гальвани или А. Вольт, совершил открытие в области электричества, т. е. открыл постоянный ток.
7. Расскажите о работе А. Гальвани, используя слова physician, a frog, muscles, electric machine, metals, non-conductor, «galvanism».
8. Расскажите об экспериментах А. Вольта, используя глаголы в Past Simple.
9. Найдите пример конверсии в описании работы над изобретением А. Вольта.
10. Прочтите текст еще раз и расскажите об устройстве первой электрической батареи.
11. Выскажите свое мнение по вопросу важности для науки экспериментов, проведенных А. Гальвани.
12. Переведите и запомните следующие слова и словосочетания: institution, chemistry, physics, technical, journal, revolutionary, research, lighting, galvanoplastics, electrophony, magnetism, exhibition; to belong to, to carry on, to consist of; scientific societies, scientific corporation, technical society, electrical engineering, elaboration of scientific problems, electrical measuring instruments, pictorial material on electricity, honoured professor.
13. Прочтите и переведите текст; в первом и втором абзацах найдите информацию о положении дел в российских научных обществах конца XIX века.

1. In the capital of Russia at the end of the second half of the XIXth century not only the higher educational and research institutions carried on scientific work; scientific societies were likewise engaged. Among them a special place is occupied by the Russian Society of Physics and Chemistry, and the Russian Technical Society. The first was connected with the St. Petersburg University and the second was an independent scientific corporation. It was at this time that the Sixth Department (Electrotechnical) of the Russian Technical Society was established with its journal Electricity.
2. In the history of electrical engineering in Russia, the part played by the Sixth Department of the Russian Technical Society is outstanding. In prerevolutionary Russia there were only a few special scientific research institutions, especially of the applied type, and therefore Russian scientific societies had to use their own money for the elaboration of scientific problems because the funds that were allotted for scientific purposes were insignificant; they had to coordinate the efforts of individual investigators and at the same time conduct a broad programme of spreading scientific knowledge. In this respect, the activities of the Sixth Department are especially characteristic.
3. During the very first year of its existence the Sixth Department organized an electrical exhibition in St. Petersburg.
4. The exhibition consisted of eight sections: telegraphy and telephony, electric lighting and electro-mechanics, electricity in the army and navy, galvanoplastics, electricity in education, electrical measuring instruments, electrophony and, finally, literature and pictorial material on electricity. The works of such Russian inventors as Yablochkov, Lodygin, Rikhter, Ragozin and Teplov were represented in all these sections.
5. The exhibition not only paid for itself but also brought in a considerable profit which formed the main source for financing the first electrical journal.
6. The Sixth Department of the Russian Technical Society opened wide its doors to all interested in the new technical field, it especially attracted the youth. A. Popov belonged to this group of young people.
7. At the request of this Department O. Khvolson (1852–1934), an honoured professor of the St. Petersburg University, delivered a series of public lectures entitled "Electricity and Magnetism". Crowds of students from different schools in the capital and also already working in the field of electricity came to Khvolson's lectures.
14. Прочтите третий и четвертый абзацы и скажите, что вы узнали о выставке, организованной в Санкт-Петербурге.
15. Расскажите о финансовом положении научно-технических обществ конца XIX века.
16. Прочтите текст еще раз и скажите, в чем выражалась просветительская деятельность Русского технического общества.
17. Прочтите последний абзац текста и расскажите о популярности деятельности Русского технического общества.
18. Прочтите текст и скажите, по каким направлениям науки, техники, образования велись работы известными российскими учеными.
19. Расскажите об истории работы Шестого департамента.
20. Определите разницу в положении Русского физического и химического общества и русского технического общества в России на конец XIX в.
21. Выскажите свое мнение о роли Шестого департамента Русского технического общества в развитии электротехники до революции в России.

## Раздел 2. The Main Elements of Electric Circuit / Основные элементы электрической цепи

### Практическое занятие № 9 – 10.

#### Тема 5. Arithmetic Operations: Addition and Subtraction. Multiplication and Division.



**Common and Decimal Fractions /**  
**Арифметические действия:**  
**Сложение и вычитание. Умножение и деление.**  
**Простые и десятичные дроби.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

**Теоретическая часть:**

**Addition and Subtraction / Сложение и вычитание**

$5 + 7 = 12$	– five plus seven equals twelve
$66 + 13 = 79$	– sixty-six plus thirteen is equal to seventy-nine
$a + b = c$	– a plus b is equal to c
$15 - 6 = 9$	– fifteen minus six equals nine
$81 - 33 = 48$	– eighty-one minus thirty-three is equal to forty-eight
$c - b = a$	– c minus b equals a

**Multiplication and Division / Умножение и деление**

$1 \times 1 = 1$	– once one is one
$2 \times 2 = 4$	– twice two is four
$3 \times 3 = 9$	– three times three equals nine
$4 \times 4 = 16$	– four times four is equal to sixteen
$12 \times 10 = 120$	– twelve multiplied by ten (by) is equal to one hundred and twenty
$a \times b = ab$	
$35 : 7 = 5$	– thirty-five divided by seven equals five
$1000 : 25 = 40$	– one thousand divided by twenty-five is equal to forty

$$d : b = c$$

## Vocabulary

addition	[ə'dɪʃən]	сложение
subtraction	[səb'trækʃn]	вычитание
plus	[plʌs]	плюс
minus	['maɪnəs]	минус
to add	[æd]	складывать, прибавлять
to subtract	[səb'trækt]	вычитать
to equal	['i:kwəl]	равняться
to be equal		быть равным
multiplication	[,mʌltɪplɪ'keɪʃn]	умножение
to multiply	['mʌltɪplaɪ]	умножать
multiplied by		умноженноена
once	[wʌns]	одинраз
twice	[twais]	дважды, двараза
three times		трираза
four times		четырераза
division	[dɪ'vɪʒn]	деление
to divide	[dɪ'vaɪd]	делить
divided by		делённеноена

## Вопросыизадания:

1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.

b) Cover the left column and translate the Russian words back into English.

2. Solve these problems and read them:

$$99 + 77 = \underline{\hspace{2cm}}$$

$$8 - 3 = \underline{\hspace{2cm}}$$

$$315 + 145 = \underline{\hspace{2cm}}$$

$$61 - 50 = \underline{\hspace{2cm}}$$

$$47 - 18 = \underline{\hspace{2cm}}$$

$$859 - 600 = \underline{\hspace{2cm}}$$

$$114 + 316 = \underline{\hspace{2cm}} \quad 1,203 + 419 = \underline{\hspace{2cm}} \quad 4,444 + 7,777 = \underline{\hspace{2cm}}$$

$$b + d = \underline{\hspace{2cm}} \quad d - c = \underline{\hspace{2cm}} \quad a - b = \underline{\hspace{2cm}}$$

**3. Pair work. Think of six problems of your own. Put them down. Ask your groupmate to solve them.**

**4. Solve these problems and read them:**

$$10 \times 7 = \underline{\hspace{2cm}} \quad 49 : 7 = \underline{\hspace{2cm}} \quad 13 \times 3 = \underline{\hspace{2cm}} \quad 749 : 7 = \underline{\hspace{2cm}}$$

$$100 \times 100 = \underline{\hspace{2cm}} \quad 175 : 25 = \underline{\hspace{2cm}} \quad 618 : 6 = \underline{\hspace{2cm}} \quad 3,550 \times 5 = \underline{\hspace{2cm}}$$

$$234 \times 6 = \underline{\hspace{2cm}} \quad 12 \times 12 = \underline{\hspace{2cm}} \quad 33 : 33 = \underline{\hspace{2cm}} \quad 10,660 : 10 = \underline{\hspace{2cm}}$$

$$b \times c = \underline{\hspace{2cm}} \quad n : m = \underline{\hspace{2cm}} \quad 1 \times k = \underline{\hspace{2cm}} \quad 1 \times 1 = \underline{\hspace{2cm}}$$

**5. Pair work. Think of five problems of your own. Put them down. Ask your groupmate to solve them.**

#### **Common and Decimal Fractions / Простые и десятичные дроби**

В простых дробях числитель выражается количественным числительным, а знаменатель – порядковым. Если числитель больше единицы, то знаменатель имеет окончание **-s**: *two fifths – две пятых*. В смешанном числе целое число читается как количественные числительные, а дробь присоединяется при помощи союза **and**: *five and two fifths – пять и две пятых*.

В десятичных дробях «ноль» произносится **zero** или **o**, за ним следует слово **point** (точка) и затем дробь: *o point five – ноль целых и пять десятых*. Между целым числом и десятичной дробью в английском языке ставится точка, а не запятая, как в русском языке.

**6. Read and translate.**

$$\frac{1}{2} \text{ -- one half (a half)}$$

$$0.7 \left\{ \begin{array}{l} 0 \text{ point seven} \\ \text{nought point seven} \\ \text{zero point seven} \end{array} \right.$$

$$\frac{1}{3} \text{ -- one third (a third)}$$

$$0.002 \text{ -- zero point two zeros two}$$

$$\frac{2}{7} \text{ -- two sevenths}$$

$$1.1 \text{ -- one point one}$$

$$3 \frac{1}{2} \text{ -- three and a half}$$

$$5.36 \text{ -- five point three six}$$

$$5 \frac{1}{7} \text{ -- five and a seventh}$$

$$65.57 \text{ -- sixty-five point five seven}$$

$$6 \frac{5}{7} \text{ -- six and five sevenths}$$

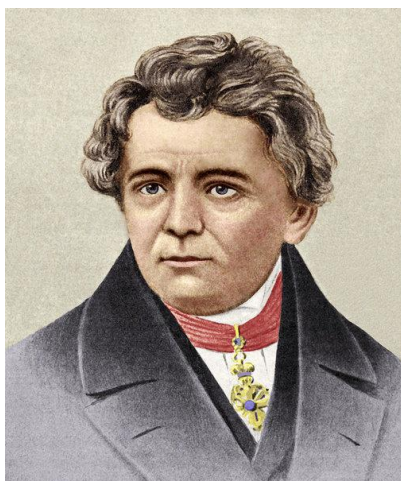
## 7. Read these common and decimal fractions:

1/3	2/5	5/8	7 1/2	9 5/8	15 8/9
0.23	0.009	10.01	205.35	79.31	0.0003

### Ohm's Law

current	['kʌrənt]	электрический ток
resistance	[rɪ'zɪstəns]	сопротивление
voltage	['vɒltdʒ]	вольтаж, напряжение
to suppose	[sə'pəʊz]	предполагать
law	[lɔ:]	закон

### The Formulation and Explanation of Ohm's Law



Georg Simon Ohm  
Георг Симон Ом

The law of the German teacher, George Ohm, is very simple. It sounds: the strength of the current in the circuit is directly proportional to the voltage and inversely proportional to the resistance. Georg Ohm introduced this law experimentally (empirically) in 1826. Naturally, the greater the resistance of a part of the circuit, the less will be the current strength. Accordingly, the higher the voltage, the greater the current.

### Формулировка и объяснение закона Ома

Закон немецкого учителя Георга Ома очень прост. Он гласит: сила тока на участке цепи прямо пропорциональна напряжению и обратно пропорциональна сопротивлению. Георг Ом вывел этот закон экспериментально (эмпирически) в 1826 году. Естественно, чем больше сопротивление участка цепи, тем меньше будет сила тока. Соответственно, чем больше напряжение, тем и ток будет больше.

$$R = \frac{V}{I} \text{ Resistance equals voltage divided by current.}$$

$$I = \frac{V}{R} \text{ Current equals voltage divided by resistance.}$$

$$V = IR \text{ Voltage equals current times resistance.}$$

$$\begin{aligned} V &= 1 \text{ V} \\ I &= 1 \text{ amp} \\ R &= ? \end{aligned}$$

### Problem

Suppose that resistance equals one volt and current equals one ampere. How much is the resistance?

### Solution

$$R = \frac{V}{I}$$

$$\frac{1 \text{ V}}{1 \text{ amp}} = 1 \text{ ohm}$$

## 8. Solve the following problems and read them.

*Model:* – How much is 10 times 4?  
– 10 times 4 equals 40.

- |                        |                       |                  |                 |
|------------------------|-----------------------|------------------|-----------------|
| 1) $7 \times 7 =$      | 5) $350 \times 2 =$   | 9) $49:7 =$      | 13) $20.2:2 =$  |
| 2) $2.5 \times 3 =$    | 6) $3.5 \times 10 =$  | 10) $75 : 25 =$  | 14) $7.5 : 5 =$ |
| 3) $10,050 \times 2 =$ | 7) $2,000 \times 5 =$ | 11) $3,500:35 =$ | 15) $40.8:4 =$  |
| 4) $100 \times 0.5 =$  | 8) $0.12 \times 2 =$  | 12) $10.25:10 =$ | 16) $15.5: 3 =$ |

## 9. Solve the following problems using the formulas of Ohm's Law.

*Model:* – Current equals 5 amp; resistance equals 10 ohms. How much is the voltage?  
– Voltage equals current times resistance.  $5 \times 10 = 50 \text{ V}$

- |                                                                 |                                                                |                                                                 |
|-----------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------|
| 1) $R = 80 \text{ ohms}$<br>$V = 55 \text{ V}$<br>$I = ?$       | 2) $R = 10.25 \text{ ohms}$<br>$I = 35 \text{ amp}$<br>$V = ?$ | 3) $V = 50.05 \text{ V}$<br>$I = 120 \text{ amp}$<br>$R = ?$    |
| 4) $I = 10,500 \text{ amp}$<br>$V = 2,000 \text{ V}$<br>$R = ?$ | 5) $V = 20.05 \text{ V}$<br>$R = 0.015 \text{ ohm}$<br>$I = ?$ | 6) $I = 0.24 \text{ amp}$<br>$R = 1.36 \text{ ohms}$<br>$V = ?$ |

## 10. Pair work. Make up similar problems of your own. Ask your groupmate to solve them.

## 11. Read the following words. What are their prefixes, stems, suffixes? Translate the words into Russian:

generate, inefficient, abnormally, underproduction, anticlockwise, counteraction, demagnetize, superconductor, inequality, misunderstand, unequally, equality, interrelation, non-conductor, input, simplify, waterless, irregularity, redden, enlargement, unreadable, southward, clockwise, fully, noisy, typically, impossible, superconductor

## 12. Translate the following commands:

1. Learn the rule, please.
2. Use additional resistors, please.
3. Include the data into the common list.
4. Do not underestimate the advantages of the new resistors!
5. Do not use the instrument.

## 13. Learn the following commands:

1. Heat the magnet, please!

2. Switch off the power, will you?
3. Use the superconductor!

#### 14. Translate into Russian in writing:

Energy is the capacity for doing work. The various forms of energy, interconvertible by suitable means, include potential, kinetic, electrical, heat, chemical, nuclear, and radiant energy. Interconversion between these forms of energy occurs only in the presence of matter.

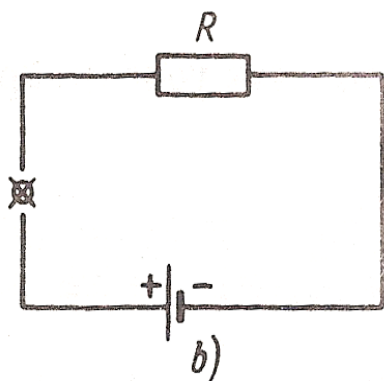
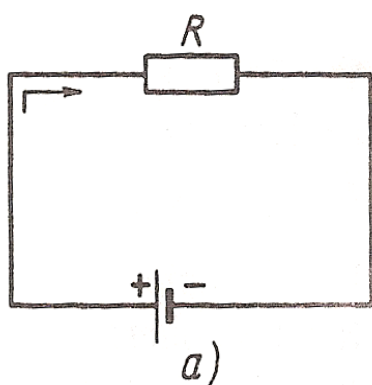
In the absence of matter energy can only exist in the form of radiant energy.

#### Практическое занятие № 11 – 12.

##### Тема 6. Electric Circuit:

##### Series Circuit. Parallel Circuit /

Электрическая цепь: Последовательная цепь. Параллельная цепь.



**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### Теоретическая часть:

#### Electric Circuit

This is a circuit. Its elements are a voltage source, a resistor and a conductor. The circuit consists of a voltage source, a resistor and a conductor. A voltage source supplies current. A resistor reduces current. A conductor connects the elements of the circuit.

Compare circuit *a* with circuit *b*. What is the difference between them? Current passes through circuit *a* while no current passes through circuit *b*. Circuit *b* has an open. No current through circuit *b* results from an open. An open and a short are troubles in a circuit. A trouble in a circuit may result in no current in it.

#### Vocabulary

circuit

['sə:kɪt]

цепь, контур

conductor	[kən'dʌktə]	проводник
function	['fʌŋkʃn]	назначение
difference	['dɪfrəns]	разница
open		обрыв
short		короткое замыкание
trouble	['trʌbl]	повреждение
no	[nou]	никакой, нисколько
to reduce	[rɪ'dju:s]	сокращать
to supply	[sə'plai]	снабжать
to connect	[kə'nekt]	связывать
to compare (with)	[kəm'preə]	сравнивать (с)
to pass through	['pɑ:s'θru:]	проходить через
to result in		приводить к, иметь результатом
to result from		следовать, проистекать из
branch	[brɑ:ntʃ]	отвод
line		линия
value	['vælju:]	величина
voltage drop		падение напряжения
series	['siəri:z]	последовательное
parallel	['pærələl]	параллельное
main	[mem]	главный, основной
to use	[ju:z]	использовать
in order (to)		для того чтобы

### Вопросы и задания:

1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.  
b) Cover the left column and translate the Russian words back into English.

### 2. Translate into Russian:

1. An open and a short are troubles in a circuit.
2. A trouble in a circuit results in no current in it.

3. What does an open in a circuit result in?
4. What does a short in a circuit result in?
5. What does a trouble in a circuit result from?

**3. Complete these sentences, using the correct variant:**

- |                                 |                                                                                                                        |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 1. Circuit <i>a</i> consists of | a) resistors and conductors.<br>b) a voltage source and resistors.<br>c) a voltage source, a resistor and a conductor. |
| 2. A voltage source             | a) conducts current.<br>b) reduces current.<br>c) supplies current.                                                    |
| 3. A conductor                  | a) connects the elements.<br>b) supplies voltage.<br>c) conducts current.                                              |
| 4. A resistor                   | a) connects the elements.<br>b) supplies current.<br>c) reduces current.                                               |
| 5. No current results from      | a) an open.<br>b) a short.                                                                                             |

**4. Answer the following questions:**

1. What elements does a circuit consist of?
2. What is the function of a voltage source?
3. What is the function of a conductor?
4. What is the function of a resistor?
5. When is there no current in a circuit?
6. What does an open or a short result in?
7. What does no current in a circuit result from?

**5. Solve these problems:**

1. How much is the current in the circuit if a 60-volt source is connected to a resistance of 1,600 ohms?
2. How much is the voltage in a circuit having a current equal to 25 amp, if a 25-ohm resistance is connected to it?
3. A 70.35-ohm resistance is connected to the circuit. How much is the voltage if the current equals 4.5 amp?

**6. Pair work. Ask your groupmate to compare circuits *a* and *b* (see Fig. 1).**

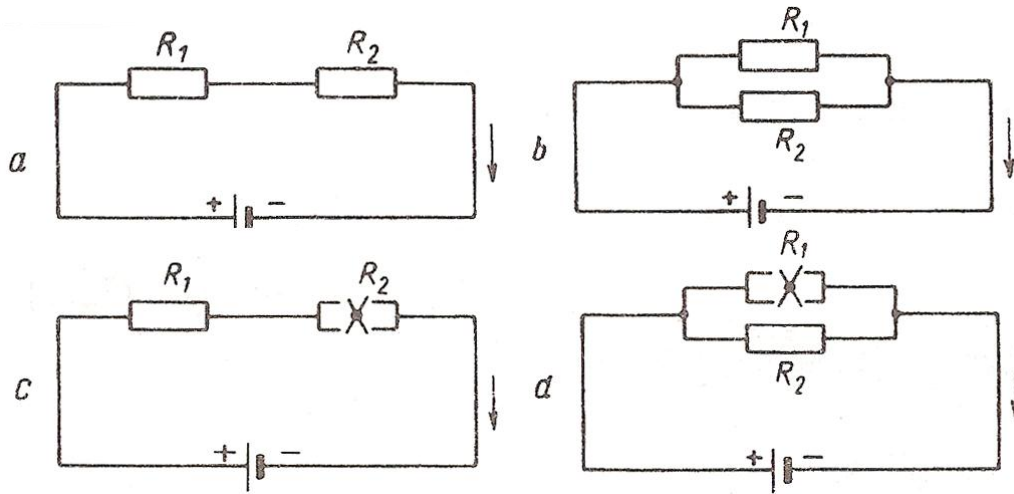
1. What do they have in common?
2. Which of the circuits has a trouble?
3. What does the trouble result from?
4. What does it result in?

**7. Read and translate.**



## Series Circuit and Parallel Circuit

Compare circuits *a* and *b*. Circuit *a* consists of a voltage source and two resistors. The resistors are connected in series. Circuit *a* is a series circuit.



Circuit *b* consists of a voltage source and two resistors. The resistors are connected in parallel. Circuit *b* is a parallel circuit.

A parallel circuit has the main line and parallel branches.

In circuit *b* the value of voltage in  $R_1$  equals the value of voltage in  $R_2$ . The value of voltage is the same in all the elements of a parallel circuit while the value of current is different. A parallel circuit is used in order to have the same value of voltage.

In circuit *a* the value of current in  $R_1$  equals the value of current in  $R_2$ . The value of current is the same in all the elements of a series circuit while the value of voltage is different. A series circuit is used in order to have the same value of current. In  $R_1$ ,  $V_1 = I \times R_1$  is the voltage drop in  $R_1$ . In  $R_2$  the voltage equals  $I \times R_2$ ;  $I \times R_2$  is the voltage drop in  $R_2$ . In circuit *c* a trouble in one element results in no current in the whole circuit. In circuit *d* a trouble in one branch results in no current in that branch only, a trouble in the main line results in no current in the whole circuit.

### 8. Complete these sentences using the correct variant:

- |                                                  |                                                                                                                        |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 1. A parallel circuit has                        | a) parallel branches only.<br>b) the main line and parallel branches.                                                  |
| 2. A parallel circuit is used in order           | a) to have the same value of current in all the elements.<br>b) to have the same value of voltage in all the elements. |
| 3. In a parallel circuit a trouble in one branch | a) results in no current in that branch only.<br>b) results in no trouble in the whole circuit.                        |
| 4. No current in a parallel circuit              | a) results from a trouble in one branch.<br>b) results from a trouble in the main line.                                |

5. The sum of IR voltage drops
- a) equals the value of voltage in the circuit.
  - b) is less than the smallest voltage drop.
  - c) is more than the value of voltage in the circuit.

**9. Complete the sentences using *while*. Follow the model:**

*Model:* Resistors connected **in series** have the same value of **current**...

Resistors connected **in series** have the same value of current *while* resistors connected **in parallel** have the same value of **voltage**.

1. Resistors connected **in series** have **different** values of voltage while ....
2. A trouble in one element of a **series** circuit results in no current in the **whole circuit** while ....
3. In order to have the same value of **current** in all the elements, a **series** circuit is used while ....
4. No current in a **parallel** circuit results from a trouble in the **main line** while....

**10. Answer the following questions:**

1. What type of circuit has the main line and parallel branches?
2. What type of circuit is used in order to have the same value of current in all the elements?
3. What type of circuit is used in order to have the same value of voltage in all the elements?
4. What does a trouble in the main line result in?
5. What does a trouble in a branch result in?
6. What does no current in a series circuit result from?
7. How much does the sum of IR voltage drops equal?
8. What is the difference between series and parallel circuits?

**11. Pair work. Ask your groupmate to draw and describe a series-parallel circuit.**

**12. Form nouns by adding the suffixes *-er*, *-or*.**

to work, to invent, to compose, to calculate, to operate, to act, to react, to emit, to transmit, to use, to combine

**13. Form adverbs from adjectives by adding the suffix *-ly*:**

easy, reasonable, usual, special, physical, functional, real, regular, magnetical, different, logical, mathematical, subsequent, consequent

**14. a) Choose the proper suffixes and add them to the stems.**

**stems:** equal-, foil-, add-, differ-, success-, common-, resist-  
**suffixes:** -ure, -ly, -ence, -ition, -ful, -less, -ance, -ness

**b) Translate the new words.**

**15. Form adjectives. Choose the proper suffixes and add them to the stems.**

**stems:** differ, advantage, metal, structure, resist, use, reason, control, base  
**suffixes:** -ous, -ic, -less, -ful, -able, -ent, -ant

## 16. Translate into Russian in writing:

1. Oxygen combines directly with nearly all elements.
2. Plastic materials are relatively new insulating materials.
3. Polythene cables have numerous advantages.
4. The importance of semiconductors for modern science cannot be underestimated.
5. Semiconductors conduct electricity less efficiently than metals.
6. The method proved to be efficient.
7. What resistance materials are in common use today?

### Практическое занятие № 13 – 14. Тема 7. Meters: Ammeter. Voltmeter. / Измерительные приборы: Амперметр. Вольтметр.

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### Теоретическая часть:

##### Meters

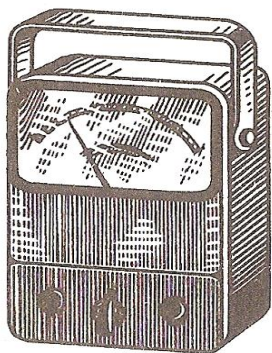


Fig. 3

Among the most common meters used there are the ohmmeter, the ammeter and the voltmeter. The ohmmeter is used to measure the value of resistance. It consists of a milliammeter calibrated to read in ohms, a battery and resistors. The meter is connected in parallel and the circuit is not opened when its resistance is measured. The readings on the scale show the measured value.

The ammeter is used to measure the value of current. When the ammeter is used the circuit should be opened at one point and the terminals of the meter should be connected to it. One should take into consideration that the positive terminal of the meter is connected to the positive terminal of the source; the negative terminal – to the negative terminal of the source. The ammeter should be connected in series. The readings on the scale show the measured value.

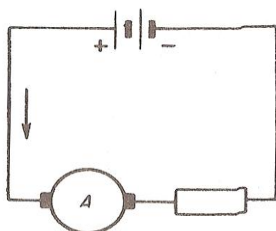


Fig. 4

### Vocabulary

meter	['mi:tə]	измерительный прибор
battery	['bætəri]	батарея
scale	[skeɪl]	шкала
readings		показания на шкале(прибора)
terminal	['tə:mi:nl]	клемма
positive	['pɒzɪtɪv]	положительный
negative	['negətɪv]	отрицательный
to measure	['meɪʒə]	измерять
to take into consideration		принимать во внимание
in this way	[weɪ]	таким путем, таким образом

### Вопросыизадания:

1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.  
b) Cover the left column and translate the Russian words back into English.

### 2. Translate into Russian:

1. **One** should take into consideration the difference between these circuits.
2. **One** should take into consideration that the ammeter is connected to the circuit in series.
3. What should **one** take into consideration using the ohmmeter?

### 3. Complete the sentences using the correct variant:

1. The ammeter is  
a) a common meter.  
b) an uncommon meter.
2. In order to measure the value of current  
a) the ohmmeter is used,  
b) the voltmeter is used.  
c) the ammeter is used.
3. A meter has  
a) positive terminals only.  
b) negative terminals only.  
c) positive and negative terminals.
4. When the ammeter is used  
a) the circuit should be opened.  
b) the circuit should not be opened.
5. The ammeter should be connected  
a) in series.

b) in parallel.

6. One should take into consideration that
- a) the positive terminal should be connected to the negative terminal.
  - b) the positive terminal should be connected to the positive terminal of the source.

**4. Complete these sentences using *while*. Follow the model.**

*Model:* The ammeter is used to measure the value of current... .

The ammeter is used to measure the value of current **while** the ohmmeter is used to measure the value of resistance.

- 1. The **ohmmeter** is used to measure the value of resistance ... .
- 2. The **ammeter** is connected in **series**... .
- 3. When the **ammeter** is used to measure the value of **current** the circuit **should be opened**... .

**5. Pair work. Put these questions to your groupmate. Let him/her answer them.**

- 1. What is the ammeter used for?
- 2. What is the voltmeter used for?
- 3. What is the ohmmeter used for?
- 4. What terminals does a meter have?
- 5. Should the measured circuit be opened when the voltmeter is used?
- 6. Should the measured circuit be opened when the ammeter is used?
- 7. In what way should the voltmeter be connected to the circuit?
- 8. In what way should the ammeter be connected to the circuit?
- 9. What is the difference between a voltmeter and an ammeter?
- 10. What common meters are used to measure the values in a circuit?

**6. Solve the following problems:**

- 1. Suppose the ammeter scale reads 1.9 amp, the voltmeter scale reads 2.4 V; how much is the value of resistance in the measured circuit?
- 2. Suppose the ohmmeter scale reads 75 ohms, the voltmeter scale reads 220 V; how much is the value of current in the measured circuit?
- 3. Suppose that you have a series circuit consisting of three resistors and a voltage source.  $R_1 = 0.18 \text{ ohm}$ ,  $R_2 = 1.15 \text{ ohms}$ ,  $R_3 = 2 \text{ ohms}$ ,  $I = 10 \text{ amp}$ . Find the voltage drop across each resistor; find the value of voltage in the circuit. Suppose  $R_1$  gets open. What does it result in?
- 4. Two resistors are connected in series.  $R_1 = 7,000$ ,  $R_2 = 2,200$ ,  $I = 110 \text{ amp}$ . Find the voltage drop across each resistor. Suppose no current passes through the circuit, what does it result from?

**7. Read the text and find in it the answers to the questions that follow it.**

**Wattmeter**

A wattmeter is used to measure the value of power. It is connected to the circuit directly. A wattmeter consists of coils: two fixed coils and a coil which moves in the magnetic field produced by the fixed coils. Wire used for the coils must have a high resistance; the fixed coils are

in series with the load, the moving coil is connected across the line in series with a resistance. When a wattmeter is used, the readings on its scale show the value of power being used.

- **What is the wattmeter used for?**
- **What does it consist of?**
- **In what way are the elements connected?**
- **What do the readings on the scale show?**

**8. Read the text and find in it the answers to the questions that follow it.**

**Voltmeter**

One of the important things that an engineer should take into consideration is «how much»? How much current is this circuit carrying? What is the value of voltage in the circuit? What is the value of resistance? In fact, to measure the current and the voltage is not difficult at all. One should connect an ammeter or a voltmeter to the circuit and read off the amperes and the volts.

Common ammeters for d.c. measurements are the ammeters of the magneto-electric system. In an ammeter of this type an armature coil rotates between the poles of a permanent magnet; but the coil turns only through a small angle. The greater the current in the coil, the greater the force, and, therefore, the greater the angle of rotation of the armature. The deflection is measured by means of a pointer connected to the armature and the scale of the meter reads directly in amperes.

When the currents to be measured are very small, one should use a galvanometer. Some galvanometers detect and measure currents as small as  $10^{-11}$  of an ampere per 1 mm of the scale.

A voltmeter is a device to be used for measuring the potential difference between any two points in a circuit. A voltmeter has armatures that move when an electric current is sent through their coils. The deflection, like that of an ammeter, is proportional to the current flowing through the armature coil.

A voltmeter must have a very high resistance since it passes only very small currents which will not disturb the rest of the circuit. An ammeter, on the other hand, must have a low resistance, since all the current must pass through it. In actual use the ammeter is placed in series with the circuit, while the voltmeter is placed in parallel with that part of the circuit where the voltage is to be measured.

In addition to instruments for measuring current and voltage, there are also devices for measuring electric power and energy.

- **What is the above article about?**
- **What is a voltmeter used for?**

**9. Choose the correct form:**

1. The aluminium plant is a (*consumer, consumption*) of the (*local, locally*) generated electric power.
2. The (*new, newly*) built shops are (*importance, important*) for the future of the power plant.
3. Nuclear energy is energy released during a nuclear (*reactor, reaction*) as a result of (*convertible, conversion*) of mass into energy.
4. Uranium is a (*comparison, comparable, comparatively*) rare element.
5. The most (*importance, important*) problems in (*atom, atomic*) power (*generator, generation*) are connected with the reactor. Reactor (*technologist, technology*) is still in (*progressive, progress*). The light-water reactor types seem most (*usefulness, usefully, useful*).

**10. Look up the meanings of these words in a dictionary, if necessary. How are they translated in the sentences below? Mind the word order.**

**a) place, iron, lift, house, light, heat, use, form, change, wire**

1. The conductor wires are placed high up.
2. Electromagnets lift iron weights.
3. The plastic box houses the conducting and the insulating elements of the apparatus.
4. The house is lighted and heated by solar energy.
5. The light went out. Light the candle, please.
6. After the metal was heated it changed its colour to a red heat.
7. Numerous changes are taking place in the uses of atomic energy.
8. Electric power is used universally.
9. The newly made invention has a great number of uses.
10. The wire and the source form a circuit.

**b) balance, amount, water, fuel, control, measure, cause, increase**

1. The fuel-and-energy balance is important for industry.
2. Conductivity increases with heating.
3. The machine should be re-fuelled.
4. The amount of power used in the world in a year amounts to 12,000 million tons of equivalent fuel.
5. Water barriers are crossed by submarine cables.
6. The instrument is foot-controlled by a pedal.
7. Force and motion go together; one is a cause, the other, a result.
8. An electromotive force causes the electrons to move.
9. Control of the apparatus is placed on the panel.
10. The volt is a measure of electromotive force.

**Практическое занятие № 15 - 16.**

**Тема 8. Passive Circuit Elements: Resistors. Rheostat /**

**Пассивные элементы электрической цепи: Резисторы. Реостат.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

**Теоретическая часть:**

**Resistors**

A resistor is one of the most common elements of any circuit. Resistors are used:

1. to reduce the value of current in the circuit;
2. to produce IR voltage drop and in this way to change the value of the voltage.

When current is passing through a resistor its temperature rises high. The higher the value of current the higher is the temperature of a resistor. Each resistor has a maximum temperature to

which it may be heated without a trouble. If the temperature rises higher the resistor gets open and opens the circuit.

Resistors are rated in watts. The watt is the rate at which electric energy is supplied when a current of one ampere is passing at a potential difference of one volt. A resistor is rated as a 1-W resistor if its resistance equals 1,000,000 ohms and its current-carrying capacity equals 1/1,000,000 amp, since

$P = E \times I = IR \times I = I^2 R$  where P – power is given in watts, R – resistance is given in ohms and I – current is given in amperes.

If a resistor has a resistance of only 2 ohms but its current-carrying capacity equals 2,000 amp, it is rated as a 8,000,000-W resistor.

Some resistors have a constant value – these are fixed resistors, the value of other resistors may be varied – these are variable resistors.

## Vocabulary

capacity	[kə'pæsɪtɪ]	емкость
power	['paʊə]	мощность
heat		теплота, нагрев
rate		скорость, степень
to produce	[prə'dju:s]	производить
to change	[tʃeɪndʒ]	менять(ся)
to vary	['veəri]	варьировать(ся)
low	[ləʊ]	низкий
high	[haɪ]	высокий
fixed	[fɪkst]	постоянный
any		(зд.) любой
variable	['veəriəbl]	переменный
the (more) ... the (more)		чем (больше) ... тем (больше)

## Вопросы и задания:

1.a) Cover the right column and read the English words. Translate them into Russian and check your translation.

b) Cover the left column and translate the Russian words back into English.

## 2. Read the words and put down their Russian equivalents:

[ 'temprətʃə]

temperature

\_\_\_\_\_



['enədʒi]	energy	_____
[wɒt]	watt	_____
['kɒnstənt]	constant	_____
[pou'tenʃəl]	potential	_____

**3. Translate into Russian using *чем ... тем*.**

1. The more one studies nature, the better one knows its laws.
2. The longer one learns, the more one knows.
3. The higher the atmosphere, the less is its pressure.
4. The heavier the object, the more work one has to do in order to lift it.
5. The greater the number of free electrons in any metal, the higher is its conductivity.

**4. Translate into Russian. Mind *no*.**

1. There is no energy in this machine.
2. No charges move through an open circuit.
3. No material is a perfect conductor of electricity.
4. No electric machinery is used without protection.
5. No special material is needed in this case

**5. Complete the sentences using the correct variant:**

1. A resistor is used
  - a) to measure the resistance.
  - b) to reduce the current.
  - c) to change the resistance.
  - d) to produce IR voltage drop.
2. When current passes through a resistor
  - a) its temperature drops.
  - b) its temperature rises.
3. Resistors are rated
  - a) in ohms.
  - b) in volts.
  - c) in watts.
4. Power is given
  - a) in amperes.
  - b) in watts.
5. Fixed resistors have
  - a) a constant value.
  - b) a variable value.
6. The value of a variable resistor
  - a) is fixed.
  - b) is varied.
7. A two-ohm resistor rated as a 8,000,000-W resistor
  - a) has a current-carrying capacity equal to 2,000 amp.
  - b) has a current-carrying capacity equal to 200 amp.

8. The higher the value of current,

- a) the lower is the temperature of a resistor.
- b) the higher is the temperature of a resistor.

**6. Complete the sentences using *while*.**

1. The value of a **fixed** resistor is constant ... .
2. **Current-carrying capacity** is given in amperes... .
3. The lower the value of current, the **lower** is the temperature of a resistor... .
4. An **electric source produces** energy ... .

**7. Pair work. Put these questions to your groupmate and let him/her answer them.**

1. What is a resistor used for?
2. When does the temperature of a resistor rise?
3. What element is used to change the value of voltage?
4. How are resistors rated?
5. What types of resistors do you know?
6. When does a resistor get open?
7. What does an open resistor result in?
8. What is the difference between a fixed resistor and a variable resistor?
9. How much is the current-carrying capacity of a two-ohm resistor?
10. What resistors have a variable value?

**8. Solve the problem:**

What is the maximum current for a resistor having a 5-watt capacity and a resistance of 20,000 ohms?

**9. Pair work. Think of three similar problems of your own. Ask your groupmate to solve them.**

**10. Read the text and find in it the answers to the questions that follow it.**

**Rheostat**

A rheostat is a resistor whose resistance value may be varied. Thus, a rheostat is a variable resistor.

It is used to change the resistance of circuits, and in this way to vary the value of current.

A rheostat consists of a coil and a switch. Take into consideration that wire used for the coil must have a very high resistance. When a rheostat is used its terminals are connected in series with the load. The switch is used to change the length of the wire through which the measured current passes. The resistance may be changed to any value from zero to maximum.

The longer the rheostat wire used in the circuit, the greater is the resistance.

- **What type of resistor is a rheostat?**
- **What is a rheostat used for?**
- **In what way does a rheostat vary the value of current?**
- **What elements does a rheostat consist of?**
- **In what way are the terminals connected with the load?**
- **What is the function of the switch?**

## 11. Translate the sentences in writing. Mind *one*. Follow the model.

*Model:*

Nuclear energy is one of the forms of energy. Ядерная энергия – одна из форм энергии (*значение one* – ...один из ...).

The old turbine was a water turbine and the new one is a steam turbine. Старая турбина была водной турбиной, а новая – паровая турбина (*значение one* – заменитель ранее упомянутого существительного).

One should control the chain reaction. Следует контролировать цепную реакцию (*значение one* – неопределенно-личное подлежащее).

1. The second sputnik was launched about a month after the first one.
2. There are many insulating materials from which one may choose.
3. Some substances are efficient conductors, others, poor ones.
4. One uses special devices to measure current, voltage, and resistance.
5. The new method proved to be much more efficient than the old one.
6. One knows that these installations do not operate on nuclear power.
7. One must choose only one of those variants.

## 12. Translate these negative sentences into Russian. What is the difference between the English constructions and the Russian ones?

1. No charges can move in an open circuit.
2. Nothing less than a map of the Universe is planned by the research.
3. No special equipment is necessary to carry out the experiment.
4. A current which does not change its polarity is called a direct current.
3. A dry battery is a type of a small battery containing no free liquid.
6. The efficiency of a machine can never be greater than unity; it is often given as a percentage.
7. A fast reactor is a reactor in which little or no moderator is used and in which, therefore, the nuclear fissions are caused by fast neutrons.
8. Electrically safe locations are those where conditions causing extremely high danger of electric shock do not exist.
9. No electric device has only advantages. All of them have also disadvantages.

### Практическое занятие № 17 – 18.

#### Тема 9. Electronic Components: Electric Cells. Capacitors/

#### Электронные компоненты: Электрические элементы. Конденсаторы.

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:**навыками профессионального общения на английском языке;способами пополнения профессиональных знаний из оригинальных источников на английском языке.  
**Актуальность темы:** обусловлена необходимостью овладения УК-4.

### Теоретическаячасть:

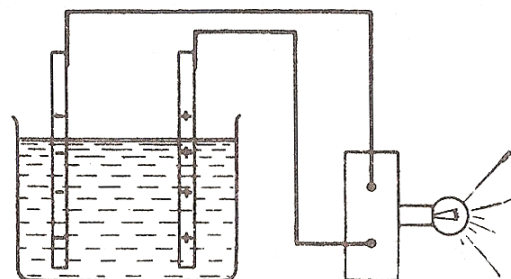
#### Electric Cells

An electric cell is used to produce and supply electric energy. It consists of an electrolyte and two electrodes. Electrodes are used as terminals, they connect the cell to the circuit – current passes through the terminals and the bulb lights.

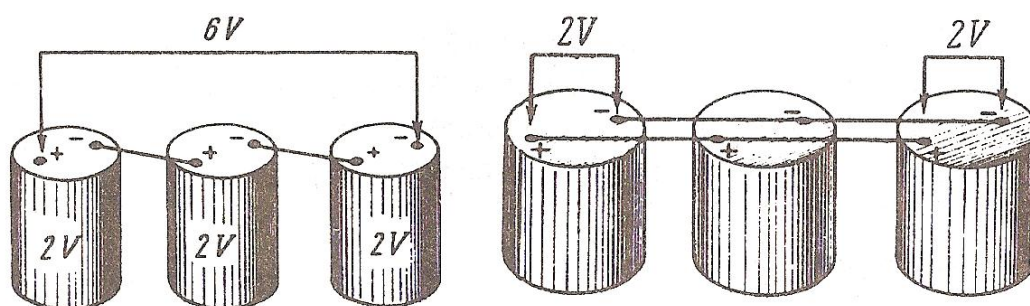
Cells can be connected in series, in parallel and in series-parallel. In order to increase the current capacity cells should be connected in parallel. In order to increase the voltage output cells should be connected in series. In case a battery has a large current capacity and a large voltage output, its cells are connected in series-parallel.

When cells are connected in series the positive terminal of one cell is connected to the negative terminal of the second cell, the positive terminal of the second cell – to the negative terminal of the third ... and so on.

When cells are connected in parallel their negative terminals are connected together and their positive terminals are also connected.



*Fig 5.*



In case a cell has a trouble it stops operating or operates badly. This cell should be substituted by another one.

#### Vocabulary

cell	[sel]	элемент
output	[ˈaʊtput]	емкость, мощность
bulb	[bʌlb]	электрическая лампа
to light	[laɪt]	зажигать, освещать
to increase	[mˈkriːs]	увеличивать(ся), возрастать

to substitute		заменять
... and so on		и так далее
capacitor	[kə'pæsɪtə]	конденсатор
insulator	[ˈɪnsjuleɪtə]	изолятор
frequency	[ˈfri:kwənsi]	частота
distance	[ˈdɪstəns]	расстояние
advantage	[əd'vɑ:ntɪdʒ]	преимущество
disadvantage		недостаток
plate		анод (лампы)
part	[pɑ:t]	часть
to apply	[ə'plai]	прилагать, применять
to move	[mu:v]	двигать(ся)
to prevent		предотвращать
reason		причина
for this reason		по этой причине
besides		кроме того
provided that		при условии что

### Вопросы и задания:

**1.a) Cover the right column and read the English words. Translate them into Russian and check your translation.**

**b) Cover the left column and translate the Russian words back into English.**

### 2. Read the words and put down their Russian equivalents:

[ɪ'lektroʊd]	electrode	_____
[ɪ'lektrolaɪt]	electrolyte	_____
[stɑ:t]	start	_____
[ˈɒpəreɪt]	to operate	_____
[ˈaɪsəleɪt]	to isolate	_____

**3. Translate into Russian and put down the Russian equivalents. Then translate the Russian equivalents back into English (orally).**

- |                                |       |
|--------------------------------|-------|
| a. current capacity            | _____ |
| resistor temperature           | _____ |
| voltage output                 | _____ |
| current value                  | _____ |
| b.to start supplying energy    | _____ |
| to stop operating              | _____ |
| to start lightening            | _____ |
| to stop lightening the bulbs   | _____ |
| c. to operate well             | _____ |
| to operate badly               | _____ |
| to increase the voltage output | _____ |
| to substitute the resistor     | _____ |

**4. Read and translate into Russian. Mind *one*:**

1. The element has a trouble. It operates badly. It should be substituted by a new *one*.
2. The element with a trouble was substituted with a new *one* and the cell started operating.

**5. Complete the sentences using the correct variant:**

- |                                           |                                                                                                                                                                                                             |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. A cell is used                         | a) to increase the voltage output.<br>b) to reduce the current capacity.<br>c) to supply electric energy.                                                                                                   |
| 2. The terminals of a cell are used       | a) to conduct current.<br>b) to increase voltage.<br>c) to connect the battery to a circuit.                                                                                                                |
| 3. When cells are connected in series     | a) all the positive terminals are connected together.<br>b) all the negative terminals are connected together.<br>c) the positive terminal of one cell is connected to the negative terminal of the second. |
| 4. Cells are connected in series in order | a) to increase the current capacity.<br>b) to increase the voltage output.                                                                                                                                  |

5. In order to increase the current capacity
- a) cells are connected in series,
  - b) cells are connected in parallel.

**6. Answer the following questions:**

1. What is a cell used for?
2. What does a cell consist of?
3. What is the function of the terminals?
4. In what way are cells connected in order to increase the voltage output?
5. In what way are cells connected in order to increase the current capacity?
6. In what way are the terminals of series cells connected?
7. In what case does a cell stop operating?
8. What should be done in case it stops operating?

**7. Solve these problems:**

1. Suppose that you have four electric cells. The current capacity of each cell equals 1.5 amp, the voltage output equals 2 V.
  - a) Connect the cells in series. In what way should it be done?
  - b) Connect the battery to a circuit whose resistance value equals 15 ohms. What is the value of current in the circuit?

2. Suppose that you have three cells of the same value.
  - a) Connect them in parallel. In what way should it be done?
  - b) Connect the second battery to the same circuit: what will it result in?

Suppose that one of the cells stops operating. What should be done in this case?

**8. Read the text and find in it the answers to the questions that follow it.**

An electric cell supplies electric energy provided its electrodes are of different materials. In case the electrodes are of the same material they become charged but there is no difference of potential across the terminals. Iron and zinc plates are commonly used for producing negative electrodes since these materials produce a high charge. Carbon is commonly used to produce positive electrodes.

The voltage output of cells in use nowadays is from 1 to 2 V. The value of the output depends only on the materials used for the electrodes. Besides, it depends on the electrolyte of a cell. It does not depend on the size of a cell and its construction, while the current capacity of a cell depends on the size of the electrodes. The larger the size of the electrodes, the more current capacity they can supply. When the size of the electrodes is increased the current capacity also increases while the voltage output does not increase. Such is the relation between the size of the electrodes and the current capacity.

- What element is described in the text?
- In what case does a cell supply energy?
- What materials are commonly used for producing negative electrodes?
- Explain why iron and zinc are used.
- What is the voltage output of cells in use nowadays?
- What does the value of the output depend on?
- What is the relation between the size of the electrodes and the current capacity?
- Give the title to the text.

## 9. Read and translate:

### Capacitors

A capacitor is one of the main elements of a circuit. It is used to store electric energy. A capacitor stores electric energy provided that a voltage source is applied to it.

The main parts of a capacitor are metal plates and insulators. The function of insulators is to isolate the metal plates and in this way to prevent a short.

In the diagram one can see two common types of capacitors in use nowadays: a fixed capacitor and a variable one. The plates of a fixed capacitor cannot be moved; for this reason its capacity does not change. The plates of a variable capacitor move; its capacity changes. The greater the distance between the plates, the less is the capacity of a capacitor. Variable capacitors are commonly used by radiomen; their function is to vary the frequency in the circuit. Fixed capacitors are used in telephone and radio work.

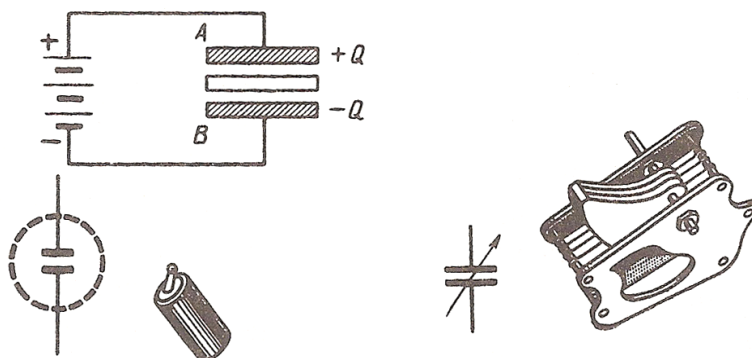


Fig. 8 Fig. 9

Fixed capacitors have insulators produced of paper, ceramics and other materials; variable capacitors have air insulators. Paper capacitors are commonly used in radio and electronics; their advantage is their high capacity: it may be higher than 1,000 picofarad.

Besides, electrolyte capacitors are highly in use. They also have a very high capacity: it varies from 0.5 to 2,000 microfarad. Their disadvantage is that they change their capacity when the temperature changes. They can operate without a change only at temperatures not lower than  $-40^{\circ}\text{C}$ .

Common troubles in capacitors are an open and a short. A capacitor stops operating and does not store energy in case it has a trouble. A capacitor with a trouble should be substituted by a new one.

## 10. Translate into Russian and write down the Russian equivalents. Then translate the Russian variants back into English (orally).

a. paper insulators

---

air insulators

---

electrolyte capacitors

---

advantages of electrolyte capacitors

---

disadvantages of air insulators

---



b. cells under test	_____
capacitors in common use nowadays	_____
radio sets under test	_____
PC in common use nowadays	_____
c. a radioman	_____
radio work	_____
radio parts	_____
telephone and radio work	_____

**11. Translate into Russian. Mind *provided that*.**

1. A circuit operates well provided that it does not have any trouble.
2. The bulb lights provided that the circuit is connected to the cell.
3. A cell supplies energy provided that its electrodes are of different materials.

**12. Complete these sentences using the correct variant:**

- |                                                               |                                                                                                           |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 1. A capacitor is used                                        | a) to supply voltage.<br>b) to increase the voltage output.<br>c) to store energy.                        |
| 2. The main parts of a capacitor are                          | a) insulators only.<br>b) metal plates only.<br>c) metal plates and insulators between them.              |
| 3. The function of insulators is                              | a) to store energy.<br>b) to isolate the metal plates.<br>c) to prevent a short between the metal plates. |
| 4. The capacity of a capacitor depends on                     | a) the size of the plates.<br>b) the distance between the plates.<br>c) the material of the insulators.   |
| 5. The capacity of a fixed capacitor                          | a) is constant.<br>b) is varied.                                                                          |
| 6. The plates of a variable capacitor                         | a) can be moved.<br>b) cannot be moved.                                                                   |
| 7. In order to charge a capacitor a voltage source is applied | a) to the metal plates.<br>b) to the insulators.                                                          |

- |                                                 |                                                                                |
|-------------------------------------------------|--------------------------------------------------------------------------------|
| 8. The greater the distance between the plates, | a) the greater is the capacity of a capacitor.<br>b) the less is the capacity. |
| 10. Electrolyte capacitors have                 | a) a very low capacity.<br>b) a very high capacity.                            |
| 11. In case a capacitor has a trouble           | a) it operates.<br>b) it stops operating.                                      |

**13. Complete these sentences using *while*.**

1. The plates of a **fixed** capacitor **cannot** be moved to vary the capacity ....
2. The capacity of a **variable** capacitor is **varied**... .
3. **Electrolyte** capacitors **change** their capacity when the temperature changes... .
4. The **less** the distance between the plates, the **greater** is the capacity... .
5. When a capacitor has **no** trouble it **stores** energy... .

**14. Pair work. Put these questions to your groupmate and ask him/her to answer them.**

1. What is a capacitor used for?
2. What are the main parts of a capacitor?
3. What is the function of insulators?
4. What does the capacity of a capacitor depend on?
5. What is the difference between a fixed capacitor and a variable one?
6. What should be done in order to change a capacitor?
7. What is the relation between the value of capacity and the distance of plates?
8. What type of insulators have variable capacitors?
9. What should be done in case a capacitor has a trouble?

**15. Solve these problems:**

Draw a diagram of a circuit consisting of two resistors and two capacitors connected in parallel. A battery of four cells is applied to the circuit. Two ammeters are used: one is connected to the main line, the other – to a parallel branch. What is the function of each element? In what way can one increase the value of resistance in the circuit?

Suppose one of the branches stops operating. What does it result from?

**16. Read the text and find in it the answers to the questions that follow it.**

The capacity of a capacitor is measured in farads. A capacitor has a capacity of one farad when a charge of one coulomb increases the potential between its plates by one volt.

The capacity depends on four things:

first, the higher the voltage used to charge the capacitor the more energy it will store;

second, the larger the size of plates and the greater their number the more energy will be stored;

third, the closer are the positive and negative plates the greater is the charge;

fourth, some insulators store greater charge than others.

- What does the capacity of a capacitor depend on?
- Give the title to the text.

**17. State the tense forms of the following verbs.**

*Model:* link – Present Indefinite (active voice)  
does not link – Present Indefinite (negative form)

is circulating, have not moved, transmits, emitted, did not emit, has burnt, will not operate,  
act

**Практическое занятие № 19 – 20**  
**Тема 10. Current: Types of Current. Coupling /**  
**Электрический ток: Типы тока. Муфта**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

**Теоретическая часть:**  
**Types of Current**

Current is a flow of electricity through a circuit. Let us consider two main types of current: direct and alternating. A direct current (d.c.) flows through a conducting circuit in one direction only. It flows provided a direct voltage source is applied to the circuit.

An alternating current (a.c.) is a current that changes its direction of flow through a circuit. It flows provided an alternating voltage source is applied to the circuit. Alternating current flows in cycles. The number of cycles per second is called the frequency of the current. In a 60-cycle alternating current circuit the current flows in one direction 60 times and in the other direction 60 times per second.

It is easy to transform a.c. power from one voltage to another by a transformer. Transformers are also used to step down the voltage at the receiving point of the line to the low values that are necessary for use.

When necessary a.c. can be changed into d.c. but this is seldom necessary.

**Vocabulary**

alternating	[,ɔ:ltə'neɪtɪŋ]	переменный
direct		прямой
direction		направление
flow	[fləʊ]	течение
necessary	[ˈnesɪsəri]	необходимый
to consider		рассматривать

use	[ju:s]	использование
inductance		индуктивность
coil	[kɔɪl]	катушка
size	[saɪz]	размер
unit	[ˈju:nɪt]	единица
fast	[fa:st]	быстрый
mutual	[ˈmju:tʃuəl]	взаимный
to induce	[ɪnˈdju:s]	индуктировать
to provide	[prəˈvaɪd]	обеспечить
to touch	[tʌtʃ]	касаться
to bring		приносить, подносить
that is		то есть
definite	[ˈdefɪnɪt]	определенный

### Вопросы и задания:

1.a) Cover the right column and read the English words. Translate them into Russian and check your translation.

b) Cover the left column and translate the Russian words back into English.

### 2. Read the words and write down their Russian equivalents:

[ˈsaɪkl]	cycle	_____
[taɪp]	type	_____
[pəˈsekənd]	per second	_____

### 3. Put down the Russian for:

one time	_____	direct voltage source	_____
five times	_____	alternating voltage source	_____
sixty times	_____	direction of flow	_____

### 4. Complete the sentences using the correct variant:

1. D.c. is a current that \_\_\_\_\_ a) changes its direction of flow.

- |                                      |                                                                                                                                                      |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | b) flows in one direction.                                                                                                                           |
| 2. A.c. flows provided               | a) a direct voltage source is applied.<br>b) an alternating voltage source is applied.                                                               |
| 3. In an alternating current circuit | a) current flows in one direction 60 times per second.<br>b) current flows in one direction 60 times and in the other direction 60 times per second. |
| 4. A.c.                              | a) can be changed into d.c.<br>b) cannot be changed into d.c.                                                                                        |

**5. Complete these sentences using *while*.**

1. An **alternating** current **changes** its direction of flow ... .
2. A **direct** current flows provided a **direct** voltage source is applied ... .

**6. Answer the following questions:**

1. What is current?
2. What types of current do you know?
3. When does a direct current flow?
4. What type of current is called an alternating current?
5. What type of current is called a direct current?
6. What is called the frequency of current?
7. What device is used to transform a.c. power from one voltage to another?
8. Is it often necessary to change a.c. into d.c.?

**7. Read about frequency, answer the question that follows.**

**Frequency**

The number of cycles per second is the frequency of an alternating current. There are two frequencies: the standard for Europe is 50 cycles per second while the standard for the USA is 60 cycles per second. A standard frequency has a great advantage since different systems can be interconnected.

- **What is the advantage of a standard frequency?**

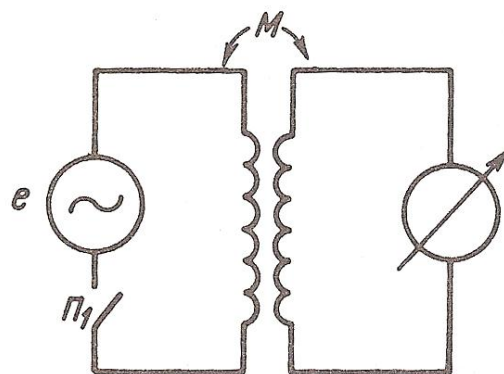
**8. Read and translate:**

**Inductance and Mutual Inductance**

Any conductor has some definite value of inductance. The inductance of a conductor shows how well it can provide induced voltage.

Elements of a circuit with a definite value of inductance are coils of wire called *inductors*. The inductance of a coil depends upon its size and material. The greater the number of turns of a coil, the higher is its inductance. An iron core also increases the value of inductance. Coils of this type are used for low-frequency currents while coils with an air core are used for high-frequency currents.

Two coils A and B are brought close together and a source of varying current is applied to coil A. If a measuring device is connected across the terminals of coil B it will be found that a voltage is induced in this coil though the two coils do not touch. The secondary voltage, that is the voltage in coil B, is called induced voltage and energy from one coil to the other transfers by induction. The coil across which the current is applied is called *the primary*; that in which voltage is induced is called *the secondary*. The primary and the secondary coils have **mutual inductance**. Mutual inductance is measured in the same units as inductance, that is in henries.



Thus, when a rate of change of one ampere per second in the primary coil will produce one volt in the secondary coil, the two coils have one henry of mutual inductance.

It should be taken into consideration that induction by a varying current results from the change **in current** not in the current **value**. The faster the current changes, the higher the induced voltage.

**9. Translate into Russian and put down the Russian equivalents. Then translate them back into English (orally).**

- |                       |       |
|-----------------------|-------|
| a. definite value     | _____ |
| primary coil          | _____ |
| wire coil             | _____ |
| mutual inductance     | _____ |
| varying current       | _____ |
| one ampere per second | _____ |

**b.1. Coils of wire are called inductors.**

\_\_\_\_\_

**2. Two coils are brought close together.**

\_\_\_\_\_

**3. A source of current is applied to one of the coils.**

\_\_\_\_\_

**4. Mutual inductance is measured in henries.**

\_\_\_\_\_

**10. Which of the words are nouns and which are verbs?**

resistor, resist, resistance; induce, induction, inductor, inductance; conductor, conduct, conductance; compute, computer

**11. Complete the sentences using the correct variant:**

- |                                                 |                                                                                            |
|-------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1. Any conductor has                            | a) some definite value of resistance.<br>b) some definite value of inductance.             |
| 2. Any conductor can provide                    | a) electric power.<br>b) induced voltage.                                                  |
| 3. Elements with a definite value of inductance | a) are called inductors.<br>b) are called coils.<br>c) are called sources.                 |
| 4. The inductance of a coil depends upon        | a) its size.<br>b) its core.<br>c) its material.<br>d) its number of turns.                |
| 5. An iron core                                 | a) increases the value of inductance.<br>b) decreases the value of inductance.             |
| 6. The value of mutual inductance is measured   | a) in watts.<br>b) in henries.                                                             |
| 7. Induction by a varying current               | a) results from the change in current.<br>b) results from the change in the current value. |
| 8. The faster the current changes,              | a) the lower is the induced voltage.<br>b) the higher is the induced voltage.              |

**12. Complete these sentences using *while*.**

1. An **air** core **decreases** the value of inductance... .
2. An **iron** core is used for **low**-frequency currents ... .
3. The coil in which voltage is **induced** is called the **secondary**... .

**13. Answer the following questions:**

1. What value of inductance do conductors have?
2. What is the function of inductors?
3. What are elements with a definite value of inductance called?
4. What does the inductance of a coil depend upon?
5. How does the inductance of a coil depend upon the material of its core?
6. In what units is the value of mutual inductance measured?
7. What does induction by a varying current result from?
8. What is the relation between the current changes and the value of induced voltage?
9. What is the unit of resistance?
10. What is the unit of potential difference?
11. For what type of current is an air core used?
12. What is the relation between the number of turns of a coil and its inductance value?

**14. Pair work. Tell your groupmate about mutual inductance. Let him/her put the questions of Exercise 13 to you and answer them.**

**15. Give negative answers to the following questions. Follow the model.**

*Model:* Will the circuit be powered by the DC supply? No, it will not.  
The circuit will not be powered by the DC supply. It will be powered by the AC supply.

1. Is the energy industry decreasing its activity?
2. Do nuclear power stations produce smoke?
3. Does the radioactive pollution from a reactor have only one form?
4. Is the result of pollution measurable by weight and volume?

**16. In the following examples the verb *to be* has different meanings. What are they?**

1. These stations can be linked up into a network.
2. It is advisable to link up these stations into a single network.
3. These stations are to be linked up into a single network.
4. Will the stations be linked up into a single network?
5. They are linking up the stations into a network.

### Coupling

When circuits are indirect-inductively coupled energy is transferred from one circuit to another using electromagnetic field of the inductance through which a varying current is flowing. The coupling device is a transformer. It is not in series with the elements of the circuit, therefore the coupling is indirect. The transformer consists of two windings: the primary and the secondary. The primary circuit is connected to the voltage source, the secondary – to the load circuit.

The coupling may be tight and loose. In case the coils of the coupling element are close together, the coupling is tight. In case the coils are separated the coupling is loose. In the loose coupling the mutual inductance is small compared with the self-inductance.

### Vocabulary

device	[di'veis]	прибор
field	[fi:ld]	поле
loose	[lu:s]	свободный, нежесткий
tight	[taɪt]	плотный
self-inductance		самоиндукция
to couple	[ˈkʌpl]	соединять, сцеплять
to separate	[ˈsepəreɪt]	отделять
to transfer	[træns'fə:]	переносить



therefore	[ 'ðeəfɔ:]	поэтому
filter	[ 'filtə]	фильтр
bypass	[ 'baɪpɑ:s]	шунт
choke	[tʃouk]	дроссель
high-pass	[ 'haɪpɑ:s]	высокопроходной
low-pass	[lou'pɑ:s]	низкопроходной
to oppose	[ə'pouz]	оказывать сопротивление
on the other hand		с другой стороны
choke coil		дроссельная катушка
bypass coil		шунтовая катушка
bypass condenser		шунтирующий конденса- тор
high-pass filter		фильтр верхних частот
low-pass filter		фильтр низких частот
opposing coils		противодействующие вит- ки
opposed current		противоток

**17. a) Cover the right column and read the English words. Translate them into Russian and check your translation.**

**b) Cover the left column and translate the Russian words back into English.**

**18. Put down the words with the opposite meaning and translate them into Russian.**

*Model:* inconstant – constant

incompetent –	_____	inactive –	_____
incorrect –	_____	inconsistent –	_____
indirect –	_____	unable –	_____
indefinite –	_____	inability –	_____

**19. Put down Russian equivalents of these word combinations. Then translate them back into English.**

loose coupling– \_\_\_\_\_

tight coupling– \_\_\_\_\_

transformer coupling– \_\_\_\_\_

electromagnetic fields– \_\_\_\_\_

**20. Complete the sentences using the correct variant:**

- |                                                           |                                                                                                                                                                                                         |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. The circuit connected to the voltage source is called  | a) the secondary circuit.<br>b) the primary circuit.                                                                                                                                                    |
| 2. The circuit receiving its energy through a coupling is | a) the primary circuit.<br>b) the secondary circuit.                                                                                                                                                    |
| 3. The function of a coupling element is                  | a) to separate the circuits.<br>b) to transfer energy.<br>c) to prevent a short between the circuits.                                                                                                   |
| 4. When the coupling is tight                             | a) the coils are separated.<br>b) the coils are close together.                                                                                                                                         |
| 5. When the coils are close together                      | a) the coupling is loose.<br>b) the coupling is tight.                                                                                                                                                  |
| 6. The circuits are indirectly coupled when               | a) the coupling element is common to both circuits and is in series with their other elements.<br>b) the coupling element is not common to the circuits and is not in series with their other elements. |

**21. Complete these sentences using *while*.**

- The circuit **receiving** energy is the secondary circuit... .
- The coupling is **loose** when the coils are **separated**... .
- When the coupling element is **not common** to the circuits and not in series with their elements, the circuits are indirectly coupled ... .

**22. Read and translate:**

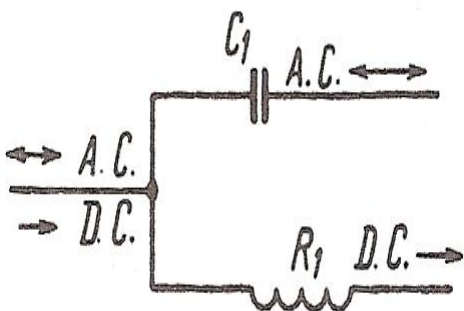


Fig. 13

**Filters**

This filter is used to separate direct current from alternating current. It consists of a capacitor and a choke coil. Direct current cannot flow through the capacitor since its insulators oppose the flow of direct current. Therefore, it flows through the choke coil. Its windings easily pass direct current through them. Alternating current, on the other hand, passes through the capacitor, since it cannot easily pass through the choke coil. In

this way the direct and the alternating currents are separated.

**I. A high-pass filter** is used to pass high frequencies and to prevent the flow of low frequencies. It consists of a condenser and an inductance coil. The condenser passes currents of high frequencies and opposes the flow of low frequency currents. Low frequencies must be returned to the source and the inductance coil is used for a bypass.

**II. A low-pass filter** is used to pass low frequencies and to prevent the flow of high frequencies. It consists of an inductance coil and a condenser. The inductance coil passes low frequencies and opposes the flow of high frequencies. To return the high frequencies back to the source, a condenser is used for a bypass. Its capacity opposes the flow of low frequencies through it.

### 23. Complete the sentences using the correct variant

- |                                      |                                                                                                                                                    |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. A filter is used in order         | a) to separate d.c. from a.c.<br>b) to transfer energy from the primary to the secondary.<br>c) to separate low frequencies from high frequencies. |
| 2. A filter consists of              | a) a resistor and a transformer.<br>b) a choke coil and a capacitor.<br>c) an inductance coil and a capacitor.                                     |
| 3. Direct current easily passes      | a) through a choke coil.<br>b) through a capacitor.                                                                                                |
| 4. Alternating current easily passes | a) through a capacitor.<br>b) through a choke coil.                                                                                                |
| 5. A low-pass filter is used         | a) to pass high frequencies and to prevent the flow of low frequencies.<br>b) to pass low frequencies and to prevent the flow of high frequencies. |
| 6. In a low-pass filter              | a) a capacitor is used as a bypass.<br>b) an inductance coil is used as a bypass.                                                                  |
| 7. In a high-pass filter             | a) an inductance coil is used as a bypass.<br>b) a capacitor is used as a bypass.                                                                  |

### 24. Complete these sentences using *on the other hand*. Follow the model.

*Model:* Direct current passes through the choke coil of a filter; alternating current, *on the other hand*, passes through the capacitor.

1. A **low-pass** filter is used to pass **low** frequencies... .
2. In a **high-pass** filter an **inductance** coil is used as a bypass... .
3. A **high-pass** filter is used to prevent the **flow** of low frequencies ... .
4. **Alternating** current passes through a **capacitor**... .

### 25. Answer the following questions:

1. What is a filter used for?
2. What does a filter consist of?
3. What is the function of a low-pass filter?
4. What is the function of a high-pass filter?
5. What is the difference between a low-pass filter and a high-pass filter?
6. What elements are used as a bypass?
7. What is the function of a choke coil?
8. What is the function of an inductance coil?

**26. Draw schemes of a choke input filter and a capacity input filter. Describe the schemes and the function of the filters.**

**27. Read the text and answer the question that follows it.**

### Choke Input Filter and Capacity Input Filter

<b>rectify</b>	[ 'rektɪfaɪ ]	выпрямить
<b>eliminate</b>	[ ɪ'lɪmɪneɪt ]	устранить

A choke input filter and a capacity input filter are used in rectifiers. Filters of this kind are connected to rectifiers in order to eliminate pulsations produced in rectified current.

1) **Choke input filter** is a low-pass filter. A choke coil is in series with the rectifier output.

2) **Capacity input filter** is a high-pass filter. A capacitor is connected directly across or in parallel with the rectifier output.

- **What is the difference between a choke input filter and a capacity input filter?**

**28. Think of questions about the following sentences:**

1. The first central electric power station was installed in 1882.

When \_\_\_\_\_ ?

What station \_\_\_\_\_ ?

2. Radioactive wastes damage man and his generation.

Who(m) \_\_\_\_\_ ?

What wastes \_\_\_\_\_ ?

3. The use of water power and wind power began more than 2,000 years ago.

The use of what kind of power \_\_\_\_\_ ?

When \_\_\_\_\_ ?

4. The cooling water is drawn from a source and passed through the condenser.

What kind of water \_\_\_\_\_ ?

What \_\_\_\_\_ from?

What \_\_\_\_\_ through?

**29. Complete the sentences using the required prepositions: *according to, because of, through, of, at, for, by, during, in, in case of, into*:**

1. The power transmitted ... a wire is the product ... the voltage times the amperage. ... resistive losses, it is desirable to transmit power ... low amperage and high voltage. ... doubling the voltage, the capability ... a given circuit can be quadrupled.
2. Devices are classed ... the operation they are intended ... .
3. This type ... aerial is useful and popular ... its small size.
4. ... a faulty device its readings are not to be relied ... .
3. Coal and oil contain sulfur ... concentrations ... a few percent.
6. As these fuels are burned, the sulfur is converted ... sulfur-dioxide gas. ... the operation ... a plant, the sulfur-dioxide and other products are discharged ... the air stacks, some ... which are about 303 metres high.

**30. Complete the sentences using the required conjunctions (*both ... and, than, until, since, provided, before*).**

1. Some devices work equally well ... on direct ... alternating current.
2. The set is used in regions without electricity ... it operates without a battery.
3. One should turn the knob ... a click is heard.
4. ... one flies to other planets one should collect as much information as possible about them.
3. Glass becomes a conductor ... it is heated to a red hot.
6. A small current is cheaper ... great because the wires need not be so thick.

**Практическое занятие № 21 – 22.**

**Тема 11. Components of Electric Circuits:**

**Electromagnetic Relay. Electron Tubes /**

**Компоненты электрических цепей: Электромагнитное реле.**

**Электронные лампы.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:**навыками профессионального общения на английском языке;способами пополнения профессиональных знаний из оригинальных источников на английском языке.  
**Актуальность темы:** обусловлена необходимостью овладения УК-4.

### **Теоретическая часть: Components of Electric Circuits**

The main components of any circuit are devices that produce and utilize electric energy. They are: 1. power sources, 2. utilizing loads, 3. connecting conductors.

The most common power sources are electric generators and primary cells. Electric generators convert chemical energy into electric energy.

Loads include electric heaters, electric motors, incandescent lamps, etc. Motors convert electric energy into mechanical, incandescent lamps and heaters convert electric energy into light and heat. Utilizing devices or loads convert electric energy into thermal, mechanical or chemical energy.

Electric power is delivered from power sources to loads by electric wires. According to their material, wires can be aluminium, copper, steel, etc.

Besides, electric circuits use different types of switches, protection devices (relays and fuses), and meters (ammeters, voltmeters, wattmeters, etc.).

#### **Vocabulary**

incandescence	[,ɪnkæn'desns]	накал, накаливание
incandescent lamp	[,ɪnkæn'desntləmp]	лампа накаливания
copper		медь
steel		сталь
to convert	[kən've:t]	преобразовывать
to deliver	[dɪ'livə]	питать, подавать
according to	[ə'kɔ:dɪŋtə]	согласно
etc. = et cetera	[,et'setərə]	и так далее
efficiency	[ɪ'fɪʃənsi]	отдача, эффективность
ignorance		незнание, неведение
dependence		зависимость
cost		стоимость
loss		потеря
length		длина
to ignore		не принимать во внимание

to depend (on)		зависеть (от)
to exceed	[ɪk'si:d]	превышать
long		длинный
exceedingly		чрезвычайно, очень
per cent		процент

### **Вопросыизадания:**

**1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.**

**b) Cover the left column and translate the Russian words back into English.**

### **2. Translate into Russian:**

**a.** convertible values, protected power source, various fuses, variable resistors, chemical cells

**b.** cells delivering electric power  
generator converting mechanical energy  
circuits utilizing common fuses

**c.** Primary cells deliver electric power.  
Different kinds of energy can be converted into electric energy.  
Protection devices are utilized in any circuit.

### **3. Complete the sentences using the correct variant:**

- |                                                 |                                                                      |
|-------------------------------------------------|----------------------------------------------------------------------|
| 1. The main components of electric circuits are | a) loads and wires.<br>b) power sources, load and wires.             |
| 2. Power sources are used                       | a) to produce electric energy.<br>b) to deliver it to the loads.     |
| 3. Electric conductors are used                 | a) to connect the circuit elements.<br>b) to deliver electric power. |
| 4. Protection devices are utilized              | a) in some circuits.<br>b) in any circuit.                           |
| 5. A switch is utilized                         | a) in some circuits.<br>b) in any circuit.                           |

### **4. Answer these questions:**

1. What are the main components of an electric circuit?
2. What is the function of an electric source?
3. What is the function of a load?
4. What is the function of wire conductors?
5. What other devices are utilized in a circuit?

5. Say a few words about your electrical engineering laboratory. Say what power sources and what loads are utilized there. Have a talk with your groupmate about their types and their operation.
6. Read and translate:

### Electric Lines and Their Efficiency

Wires are used to deliver electric power and to interconnect different components of electrical installations. Conductors used for electric wiring are commonly produced of copper and aluminium. Aluminium is widely used nowadays due to its low cost. Copper is also widely used in electrical engineering but its cost is much higher.

Wires connecting the components of various installations may be insulated. They may also be used without insulation. Since in short lengths of wire power loss is exceedingly low one can ignore it. In long wires (longer than 10 m), power loss cannot be ignored since it is rather high. Power loss in a line should not exceed a definite value. If this value is exceeded the line becomes inefficient.

One should know that the efficiency of a line is not constant – it may change. The value of the line efficiency depends on the load: the greater the load the lower is the line efficiency. At voltage losses of 2 to 5 per cent the efficiency of a line is 98-95 per cent. Protecting devices, fuses and relays are used to protect the circuit against overcurrents and short-circuits.

7. Put down the nouns corresponding to these verbs. Follow the model.

*Model:* to act – action

to ignore– _____	to produce– _____
to depend– _____	to use– _____
to cost– _____	to lose– _____

8. Translate into Russian:

a. line efficiency \_\_\_\_\_

voltage loss \_\_\_\_\_

power station \_\_\_\_\_

b. interdependent values \_\_\_\_\_

interconnected sources \_\_\_\_\_

changing power efficiency \_\_\_\_\_

c. exceedingly high power losses \_\_\_\_\_

d. One can ignore these exceedingly low power losses.



---

One should take into consideration the interdependence of these values.

---

One should not ignore the high cost of these installations.

---

**9. Complete the sentences using the correct variant:**

- |                                          |                                                   |
|------------------------------------------|---------------------------------------------------|
| 1. Aluminium is used due to its          | a) high cost.<br>b) low cost and high efficiency. |
| 2. Cross-section of different conductors | a) varies.<br>b) is the same.                     |
| 3. Power loss can be ignored             | a) in short wires.<br>b) in long wires.           |
| 5. Electric lines nowadays are           | a) efficient.<br>b) inefficient.                  |
| 6. Installations are protected           | a) by switches.<br>b) by fuses.                   |

**10. Complete these sentences using *while*.**

1. The cost of aluminium is comparatively **low** while... .
2. In a **short** length of wire power loss is extremely **low** while... .
3. The **greater** the load the **lower** is the efficiency of the line ... .

**11. Answer these questions:**

1. Why is aluminium widely used nowadays?
2. Is its cost very low or comparatively low?
3. What is the cross-section of copper conductors?
4. May one ignore power loss in short wire? Why?
5. What does the efficiency of a line depend on?
6. What are fuses used for?
7. When does a line become inefficient?

**12. Think of three questions about this extract and put them to your groupmate.**

**consumer**—потребитель; **relation**—отношение

When electric energy is produced at the power station, it is to be transmitted over electric wires to the consumer. Wire conductors offer resistance to the current flow; the longer the wire, the greater is its resistance to the current flow. Accordingly, the higher the offered resistance, the greater are the heating losses in the wire.

### 13. Choose the correct form:

1. One can (*reduce, be reduced*) heat losses in a transmission line.
2. Heat losses should (*reduce, be reduced*) constantly and effectively.
3. The output of machinery is steadily being (*increasing, increased*).
4. Man has been constantly (*increasing, increased*) the output of machinery.
5. The main principles of energy production has (*being, been*) known to science for a long time.
6. The energy industry (*undergoes, is undergoing*) considerable development.
7. Development of nuclear power plants for civil use (*began, has began*) in the mid-1950s.

### 14. Copy the sentences below and underline participles. Say what forms of participles are used. Translate the examples into Russian in writing.

Ванглийском языке имеется пять форм причастия:

	<i>Active</i>	<i>Passive</i>
<i>Participle I</i>	using	being used
<i>Participle II</i>	—	used
<i>Perfect Participle</i>	having used	having been used

1. The energy lost in the capacitor appears in the form of heat being generated in the dielectric.
2. The problem being discussed is of no great importance for practice.
3. The generators constructed at the plant have no commutators.
4. The code widely used is called Morse code.
5. While passing through the conductor, resistance results in the production of heat.
6. Having been insulated with polythene, the line was tested under unfavourable conditions.
7. Having made a number of tests, the researcher got some useful results.
8. Having been tested under different conditions, the motors were put to use.
9. When being rubbed, some substances produce electric charges.
10. Decelerating trains and descending elevators use negative, or braking, torque.
11. In what way is the transmitter controlled in an amplitude-modulated system?

## Electromagnetic Relay

Electromagnetic devices called *relays* are widely used in various branches of industry.

The main parts of a relay are an electromagnet, a spring and an armature. When a current starts flowing in the electromagnet winding, the armature moves and the spring closes the contacts. The primary circuit of a relay is its electromagnet circuit and the secondary circuit is the one closed by the contacts.

When there is no current in the relay's primary circuit, the spring pulls the armature and the contacts open.

Fig. 18 shows how a relay is used to control the work of an electric motor. The relay is placed close to the motor which is connected to its secondary circuit. The armature closes the contacts of the secondary circuit, and the motor starts operating; it will stop when the relay opens.

Without a relay, conductors with a large cross-section would have to be brought to the motor. This would be very uneconomical. The current in a relay is tens and even thousands of times smaller than that used to power the motor. Therefore, the connecting wires can have small cross-sections.

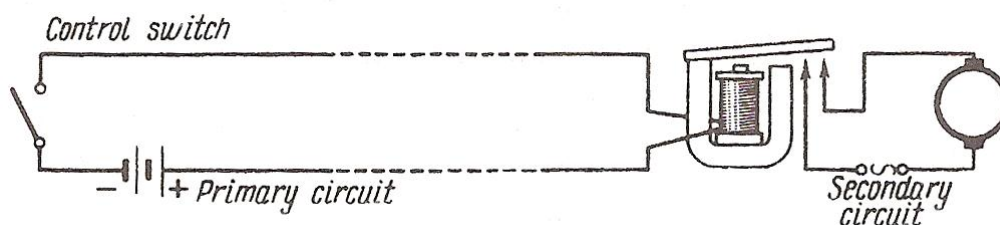


Fig. 18

In many systems the relay primary circuit operates automatically. Every evening and morning street lights are switched on and off from the main control panel by means of a great number of relays.

### Vocabulary

spring		пружина
cross-section		поперечное сечение
to close	[klouz]	замыкать, закрывать
close to	['kloustə]	близко к (от)
to move		двигаться), приводить в движение
to switch on		включать
to switch off		выключать
various	['veəriəs]	различный, разнообразный
fuse	[fju:z]	плавкий предохранитель
link	[lɪŋk]	звено, связь
fault	[fɔ:lt]	дефект, неисправность
faulty		неисправный
equipment	[ɪ'kwɪpmənt]	оборудование
installation	[,ɪnstə'leɪʃn]	установка; pl. сооружения
to protect	[prə'tekt]	защищать, предохранять

to utilize	[ˈjuːtɪlaɪz]	использовать
to equip	[ɪˈkwɪp]	оборудовать, снаряжать
to serve		служить
to melt		плавить
up to		вплоть до

**Вопросы задания:**

- 15. a) Cover the right column and read the English words. Translate them into Russian and check your translation.**  
**b) Cover the left column and translate the Russian words back into English.**

- 16. Read the words and put down their Russian equivalents. Then translate them back into English (orally).**

[rɪˈleɪ]	relay	_____
[ɪˌlektroʊˈmæɡnɪt]	electromagnet	_____
[ˈɑːmətʃə]	armature	_____
[ˈkɒntækt]	contact	_____
[ˈsɪstɪm]	system	_____
[ˌɔːtəˈmætɪk]	automatic	_____
[ˈpænl]	panel	_____

- 17. Change the adjectives into adverbs by adding -ly. Put down their Russian equivalents.**

*Model:* automatic – automatically

wide –	_____
economical –	_____
unprogressive –	_____
unnecessary –	_____
uneconomical –	_____

- 18. Put down the Russian for:**

a. to start flowing	_____
to start moving	_____
to start operating	_____
to start powering the motor	_____
	_____
b. various branches of industry	_____
small cross-section	_____
relay's primary circuit	_____

**19. Complete the sentences using the correct variant:**

- |                                                  |                                                                                                         |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| 1. The main parts of a relay are                 | a) an electromagnet, a capacitor, and a spring.<br>b) an electromagnet, an armature, and a spring.      |
| 2. When current starts flowing                   | a) the spring opens the contacts.<br>b) the spring closes the contacts.                                 |
| 3. The spring pulls the armature                 | a) when there is current in the primary circuit.<br>b) when there is no current in the primary circuit. |
| 4. The wires connecting the panel with the relay | a) have a large cross-section.<br>b) have a small cross-section.                                        |
| 5. Street lights are switched on and off         | a) by means of relays.<br>b) by means of electric motors.                                               |

**20. Complete these sentences using *while*.**

1. The **primary** circuit of a relay is its **electromagnetic** circuit ... .
2. When there is **no current** in the relay's **primary** circuit the contacts **open**... .
3. **Without** a relay conductors with a **large** cross-section should be used... .
4. Every **evening** street lights are switched **on**... .

**21. Answer the following questions:**

1. What are the main parts of a relay?
2. How is a relay put into operation?
3. When does the spring pull the armature?
4. What wires connect the panel with the relay?
5. By what means are street lights switched on and off?

**22. Pair work. a) Match the questions and the answers, b) Ask the questions and let your groupmate answer them.**

- |                                                                 |                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. In what position does the switch have high (low) resistance? | a) Switches are used to open and close the circuits.                                                                                                                                                                                                     |
| 2. What are the functions of the switch?                        | b) Closed is the on-position; open is the off-position.                                                                                                                                                                                                  |
| 3. In what position is the switch open? Closed?                 | c) The switch is connected in series with the load.                                                                                                                                                                                                      |
| 4. In what way is the switch connected to the circuit?          | d) In the on-position the closed switch has a very low resistance, which results in maximum current in the load with zero voltage loss across the switch. When the switch is off it has a very high resistance and no current flows through the circuit. |

**23. Read and translate:**

**Fuses**

Fuses are widely used nowadays as protection devices. They are utilized in various circuits, electrical equipment and installations. Fuses serve to protect them against overcurrents and short-circuits.

There are different types of fuses in use nowadays. Of them, quartz-sand fuses serve for voltages up to 500 volts; fuses of this kind are produced with current ratings of 15 to 60 amp and of 100 to 350 amp.

Fuses are commonly used in low-voltage industrial installations rated up to 1,000 V.

Fuse protection is based on a very simple principle: in case of a short-circuit or overcurrent, when the maximum value of current has been exceeded, the fusible link of a fuse is heated to its melting point. This opens the circuit and disconnects the circuit from the power source. In case of a fault, one should replace the faulty fusible element by a new one.

Fuses are used both in direct current (d.c.) and alternating current (a.c.) circuits.

**24. Read the words and put down their Russian equivalents. Then translate them back into English (orally).**

quartz	[kwɔ:ts]	_____	quartz-sand fuse	_____
base	[beɪs]	_____	fusible link	_____
principle	_____		faulty protection device	_____
stress	_____		faulty fusible link	_____

**25. Form the words according to the model and translate them.**

*Model:* charge – overcharge – перегрузка

Connect – disconnect – разъединять

pressure	—	_____	—	_____
heat	—	_____	—	_____
stress	—	_____	—	_____
current	—	_____	—	_____
load	—	_____	—	_____
organize	—	_____	—	_____
place	—	_____	—	_____
stress	—	_____	—	_____

**26. Form the nouns from the given verbs according to the model. Translate them.**

*Model:* to protect—protection—защита

to utilize	—	_____	—	_____
to install	—	_____	—	_____
to reduce	—	_____	—	_____
current	—	_____	—	_____
to connect	—	_____	—	_____

**27. Distribute the words below into the three columns:**

action

process

doer

utilizer, utilize, installation, displace, overheater, displacement, overproduction, starter, equip, protection, disorganize

**28. Translate into Russian. Mind both ... and, in case, up to:**

- Both solid and gaseous insulators are highly in use.
- In case a fuse gets faulty it should be replaced by a new one.
- Capacitors of very high capacity – up to 1000 and more mF – are utilized in modern installations.

**29. Complete the sentences using the correct variant:**

- A fuse serves
  - as a load.
  - as a protection.
- Fuses are used
  - for d.c. only.

3. In case of a fault
- a) the whole fuse should be replaced.  
b) the faulty link should be replaced.
4. Fuse protection is based on
- a) a simple principle.  
b) a complex principle.

**30. Memorize the questions. Use them in a talk with your groupmate:**

1. What does a fuse serve for?
2. For what type of current are fuses used?
3. What should be done in case of a faulty fuse?
4. What principle is fuse protection based on?

**31. Translate and compare. Mind variants of the predicate.**

1. The device is faulty; you cannot/should not rely on its readings.
2. The cable is to/will be used to test the transmission line.
3. The electric field can be/may be thought of as consisting of a number of lines of force.
4. Nowadays one must/can connect power stations into power grids.
3. One has to/should take safety precautions.
6. Deserts are to/may be turned into gardens by solar energy.
7. The current must/should be as small as possible not to melt the wires.
8. A fast reactor has to/is to/must be designed to produce more fuel than it consumes.
9. The heat from the nuclear chain reactor can/is to be removed by the coolant.

### Electron Tubes

Let us consider electron tubes. Among the electron tubes in use nowadays there are a diode, a triode, a tetrode and a pentode. The main parts of electron tubes are electrodes. Electrodes are placed into a glass or metal bulb.

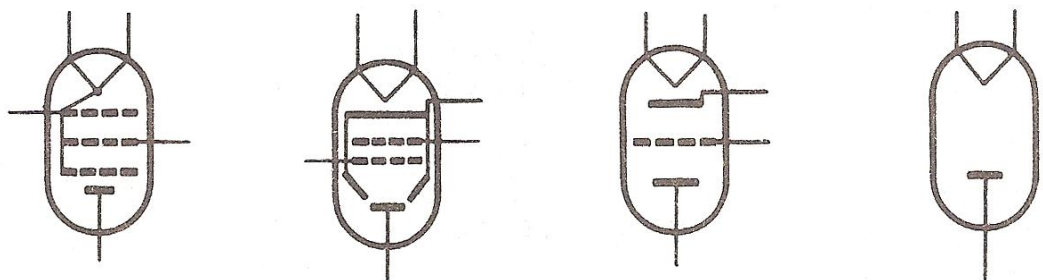


Fig. 14

A diode contains the cathode and the plate. When a diode operates the cathode emits electrons, the plate collects them.

A triode contains the cathode, the plate and the control grid. When the tube operates the cathode emits electrons, the plate collects them and the grid controls the flow of electrons. Therefore, the grid is called a *control grid*.

A tetrode contains the cathode, the plate, the control grid and the screen grid.

When a tube operates it may oscillate. The function of the screen grid is to eliminate oscillations. Therefore it is called a *screen grid*.



A pentode contains two electrodes and three grids: the control grid, the screen grid and the suppressor grid. When a pentode operates the suppressor grid eliminates the secondary emission.

Common troubles in tubes are an open heater and low emission. These troubles result from constant use or from some other reason. In case a tube has a trouble it stops operating or operates badly. A tube with a trouble should be replaced by another one.

### Vocabulary

tube	[tju:b]	электронная лампа
bulb	[bʌlb]	баллон
grid		сетка
screen		экран
to contain	[kən'teɪn]	вмещать
to collect	[kə'lekt]	собирать
to emit	[ɪ'mɪt]	излучать
to suppress	[sə'pres]	глушить, подавлять
control circuit		контрольная цепь
control grid		управляющая сетка
screen grid		экранирующая сетка
screen grid tube		экранированная лампа
suppressor grid		защитная сетка
counter flow		противоток
oscillatory circuit		колебательный контур
half	[ha:f]	половина
to rectify	[ˈrektɪfaɪ]	выпрямлять
to amplify	[ˈæmplɪfaɪ]	усиливать
to convert	[kən'veɜ:t]	преобразовывать, обра- щать
by means of		посредством, с помощью
that is why		вот почему
to put into operation		приводить в действие, за- пускать

**32. Form nouns adding -er and translate them.***Model:* to heat – heater

to emit – \_\_\_\_\_

to control – \_\_\_\_\_

to suppress – \_\_\_\_\_

**33. Distribute the words below into the three columns.***Model:***action****process****doer**

emit

emission

emitter

collector, heat, collection, suppress, collect, suppressor, suppression, contain, reaction, container, react, heater, reactor, computer, compute, oscillate, oscillating, oscillator

**34. Read the words and put down their Russian equivalents. Then translate them back into English.**

diode [daɪəd] \_\_\_\_\_

cathode ['kæθoud] \_\_\_\_\_

triode [traɪəd] \_\_\_\_\_

metal ['metl] \_\_\_\_\_

tetrode [tet'rɔud] \_\_\_\_\_

glass [glɑ:s] \_\_\_\_\_

pentode [pen'tɔud] \_\_\_\_\_

oscillator ['ɒsɪleɪtə] \_\_\_\_\_

pulse [pʌls] \_\_\_\_\_

electron [ɪ'lektrɒn] \_\_\_\_\_

cycle ['saɪkl] \_\_\_\_\_

radio ['reɪdɪəʊ] \_\_\_\_\_

**35. Complete the sentences using the correct variant:**

1. A pentode contains

a) the cathode, the plate, two screen grids and the suppressor grid.

b) the cathode, the plate, the control grids, the screen grid and the suppressor grid.

2. A tetrode contains

a) the cathode, the plate, the suppressor grid and the screen grid.

b) the cathode, the plate, the screen grid and the control grid.

3. A triode contains

a) the cathode, the plate and the screen grid.

b) the cathode, the plate and the control grid.

- |                                           |                                                                                                          |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------|
| 4. The function of the cathode is         | a) to collect electrons.<br>b) to eliminate the secondary emission.<br>c) to emit electrons.             |
| 5. The function of the plate is           | a) to eliminate oscillations.<br>b) to emit electrons.<br>c) to collect electrons.                       |
| 6. The function of the control grid is    | a) to emit electrons.<br>b) to control the electron flow.<br>c) to eliminate secondary emission.         |
| 7. The function of the screen grid is     | a) to collect electrons.<br>b) to reduce the capacity.<br>c) to eliminate oscillations.                  |
| 8. The function of the suppressor grid is | a) to control the electron flow.<br>b) to eliminate secondary emission.<br>c) to eliminate oscillations. |
| 9. Constant use of a tube results in      | a) high emission.<br>b) low emission.<br>c) an open heater.                                              |

**36. Answer the following questions:**

1. What types of electron tubes are used nowadays?
2. How many electrodes does a diode (a triode, a tetrode, a pentode) contain?
3. What is the function of the cathode (the plate, the control grid, the screen grid, the suppressor grid)?
4. What does the constant use of a tube result in?
5. What does low emission result from?
6. When must a tube be replaced?

**37. Pair work. Think of five questions covering the article given below. Put these questions to your groupmate and ask him/her to answer them.**

**Pentode**

When in an operating tube the screen-grid voltage is high, secondary emission does not return to the plate and passes to the screen grid. This results in a counter flow of electrons. To eliminate this counter flow, a third grid was placed between the plate and the screen grid and connected to the cathode. This grid is called a suppressor grid. Since the suppressor grid has a negative potential it returns the secondary emission back to the plate and thus eliminates it in the tube. The tube containing electrodes – the cathode, the plate, the control grid, the screen grid and the suppressor grid – is called a pentode. The cathode emits electrons, the plate collects them, the control grid controls the flow of electrons, the screen grid helps the plate to collect electrons and reduces the capacity between the control grid and the plate, the suppressor grid eliminates the secondary emission.

**38. Translate these word combinations into Russian:**

- |                                    |       |
|------------------------------------|-------|
| a. half-wave                       | _____ |
| half-cycle                         | _____ |
| half-wave rectifier                | _____ |
| positive half-cycles               | _____ |
| electron tube application          | _____ |
| negative half-cycles               | _____ |
| by means of a filter               | _____ |
|                                    |       |
| b. by means of the suppressor grid | _____ |
| tubes used as rectifiers           | _____ |
| tubes used as oscillators          | _____ |

### 39. Read and translate:

#### Use of Electron Tubes

Let us consider some cases of electron tube application. Tubes are common elements of radio and electronic devices. Tubes are used

as **rectifiers**– to convert a.c. into d.c.,

as **oscillators**– to produce oscillating waves and

as **amplifiers**– to amplify the input voltage and current.

#### Half-Wave Rectifier

Alternating current is converted into direct current by means of a rectifier.

A half-wave rectifier consists of a diode in series with a resistance. In order to put a rectifier into operation, a source of a.c. should be applied to it. When an a.c. source is applied the diode begins to conduct. The rectifier passes currents during positive half-cycles of the applied voltage. That is why it is called a half-wave rectifier. When the device operates d.c. flows in the same direction. It is a pulsating current. Since pulsations should be eliminated, a filter is applied. Pulsations are eliminated by means of this filter.

### 40. Complete the sentences using the correct variant:

- |                                |                                                                                                    |
|--------------------------------|----------------------------------------------------------------------------------------------------|
| 1. Electron tubes are used     | a) as amplifiers only.<br>b) as oscillators only.<br>c) as rectifiers, amplifiers and oscillators. |
| 2. A.c. is converted into d.c. | a) by means of a rectifier.<br>b) by means of an amplifier.                                        |

- |                                               |                                                                                                        |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 4. In order to put a rectifier into operation | a) d.c. is applied.<br>b) a.c. is applied.                                                             |
| 5. A half-wave rectifier passes currents      | a) during positive and negative half-cycles.<br>b) during positive half-cycles of the applied voltage. |
| 6. Rectified current is                       | a) direct oscillating current.<br>b) direct pulsating current.                                         |
| 7. Pulsations are eliminated                  | a) by means of a choke coil.<br>b) by means of a filter.                                               |

**41. Answer the following questions:**

1. How are electron tubes used?
2. What type of device is called a rectifier?
3. By what means is alternating current rectified into direct current?
4. What elements does a half-wave rectifier consist of?
5. What current should be applied to put a half-wave rectifier into operation?
6. When does a half-wave rectifier pass current?
7. By what means are pulsations eliminated?

**42. Draw a scheme of a half-wave rectifier and describe its operation.**

**43. Underline the infinitives in the sentences. Translate the sentences into Russian.**

1. To magnetize a body requires some energy.
2. In order to build the power plant near Northfield (USA), three miles of tunnels were drilled.
3. The distance to be covered was equal to ten miles.
4. To reduce the power losses, thick wires should be used.
5. No additional components were used since they were not needed to actuate the relay.
6. Various installations were used in order to transform electric power into mechanical, heat, and chemical power.
7. At least 90 per cent of electric energy to be generated at present is a.c.
8. A.c. can be increased, or decreased to meet industrial requirements.
9. Gas turbines can be started within minutes, while steam plants may require hours to be put into operation.

**44. What forms of infinitives are used in the Infinitive Complexes given below – Complex Subject or Complex Object?**

1. Communication is supposed to have no limits nowadays.
2. The line appeared to be demagnetized.
3. Every battery is known to possess two terminals.
4. The output of machinery is known to be steadily increasing all over the world.
5. In some countries, the nuclear power plants are believed to produce about 80 per cent of the whole amount of energy.
6. The capacity of generating units was said to have been doubled.
7. What two conditions are necessary to cause an electric current to flow?
8. Ebonite, rubber, and glass are considered to be good insulators.
9. Nuclear plants are expected to be located away from urban areas.
10. The use of underground transmission lines is known to have been increased.

11. By 1959, maximum transmission voltages were proclaimed to have been increased to 345,000 volts.
12. The most important problems in atomic power generation are known to be concerned with the reactor. The light-water reactor types seem to be most promising.

**45. Use Participle I, Participle II or the Gerund of the verb in brackets and translate the sentences.**

1. (*Cool*) an electric conductor results in its reduced resistance to electric current.
2. What is the name of an (*insulate*) material (*use*) to prevent an electric shock?
3. The (*apply*) technique brought about quite unexpected results.
4. Mica is used as a dielectric due to (*have*) high voltage strength.
5. The world's first tidal power station, a plant on the Rance River in France, began (*operate*) in 1966.
6. Solar energy has been converted to electricity by (*use*) solar cells, which are semiconductor devices (*produce*) from thin slices of silicon.

**Практическое занятие № 23 – 24.**

**Тема 12. General Aspects of Electrical Wiring:**

**Conductors and Insulators. Insulation Methods for Electrical Wires /**

**Общие аспекты электропроводки: Проводники и изоляторы.**

**Способы изоляции электрических проводов**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

**Теоретическая часть:**

**Conductors and Insulators**

**Conductors** are materials having a low resistance so that current easily passes through them. The lower the resistance of the material, the more current can pass through it.

The most common conductors are metals. Silver and copper are the best of them. The advantage of copper is that it is much cheaper than silver. Thus copper is widely used to produce wire conductors. One of the common functions of wire conductors is to connect a voltage source to a load resistance. Since copper wire conductors have a very low resistance a minimum voltage drop is produced in them. Thus, all of the applied voltage can produce current in the load resistance.

It should be taken into consideration that most materials change the value of resistance when their temperature changes.

Metals increase their resistance when the temperature increases while carbon decreases its resistance when the temperature increases. Thus metals have a positive temperature coefficient of resistance while carbon has a negative temperature coefficient. The smaller is the temperature coefficient or the less the change of resistance with the change of temperature, the more perfect is the resistance material.

Materials having a very high resistance are called **insulators**. Current passes through insulators with great difficulty.

The most common insulators are air, paper, rubber, plastics.

Any insulator can conduct current when a high enough voltage is applied to it. Currents of great value must be applied to insulators in order to make them conduct. The higher the resistance of an insulator, the greater the applied voltage must be.

When an insulator is connected to a voltage source, it stores electric charge and a potential is produced on the insulator. Thus, insulators have the two main functions:

1. to isolate conducting wires and thus to prevent a short between them and
2. to store electric charge when a voltage source is applied.

### Vocabulary

cheap		дешевый
copper		медь
decrease	[ 'dikri:s]	уменьшение
load		нагрузка
make smb (smth) dosmth		заставить кого-л. (что-л.) делать что-л.
thus		таким образом, так
difficulty		трудность
rubber		резина
since		так как
to decrease	[ di 'kri:s]	уменьшать
increase	[ 'inkri:s]	увеличение

### Вопросыизадания:

1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.

b) Cover the left column and translate the Russian words back into English.

2. Read the words and put down their Russian equivalents:

[ 'daɪəgræm]	diagram	_____
[ ,kɒuɪ 'fɪʃənt]	coefficient	_____
[ 'fʌŋkʃən]	function	_____
[træns' fɔ:mə]	transformer	_____
[træns' fə:]	to transfer	_____

### 3. Form adverbs. Follow the model.

*Model:* wide – widely

cheap – \_\_\_\_\_

positive – \_\_\_\_\_

high – \_\_\_\_\_

negative – \_\_\_\_\_

### 4. Put down the Russian for:

load resistance \_\_\_\_\_

wire conductors \_\_\_\_\_

silver wire conductors \_\_\_\_\_

temperature 'decrease \_\_\_\_\_

temperature 'increase \_\_\_\_\_

### 5. Translate into Russian. Mind *since*.

1. Copper conductors are widely used *since* they are much cheaper than silver ones.
2. A minimum voltage drop is produced in copper wire conductors *since* they have a low resistance.
3. A bulb connected to an open circuit does not light *since* an open circuit has no current.

### 6. Find answers to these questions in the text above:

1. What materials are called conductors?
2. What is the advantage of copper compared with silver?
3. What is the most common function of wire conductors?
4. Why is a minimum voltage drop produced in copper conductors?
5. What is the relation between the value of resistance and the temperature in carbon?
6. What materials are called insulators?
7. What are the most common insulators?
8. What are the two main functions of insulators?

### 7. Complete the sentences using the correct variant:

- |                                      |                                                |
|--------------------------------------|------------------------------------------------|
| 1. Insulators are materials having   | a) low resistance.<br>b) high resistance.      |
| 2. Current passes through conductors | a) easily.<br>b) with great difficulty.        |
| 3. Copper and silver are             | a) common conductors.<br>b) common insulators. |



- |                                                      |                                                                                                              |
|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| 4. Air, paper and plastics are                       | a) common insulators.<br>b) common conductors.                                                               |
| 5. In case a high voltage is applied to an insulator | a) it does not conduct current.<br>b) it conducts current.                                                   |
| 6. Insulators are used                               | a) to store electric charge.<br>b) to reduce voltage.<br>c) to prevent a short between conducting wires.     |
| 7. Metals increase their resistance                  | a) when the temperature decreases.<br>b) when the temperature increases.                                     |
| 8. Carbon decreases its resistance                   | a) when the temperature increases.<br>b) when the temperature decreases.                                     |
| 9. Metals have                                       | a) a positive temperature coefficient of resistance.<br>b) a negative temperature coefficient of resistance. |

**8. Complete the sentences using *while*.**

- Conductors** have a **low** resistance... .
- Current passes through **insulators with great difficulty** ... .
- Metals** are common **conductors**... .
- To make **insulators** conduct, currents of **great** value must be applied... .
- Carbon decreases** its resistance when the temperature increases... .
- Metals** have a **positive** temperature coefficient of resistance... .

**9. Pair work. Put these questions to your groupmate, and ask him/her to answer them:**

- What is the difference between conductors and insulators?
- How does current pass through insulators?
- What materials are commonly used to produce insulators?
- What materials are commonly used to produce conductors?
- In what case do insulators conduct current?
- How does resistance change when the temperature decreases?

**10. Read the text and find in it the answer to the question that follows it.**

**Voltage Values**

Voltages up to about 250 V are called low. The common electric lighting circuit operates either at about 127 or 200 V, and the voltage used on the main circuit of large houses is usually the same. One can get an electric shock, when one touches an uninsulated wire of such a circuit.

Voltages above 250 V are high voltages. They are used in industry. Medium-powered motors are usually operated at 380 V. Large motors are supplied by voltages of from about 500 up to 6,000 V.

- **What have you read about?**

**11. Put down the tense forms of the verbs.**

*Model:* to lower – *Pres. Perf.* have (has) lowered

to heat –	<i>Past Indef.</i>	– _____
to discharge –	<i>Pres. Contin.</i>	– _____
to remove –	<i>Pres. Perf.</i>	– _____
to bum –	<i>Pres. Perf. Contin.</i>	– _____
to waste –	<i>Future Ind.</i>	– _____
to demand –	<i>Past Perf.</i>	– _____
to move –	<i>Future Perf.</i>	– _____

**12. Put down the negative form of the following verbs.**

*Model:* moved – did not move

required	– _____
was operating	– _____
links	– _____
has demanded	– _____
will have been replaced	– _____
release	– _____
is transmitting	– _____
fissioned	– _____

**13. State the voice and the tense form of the following verbs.**

*Model:* was removed – Past Indefinite Passive

is discharged	– _____
was being discharged	– _____
has discharged	– _____

had not been attached	— _____
is circulating	— _____
will not be heated	— _____
extends	— _____
does not maintain	— _____
is not maintained	— _____
will be linked	— _____
will release	— _____
will have been removed	— _____

#### 14. Change the sentences into questions:

1. There are various types of nuclear reactors.
2. The use of underground transmission lines must be increased.
3. The fuel can be enriched uranium.
4. The fission heat is used to generate steam, which drives a turbine generator.

**15. Найдите в словаре эквиваленты следующих слов и выражений, которые понадобятся вам для текста, и выучите их:** Electrical wiring, accessories, to provide, safe, insulators, hanging objects.

**16. Прочитайте, устно переведите и предложите свое название текста. Обоснуйте свой выбор:**

**Electrical wiring** in general refers to conductors used to carry electricity, and their accessories. This article describes general aspects of electrical wiring as used to provide power in or to buildings and structures, commonly referred to as **building wiring**. Electrical wiring practices vary greatly by locality. This article is intended to describe common features of electrical wiring that that should apply worldwide.

#### **Knob and tube**

The earliest standardized method of wiring in buildings, from about 1880 to the 1940's, was single insulated copper conductors run across interior walls or within ceiling cavities, passing through holes in porcelain insulating tubes, and supported along their length on porcelain insulators. This system is known as "knob-and-tube" from the insulators used. Where conductors entered a wiring device such as a lamp or switch, they were protected by flexible insulating sleeving. Wire splices in such installations were typically soldered and wrapped with cloth tape, or made inside metal junction boxes.

While a knob-and-tube wiring system can be safe and reliable when in good condition, it is not used in modern building construction. The installation is costly due to the high labor content, and originally knob-and-tube installations did not include a safety ground connection.

Older homes may have knob-and-tube wiring for all or part of their electrical system. Such wiring systems may require replacement or upgrade. Wiring in such buildings may be inadequate for modern levels of power use. Wiring may have been damaged by renovations done in the building. Insulation covering the wires may be brittle due to age or may be damaged by rodents or carelessness (for example, hanging objects off wiring running in accessible areas like basements).

### **Other historic wiring methods**

Other methods of securing wiring that are now obsolete include:

- Re-use of existing gas pipes for electric lighting. Insulated conductors were pulled into the pipes feeding gas lamps.
- Wood moldings with grooves cut for wires. These were eventually prohibited in North American electrical codes by the 1930's, but may still be permitted in other regions.

**17. Закончите предложения в соответствии с текстом, используя следующие слова и выражения:** a safety ground connection, construction, or part of their electrical system, upgrade, locality.

1. And originally knob-and-tube installations did not include ....
2. Older homes may have knob-and-tube wiring for all ....
3. Such wiring systems may require replacement or ....
4. It is not used in modern building ....
5. Electrical wiring practices vary greatly by ... .

**18. Составьте предложения из следующих слов и словосочетаний:**

1. wiring, electrical, practices, locality, vary, by, greatly .
2. known, this system is, insulators, as, "knob-and-tube" from the, used.
3. replacement, wiring, such, may, systems, require, or upgrade.
4. feeding, gas lamps insulated, were, conductors, pulled, into, the pipes.

**19. Соедините слова левой колонки с подходящим определением в правой и составьте свои предложения с этими словами:**

- |              |                                 |
|--------------|---------------------------------|
| 1. to refer  | 1. to harm                      |
| 2. a lamp    | 2. a thing that gives light     |
| 3. to damage | 3. to belong                    |
| 4. copper    | 4. joint                        |
| 5. splice    | 5. a soft, reddish brown metal. |

**20. Найдите в словаре эквиваленты следующих слов и выражений, которые понадобятся вам для текста, и выучите их:** several forms, a conduit, to be wrapped, underground, switch room, assembly, to establish, cloth tape, heavy, to connect, flammable gasses, current capacity, cables, wire ways, to be installed.

**21. Прочитайте, устно переведите и предложите свое название текста. Обоснуйте свой выбор:**

**Conduits, ducts, wire ways, cable trays**

Insulated wires may be run in one of several forms of tube between electrical devices. This may be a rigid steel or aluminum pipe, called a conduit, or in one of several varieties of metal or non-metallic tubing. Wires run underground, for example, may be run in plastic tubing encased on concrete. Wiring in exposed areas, for example factory floors, may be run in tubing for protection from mechanical damage and to prevent ignition of flammable gasses that may be present. Special fittings are used to mount wiring devices in conduit run or tubing, and to mechanically connect the tubing with equipment enclosures. Depending on the type of metallic pipe or tube, and local regulations, the metal pipe may form all or part of the grounding (earthing) conductor for the equipment.

In Edison's first commercial distribution system, conductors were wrapped in cloth tape, coated with a bituminous compound, and placed in steel pipes buried below ground. Alternatively, the conductors were placed in buried wooden troughs.

Cable trays are used in industrial areas where many insulated cables are run together. Where wiring regulations allow it, individual cables can exit the tray at any point, simplifying the wiring installation and reducing the labor cost for installing new cables.

Since wires run in conduits or underground cannot dissipate heat as easily as in open air, wiring regulations give rules to establish the current capacity of enclosed wiring based on the insulation temperature rating and the number of conductors in the enclosure.

**Bus bars, bus duct**

For very heavy currents in electrical apparatus, and for heavy currents distributed through a building, bus bars can be used. Each live conductor of such a system is a rigid piece of copper or aluminum, usually in flat bars (but sometimes as tubing or other shapes). Open bus bars are never used in publically- accessed areas but are sometimes applied in electrical switchrooms.

In industrial applications, conductor bars are assembled with insulators in grounded enclosures. This assembly, known as bus duct, can be used for connections to large switchgear or for bringing the main power feed into a building. A form of bus duct known as plug-in bus is used to distribute power down the length of a building; it is constructed to allow tap-off switches or motor controllers to be installed at definite places along the bus.

Bus duct may have all phase conductors in the same enclosure (non-isolated bus), or may have each conductor separated by a grounded barrier from the adjacent phases (segregated bus). For very large currents in generating stations or substations, where it is difficult to provide circuit protection, isolated-phase bus is used. Each phase of the circuit is run in a separate metal enclosure. The current induced in the enclosure essentially cancels all magnetic field outside the enclosure. A fault in any phase cannot jump between phases. This type of bus can be rated up to 50,000 amperes and up to hundreds of kilovolts, but is not used for building wiring in the conventional sense.

22. Найдите в тексте английские эквиваленты следующих слов и выражений. На базе текста составьте с ними предложения: изоляционная труба, вспышка, система распределения, монтировать, заворачивать, промышленное употребление, открытый воздух, емкость тока,

кусочек меди, длина здания, рассеивать, электрические приборы, приносить, определенное место, индутировать.

**23. Согласитесь или не согласитесь со следующими высказываниями. Обоснуйте свое мнение, пользуясь текстом:**

1. In Edison's first commercial distribution system, conductors were wrapped in cloth tape.
2. Since wires run in conduits or underground can dissipate heat as easily as in open air.
3. Each live conductor of such a system is a rigid piece of plastic.
4. A form of bus duct known as plug-in bus is used to distribute power down the length of a building.
5. The current induced in the enclosure essentially cancels all magnetic field.

**24. Найдите в тексте слова, которые соответствуют следующим определениям и в соответствии с прочитанным текстом письменно составьте с ними предложения:**

- a very strong, thick rope made of wires twisted together.
- A pipe through which electrical wires go.
- The machines, that are used for particular purpose.
- A system that distributes a current.
- A soft metal from which conductors are made.

**25. Каждое слово в английском языке имеет несколько значений, которые зависят от контекста и ситуации, в которых оно применяется, также оно может быть как глаголом, так и существительным, поэтому вам предлагается выполнить следующие задания:**

- Пользуясь англо-русским словарем, изучите статьи о слова "rate" и "toplace"
- Выпишите сложные слова и производные, приведенные в статьях;
- Укажите количество определений, приведенных в статьях;
- Выпишите из текста предложения с данными словами и укажите, какое из значений они имеют в данном контексте.

**26. Соедините слова левой колонки с подходящим определением в правой и составьте свои предложения с этими словами:**

- |                |                 |
|----------------|-----------------|
| 1. Underground | 1. to link      |
| 2. Equipment   | 2. Subterranean |
| 3. To wrap     | 3 fittings      |
| 4. to connect  | 4. certain      |
| 5. Definite    | 5. to bundle up |

**27. Ответьте на вопросы.**

1. What is conduit?
2. Where do usually wires run?
3. What were conductors wrapped in?
4. What is bus duct?
5. What may form all or part of the grounding (earthing) conductor for the equipment?
6. Do you agree that bus duct known as plug-in bus is used to distribute power down the length of a building?
7. What is an electrical switch room?
8. How do you think, wires can run underground?
9. Where are conductor bars assembled in industrial applications?

**28. Перескажите текст.**

**Практическое занятие № 25 – 26.**  
**Тема 13. Transmission Lines:**  
**Safety Earthing System. Electric Shock/**  
**Линии электропередачи:**  
**Система защитного заземления. Электрический шок**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

**Теоретическая часть:**  
**Transmission Lines**

A power system is an interconnection of electric power stations by high voltage power transmission lines. Nowadays the electricity is transmitted over long distances and the length of transmitting power lines varies from area to area.

A wire system is termed a power line in case it has no parallel branches and a power network in case it has parallel branches.

According to their functions, power lines and networks are subdivided into transmission and distribution lines.

Transmission lines serve to deliver power from a station to distribution centres. Distribution lines deliver power from distribution centres to the loads.

Lines are also classed into: 1) overhead; 2) indoor; 3) cable (underground).

Overhead lines include line conductors, insulators, and supports. The conductors are connected to the insulators, and these are connected to the supports. The greater the resistance, the higher are the heating losses in the conducting wires. In order to reduce the losses, a step-down transformer can be used.

Indoor lines include conductors, cords, and buses. The conductor may include one wire or a combination of wires not insulated from one another. They deliver electric current to the consumers.

As to underground lines, they are used in city areas. Accordingly, they are used in cities and towns, and in the areas of industrial enterprises.

**Vocabulary**

area	['ɛəriə]	площадь, область
distance		расстояние
network		сеть электролиний
support		опора, мачта

cord		провод
bus		шина
enterprise	['entəpraɪz]	предприятие
to term		называть, именовать
to divide	[dɪ'vaɪd]	делить, разделять
to support		поддерживать
to distribute		распределять
accordingly		соответственно
as to		... что касается; ... что до
long distance		большое расстояние
length of transmission lines		длина линий передачи
power consumption		потребление энергии
distribution centre		распределительный центр
city area		район городской застройки

**Вопросы и задания:**

**1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.**

**b) Cover the left column and translate the Russian words back into English.**

**2. Put down the Russian for:**

interdependent city areas	_____
interacting underground lines	_____
interconnected overhead lines	_____
transmitting power lines	_____
transmission and distribution lines	_____
overhead lines	_____
step-down transformer	_____



indoor lines

---

underground lines

---

**3. Complete these sentences using the correct variant.**

- |                                  |                                                                           |
|----------------------------------|---------------------------------------------------------------------------|
| 1. Electric power is transmitted | a) by electric lines.<br>b) by power networks.                            |
| 2. Lines are divided into        | a) overhead and underground.<br>b) overhead, indoor and underground.      |
| 3. An overhead line includes     | a) conductors and supports.<br>b) conductors, insulators and supports.    |
| 4. The insulators are connected  | a) to the buses.<br>b) to the supports.                                   |
| 5. Conductors consist of         | a) bare wire.<br>b) insulated wire.                                       |
| 6. Underground lines are used    | a) in cities.<br>b) in areas of enterprises.<br>c) in agricultural areas. |

**4. Complete the sentences using *while* or *as to*.**

1. The system is termed a **power line** in case it **has no parallel branches**...
2. **Transmission lines** deliver power from a station to **distribution centres**...
3. **Low** current results in **decreased** heating losses ...
4. **Overhead** lines are used in open areas ...

**5. Answer these questions:**

1. By what means is electric power system transmitted?
2. Which system has no parallel branches?
3. Into what groups are all the transmitting lines classed?
4. What components does an overhead line have?
5. What elements do conductors consist of?
6. In what areas are overhead (underground) lines used?

**6. Read the text and find in it the answers to the questions that follow it.**

**HV Power Transmission**

A high-capacity hydrogenerator produces an a.c. current at 22,000 V. The current with the potential difference of 220,000 V is produced by means of the transformers at a step-up station and then transmitted over the power lines.

The current potential difference is lowered to medium 6,600 V at the main step-down substation at the end of the line. From here the power is transmitted to the next substations. Transformers stepping the voltage down from 6,600 V are installed at those substations.

Due to voltage conversion, alternating current is used widely in industry. Direct current for battery charging for trams, trolleybuses and electric locomotives is changed from alternating current by means of rectifiers.

- **Where is the current potential difference lowered?**
- **Where is the main step-down substation installed?**

**7. Read the text and find in it the answers to the questions that follow it.**

### **Compressed-gas-insulated Transmission**

Transmission lines in which compressed gas is used as insulator have a number of advantages. The main advantages are simplicity of construction and low cost.

What is the construction of compressed-gas-insulated transmission lines? It is rather simple. They comprise a number of phase conductors; each phase conductor is placed inside a tube and centered by means of circular spacers. The tube space is filled with compressed gas – usually sulphurhexafluoride. Each tube in a 345-kV line has a diameter about 50 cm.

The system including compressed-gas-insulated transmission has the following advantages: its losses are rather low, they are considerably lower than those of cable transmission. Unlike cables, compressed-gas-insulated transmission system can be designed for ultra high frequencies. No external electric field appears in the system. The shunt capacitance is considerably less for a gas-insulated line than for a cable. A gas-insulated line can thus transmit power over larger distances than cable lines.

The system should be protected against metallic particles. In case metallic particles get into the system, they cause a fault – a dielectric breakdown.

- **Does the system described have any advantages? What are they?**
- **What gas is the space filled with?**
- **Why should the system be protected?**

**8. Read the text and find in it the answers to the questions that follow it.**

### **Negative Transconductance Oscillator**

A negative transconductance oscillator consists of a pentode with the screen and suppressor grids coupled together. The screen is more positive than the plate. The cathode supplies electrons to both the screen and the plate. If the screen voltage rises, this increase is transferred over to the suppressor. It becomes more positive than before. A large quantity of electrons passes to the plate and a small quantity of electrons passes to the screen. Thus, the screen current is reduced. A negative resistance characteristic is produced in the screen circuit at the terminals.

A tuned circuit is connected to the terminals and in this way oscillations are produced.

- **In what way is the screen current reduced?**
- **What does negative transconductance oscillator consist of?**

**9. Read the text and find in it the answer to the question that follows it.**

### **What are the names of the Oscillators?**

Many types of oscillator circuits are used nowadays. Their tube types, tank circuits, and feedbacks are different.

Examine the diagrams given below. To answer this question read the following texts.

1. **The Electron-coupled Oscillator** uses a multi-grid vacuum tube with a cathode and two grids operating in common. In this device the plate circuit load is coupled to the oscillator through the electron stream. The diagram shows a tetrode variant using a series-fed oscillator.

2. **The Dynatron Oscillator** uses the negative resistance characteristic of a tetrode tube to eliminate the resistance of its tank circuit in order to keep oscillations.

3. **The Blocking Oscillator** uses a plate transformer to provide the feedback voltage.

4. **A Multivibrator** is a form of oscillator using two RC-controlled triodes.

5. **The Tuned Plate – Tuned Grid oscillator** has parallel or resonant circuits in both plate and grid circuits. The necessary feedback is supplied by the plate-to-grid interelectrode capacitance.

- Name the five oscillators in Fig. 20.

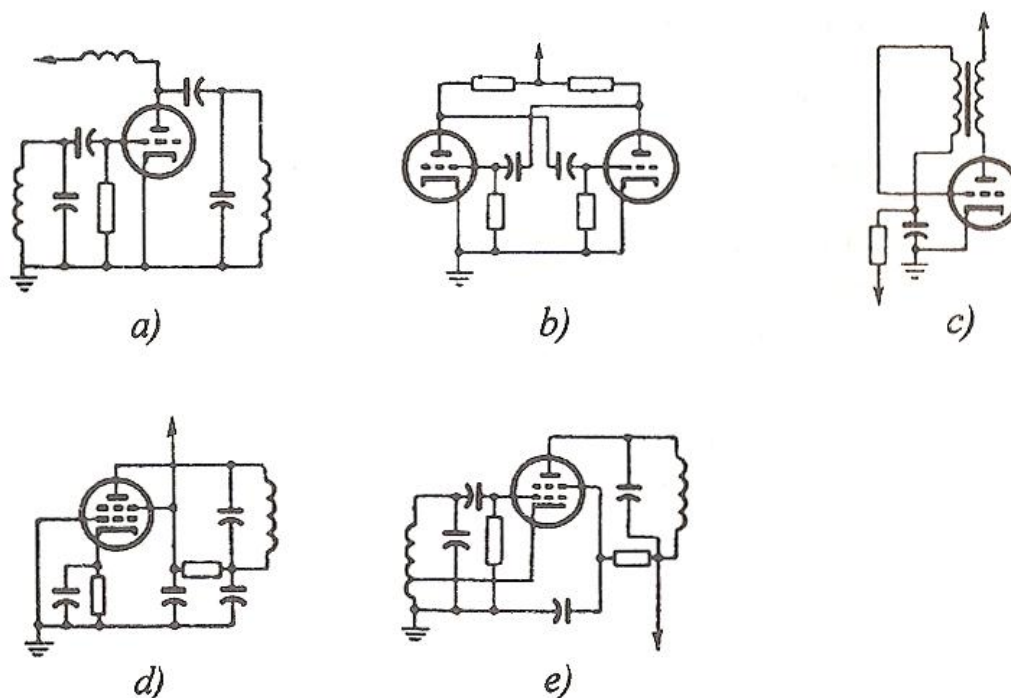


Fig. 20

# 10. Say which *-ing* and *-ed* forms are parts of the predicates and which are participles.

1. Water-turbine plants are called hydroturbines.
2. The measures discussed are to be used for determining the faults in the conducting wires.
3. The transmission system selected for everyday use is based on the combined activity of telecommunication and computers.
4. Being a semiconductor, germanium is widely used in transistors.
3. Switch board is an assemblage of controlling and indicating devices mounted upon a frame.
6. The data obtained formed the basis for further activity.
7. Gas coolants used to remove heat losses help to increase the current- carrying capacity of the motor's main parts.
8. Water power is being used to drive a dynamo.
9. Nuclear fuel is undergoing nuclear fission.

# 11. What are the forms of the gerund in the examples given below? Translate the sentences into Russian.

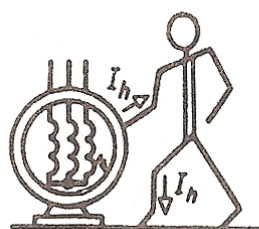
Герундий имеет четыре формы:

	<i>Active</i>	<i>Passive</i>
<i>Indefinite</i>	supplying	being supplied
<i>Perfect</i>	having supplied	having been supplied

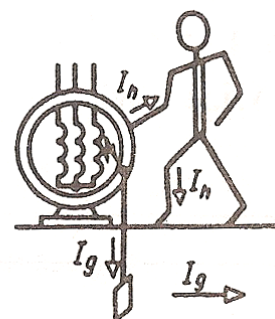
1. Programming is the process of preparing, testing and correcting instructions for a computer.
2. Is any metal capable of being drawn out into a wire?
3. After having been subjected to severe testing the material was recommended for use.
4. A motor-starter is a device for starting motors from rest by the simple act of closing the switch.
5. A constant speed of the device is maintained by supplying it with energy.
6. Steam is an important factor in producing usable energy because of the power being created by its expansion.
7. One of the problems modern research laboratories are working at is the problem of finding materials that can serve as electrical conductors in fusion reactors.
8. On having lost some of its electrons, the atom has a positive charge.

### Safety Earthing System. Electric Shock

The strength of current depends on both the voltage and the resistance in a circuit. A current of 50 mA is dangerous for a man and a current of 100 mA and higher is lethal.



a) Contact with an ungrounded motor frame



b) Contact with a grounded motor frame

Fig. 19

Earthing system serves to protect attending personnel from electric shocks when voltage appears on parts that are normally dead. The risk of an electric shock decreases with decreasing voltage. In wet and hot atmosphere the risk of electric shock increases. Safe voltage for circuits used in dry atmosphere is under 36 V. When the power is on, contacts with live conductors are dangerous for life. Thus, measures are taken to protect attending personnel from contacts with live parts of installations under voltage.

The danger of an electric shock disappears provided the metal parts of installations under voltage are connected with ground by means of safety earthing.

Connecting to ground is made by means of earthing electrodes which are connected directly with ground.

The insulation resistance of any installation should be regularly controlled by means of measuring devices. The faulty parts should be detected, eliminated, and replaced by new ones.

## Vocabulary

safe		безопасный
safety		безопасность; предохранительный
danger	['deɪndʒə]	опасность
strength	[streŋθ]	сила
earth	[ɜ:θ]	заземление, земля
ground		земля, почва
dead	[ded]	выключенный
dangerous	['deɪndʒərəs]	опасный
strong		сильный, яркий ( <i>о свете</i> )
to save		спасать
to disappear		исчезать
to appear		появляться
live	[laɪv]	под напряжением
dry		сухой
wet		сырой, мокрый

12. a) Cover the right column and read the English words. Translate them into Russian and check your translation.

b) Cover the left column and translate the Russian words back into English.

13. Put down the corresponding nouns. Form nouns from these adjectives and translate them into Russian.

*Model:* wide – width

strong –	_____	broad –	_____
long –	_____	high –	_____

14. Put down the Russian for:

under voltage	_____
under 20 V	_____

over 30 V	_____
the power is on	_____
the power is off	_____
great strength	_____
dry air	_____
dead conductor	_____
live conductors	_____

**15. Choose the suitable words and translate the sentences:**

1. The danger of electric shock (*appears, disappears*) when the conductor becomes (*live, dead*).
2. Current passes through faulty (*earthed, unearthed*) part of installations when the power is on.
3. Low accuracy of measurement is (*an advantage, a disadvantage*) of the measuring device.
4. The danger of electric shock (*increases, decreases*) in the wet and hot atmosphere.
5. No current flows through a (*dead, live*) conductor.

**16. Fill in using the verbs *to detect, to appear, to disappear, to decrease*:**

1. When resistance increases, the risk of electric shock ... .
2. Faults in electric installations are ... by means of special devices.
3. Electric power ... only on live conductors with power on.
4. When the device is switched off electric power ... .

**17. Complete the sentences using the correct variant:**

- |                                                        |                                                                           |
|--------------------------------------------------------|---------------------------------------------------------------------------|
| 1. Earthing system serves                              | a) as protection from an electric shock.<br>b) as connection with ground. |
| 2. Voltage appears on                                  | a) dead parts.<br>b) live parts.                                          |
| 3. Contact with live conductors is                     | a) dangerous.<br>b) safe.                                                 |
| 4. Connection to ground is made                        | a) by means of wire conductors.<br>b) by means of earthing electrodes.    |
| 5. Danger of an electric shock disappears if the frame | a) is earthed.<br>b) is unearthed.                                        |

**18. Complete the sentences using *while*.**

1. The insulation resistance of a faulty **unearthed** frame is extremely **low**... .

2. Danger of an electric shock **disappears** when the faulty parts are **earthed**... .
3. One should work on the circuit when the power is **off**. One should not work on the circuit when the power is ... .
4. Contact with **dead** conductors is **safe**... .
5. In **dry** air the risk of an electric shock **decreases**... .

**19. Answer these questions:**

1. What does an earthing system serve for?
2. What parts are termed dead (live)?
3. In what air does the risk of an electric shock decrease?
4. By what means is connection to ground made?
5. What does an electric shock result from?
6. Is a current of 50 mA dangerous for a man?
7. Is wet and hot atmosphere dangerous for the attending personnel?
8. Does the risk of an electric shock decrease with increasing current?

**20. Read the text and write four questions about it. Ask your groupmates to answer them.**

A man can get an electric shock when he comes into contact with the electric fish. One of this kind is found in the tropical waters of South America: it is the electric eel. Small electric eels, one inch long, give a small shock. When the fish is 6 inches long its internal battery gives as much as 200 volts. A very big fish can generate 600 volts! When it is short-circuited, a current of one ampere can be obtained. A two-meter long eel can light a dozen 50 watt lamps. The eel's head is positively charged and the opposite end is negatively charged.

**Раздел 4. Variety of Electric Motors / Многообразие электродвигателей**

**Практическое занятие № 27 – 28.**

**Тема 14. Principle of Electric Motor Operation:**

**Electromagnetic Machines. The Development of Electric Motor /**

**Принцип работы электродвигателя:**

**Электромагнитные механизмы. Развитие электродвигателя**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

**Теоретическая часть:**

**Electromagnetic Machines**

1. Before Faraday's discoveries the only usable source of electricity was the galvanic battery, and it made possible some practical applications, including the electric light and the electric telegraph. But the practical supply of electricity on a large scale was only possible by the development of electromagnetic machines, generators and transformers.
2. For the use of electricity to produce mechanical power where it is wanted, another electromagnetic machine – the electric motor – still remains the most effective method.
3. What made all this possible? It needed not only the discovery and understanding of the basic laws (by Faraday), but also the discovery of materials with suitable properties. It is really very fortunate that high magnetic fields can be sustained in a material as cheap as iron. Without iron, the whole economics of electromagnetic machines and of electrical-power applications would be quite different.
4. The electromagnetic machine is still developing in other respects. Using iron, it is cheap to produce the magnetic field, but an important limitation is imposed by saturation. This limit can be overcome by using superconductors at very low temperatures to carry very high currents and produce much stronger magnetic fields – without using iron. This development opens up a new field for machine designs and applications, and it offers a different set of limits from those of the copper-iron machine.
5. Nevertheless, the copper-iron machine is so simple and reliable that it is likely to continue for a very long time as the main method of producing mechanical power. For many applications, the dominant factors are not efficiency and **power/weight ratio**<sup>1</sup> but convenience and cleanliness, and with electricity one is really buying convenience rather than power. It seems likely that the main advances in domestic applications will be by developments of control and programming to give even greater convenience, a good present example being the automatic washing machine.
6. The electric motor is a superb machine to provide power, and its applications must expand for that reason alone.

#### **Примечание**

1 power/weight ratio – мощность на единицу веса (двигателя)

#### **Vocabulary**

automatic	автоматический
generator	генератор
limitation	ограничение
machine	машина
mechanical	механический
motor	двигатель
ratio	соотношение
saturation	насыщение
superb	превосходный
superconductor	сверхпроводник
sustain	поддерживать
temperature	температура
transformer	трансформатор

#### **Вопросы и задания:**

1. Переведите и запомните следующие слова и словосочетания: discovery, application, development, property, limitation, superconductor, convenience, programming; copper-iron machine, electromagnetic machine, electrical- power applications, magnetic fields, dominant factor, power/ weight ratio, automatic washing machine, method of producing mechanical power, different set of limits.
2. Прочтите и переведите текст; расскажите о назначении *galvanic battery* и *copper-iron machine*.
3. Назовите основные причины использования железа в электротехнике.



4. Расскажите о недостатках в использовании железа при создании electromagnetic machine и их преодолении, употребите слова limit, overcome, superconductor, temperature, current.
5. Прочтите пятый и шестой абзацы текста и скажите, почему, по вашему мнению, имеют широкое применение copper-iron machines.
6. Прочтите текст еще раз и расскажите об электромагнитных механизмах; употребите в ответе следующие слова и словосочетания: practical supply, to produce, materials with suitable properties, fortunate, iron, quite different, limitation, saturation, nevertheless; to continue for a long time, convenience and cleanliness, the main advances, a superb machine.
7. На основании прочитанного расскажите о развитии электрической машины, используя слова и выражения to overcome, low, superconductors, temperature, stronger, to carry, high currents и др.
8. Выскажите свое мнение о преимуществах и недостатках электромагнитной машины, употребите в ответ слова и выражения, данные в скобках (effective, reliable, iron, to make possible, magnetic fields, limitation, saturation, to produce).
9. Сообщите кратко о главных факторах в применении домашних электрических приборов, используйте слова и словосочетания, предложенные в скобках (efficiency, rather than, main, convenience, cleanliness, advantage, power/weight ratio).
10. Переведите и запомните следующие слова и словосочетания: electromagnet, electricity, generator, achievement, aluminium; electric motor, induction motor, galvanic battery, squirrel-cage motor, circular rings, parallel bars, a cylindrical cage, far-reaching innovation, speed change, the pole-amplitude of the machine, high-frequency engineering, wire cage.
11. Прочтите и переведите текст; расскажите о значениях слова «it» в соответствии с содержанием текста.

### The Development of Electric Motor

1. The engine which could convert electric energy into mechanical power was already in existence. As early as 1822 Faraday outlined the way in which an electric motor could work: by placing a coil, or armature, between the poles of an electromagnet; when a current is made to flow through the coil the electromagnetic force causes **it** to rotate – the reverse principle, in fact, of the generator.
2. The Russian physicist, Jacobi built several electric motors during the middle decades of the XIXth century. Jacobi even succeeded in running a small, battery-powered electric boat on the Neva river in St. Petersburg. All of them, however, came to the conclusion that the electric motor was a rather uneconomical machine so long as galvanic batteries were the only source of electricity. It did not occur to them that motors and generators could be made interchangeable.
3. In 1888, Professor Galileo Ferraris in Turin and Nikola Tesla – the pioneer of high-frequency engineering – in America invented, independently and without knowing of each other's work, the induction motor. This machine, a most important but little recognized technical achievement, provides no less than two-thirds of all the motive power for the factories of the world, and much of modern industry could not do without **it**. Known under the name of "squirrel-cage motor" – because **it** resembles the wire cage in which **squirrels**<sup>1</sup> used to be kept – **it** has two circular rings made of copper or aluminium joined by a few dozen parallel bars of the same material, thus forming a cylindrical **cage**.<sup>2</sup>
4. Although the induction motor has been improved a great deal and its power increased many times ever since its invention, there has never been any change of the underlying principle. One of its drawbacks was that its speed was constant and unchangeable.
5. Some years later a squirrel-cage motor with two-speeds – the most far-reaching innovation since the invention of the induction motor was developed. The speed change is achieved by modulating the pole amplitude of the machine.

#### Примечания

- 1 squirrel – белка
- 2 cage – клетка

12. Прочтите текст и обратитесь к вниманию на следующие слова: battery-powered, high-frequency, «squirrel-cage», two-speeds, far-reaching, pole-amplitude – искажите, какими изобретениями они связаны.
13. Прочтите текст еще раз, расскажите о принципе работы электрического двигателя, используйте следующие слова и выражения: a coil, pole, to flow through, to cause, the reverse principle и др.
14. Расскажите об устройствах гальванического элемента и «a squirrel-cage motor».
15. Прочтите текст и скажите, какая разница между электродвигателем и асинхронным двигателем, используйте слова poles, current, coil, a wire cage, rings, copper or aluminium, parallel bars.
16. На основании полученной информации расположите в нужной последовательности открытия, сделанные учеными в области электричества и электротехники, скажите, в каких странах и в какое время это происходило.
17. Расскажите о причине постоянства основного принципа работы двигателя, очень важного, но мало признанного.
18. Прочтите текст и скажите, какая инновация произошла с двигателем Г. Феррари и Н. Тесла в конце XIX века.
19. Расскажите о современном использовании электрических двигателей в быту и промышленности.

### **Практическое занятие № 29 – 30.**

#### **Тема 15. Types of Electric Motors and Their Features:**

#### **Direct Current Motors. Alternating Current Motors /**

#### **Виды электродвигателей и их особенности:**

#### **Электродвигатели постоянного тока. Электродвигатели переменного тока**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### **Теоретическая часть:**

#### **Electric Motors**

1. Motors are used for converting different forms of energy into mechanical energy.
2. The main part of a motor is a coil or armature. The armature is placed between the poles of a powerful magnet. When a motor is put into operation current starts flowing through the coil (armature) and the armature starts rotating.
3. Electric motors are necessary for all branches of industry, transport and agriculture. They are used in industrial plants, and operate under different conditions, both favourable and unfavourable for their service life. Because of their different applications, motors are manufactured in many different designs.
4. Each motor has a nameplate attached to its frame. The nameplate bears machine ratings. To these belong: output power in kilowatts, voltage, the rated current, the starting current, the power factor, the efficiency, the rated torque.

5. These machine ratings are important for the use of motors during their service life-which is normally equal to about 10 years, provided the operating conditions are favourable. Under abnormal and unfavourable conditions it is much shorter. Thus normal and favourable ambient conditions are very important for the length of a motor's service life.

6. According to the type of energy required for their operation, electric motors are divided into d.c. and a. c. motors.

### **Vocabulary**

a.c. – alternating current	переменный ток
abnormal	ненормальный
agriculture	сельское хозяйство
ambient	окружающий
armature	арматура
coil	катушка
current	ток
design	дизайн
efficiency	эффективность
favourable	благоприятный
machine	машина
manufacture	производство
mechanical	механический
service	оказание услуг
torque	крутящий момент

### **Вопросыизадания:**

1. Переведитеизапомнитеследующиесловаисловосочетания:industry, conditions, application, manufacture, nameplate, ratings,voltage, efficiency;service life, output power in kilowatts, to put into operation, both...and, because of, the rated current, the starting current, the rated torque,according to, to divide into, direct current = d.c.
2. Прочтите и переведите текст; дайте информацию о причинемноогообразия электрических моторов, используя because of в ответе.
3. Прочтите пятый абзац текста, обратите внимание на отрицательные приставки прилагательных и скажите о сроке службыэлектрических моторов.
4. Прочтите внимательно два последних абзаца и скажите,в чем состоит разница между двигателями постоянного и переменного тока.
5. Расскажите о конструкции мотора и его принципе работы.
6. Какой «документ» имеет каждый двигатель и какие сведения можно узнать, прочитав его.
7. Скажите, какая разница между номинальным и пусковымтоком.
8. Расскажите о возможных сроках службы электрическихдвигателей.
9. Выпишите из текста термины, относящиеся к электротехнике.
10. Переведитеизапомнитеследующиесловосочетания:starting current, starting torque, armature current, starting rheostat,prime mover, rated value, line voltage, automatic control system, stationarypart, rotating part, coil section;to operate at no-load, to result in fluctuation, to prevent fault, to beattached to, to be actuated by.
11. Прочтите и переведите текст; расскажите о сфере применения двигателей постоянного тока.

### **Direct Current Motors**

1. D. c. motors actuate installations requiring large starting torques. To them belong, for example, electrified transport (electric trains, trolleybuses, etc.), cranes and other installations. D. c. motors are also used in automatic control systems.
2. A d. c. motor consists of two main parts: stationary part (stator) and rotating part (rotor). These parts are separated by an air gap. The stator serves for producing the magnetic field. It includes the poles and a frame manufactured from iron and steel.
3. The rotor (armature) comprises a shaft, a core, a commutator and windings. The winding is made of coil sections consisting of insulated copper wire. The commutator includes copper bars insulated from one another. The bars are also insulated from the shaft. The commutator is attached to the shaft by means of metal rings. The armature connected to the load is actuated by a prime mover. The prime mover supplies a torque.
4. When a motor is operating at no-load, the armature current is equal to zero or so small that it can be ignored.
5. In direct connection of a d. c. motor to a supply circuit the starting current is rather heavy; it may exceed the rated value. This may result in fluctuations in the voltage or some other faults. In order to prevent these faults, d. c. motors should not be connected directly to the line voltage. In order to reduce high starting currents, starting rheostats should be utilized.
12. Прочтите второй и третий абзацы текста и скажите о функциях статора и ротора.
13. Расскажите о конструкции двигателя постоянного тока, используя следующие глаголы: to consist of, to separate by, to include, to comprise, to make of, to insulate from, to attach to, to connect to, to actuate by.
14. Прочтите третий абзац текста и расскажите о преобразователе тока.
15. Расскажите, в чем состоит разница между током статора без нагрузки и пусковым током.
16. Прочтите последний абзац текста и скажите, что происходит с двигателем постоянного тока, если «тяжелый» пусковой ток превышает номинальный.
17. Расскажите все, что вы знаете о двигателе постоянного тока.
18. Переведите и запомните следующие словосочетания: squirrel-cage motor, single-phase motor, three-phase motor, phase-wound motor, wound-rotor motor; low speed motor, voltage drop, flexible lamination, considerable voltage drop, deenergization of metal parts, constant disinformation, decomposition of structure, lengthy period of (dis)use, low/high speed operation.
19. Прочтите и переведите текст; найдите все определения, выраженные простыми и составными существительными; скажите, каким образом с их помощью характеризуются электродвигатели переменного тока (alternating current (a.c.) motors).

### **Alternating Current Motors**

1. A. c. motors are subdivided into single- and three-phase motors. The single-phase motors are used in refrigerators, washing machines, floor polishes, etc.
2. As to the three-phase motors they are widely used in industry. The two main designs of three-phase motors are highly in use nowadays: phase-wound motors and squirrel-cage motors.
3. The a. c. phase-wound motor, like the d. c. machines, includes the stationary part—the stator, and the rotary part—the rotor. The stator consists of a frame with a core. The rotor, like the d.c. armature, consists of steel laminations, insulated from one another; the three-phase winding is connected to the three rings insulated from one another by means of brushes. By these brushes the rotor is connected to the starting rheostat. As soon as the motor is started, the rotor current drops to its normal value and the starting rheostat stops operating.
4. The rotor of the squirrel-cage three-phase motor differs from that of the wound-rotor motor. Its rotor is a winding built in the form of a cylindrical cage. The cage consists of copper bars attached to the copper rings; this kind of rotor is termed squirrel-cage. Squirrel-cage motor rotors are supplied with ventilation. The ventilation serves to prevent their overheating.
5. Installed motors are given a test at no-load and under a load. No-load test serves to check the motor for noise. In the process of test no abnormal noise should be heard. In case this noise appears, the motor must be disconnected. After the check, the motor is given one more, no-load

test.

20. Прочтите текст еще раз и выделите все ключевые существительные, которые дают представление о конструкции электродвигателя.

21. Прочтите третий абзац этого же текста и найдите в нем причастия прошедшего времени (PII), которые дают представление о конструкции электродвигателя переменного тока.

22. Прочтите третий абзац текста и скажите, как слово like дает нам представление о конструкции электродвигателя.

23. Прочтите четвертый абзац этого же текста и найдите примеры употребления глаголов с послелогом, расширяющими наши знания о конструкции электродвигателя.

24. Прочтите пятый абзац текста, обратите внимание на использование слова «to»; скажите, какую информацию вы получили методами проверки электродвигателей.

25. Прочтите первый и третий абзацы текста и скажите, что обозначают сокращения d.c. и a.c.; в чем состоит различие в конструкции соответствующих электродвигателей.

250. Расскажите все, что вы знаете о двигателе переменного тока.

### Практическое занятие № 31 – 32.

#### Тема 16. Electric Machines:

#### Transformers and Electric Motors.

#### Faults of Motors and Ways of Their Repair / Электрические машины:

#### Трансформаторы и электродвигатели.

#### Неисправности двигателей и способы их устранения

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

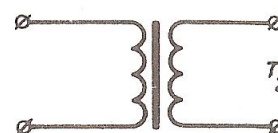
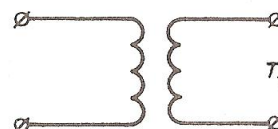
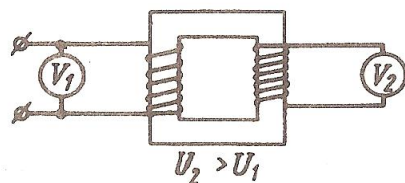
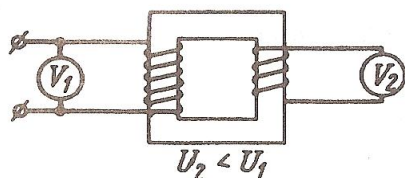
**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### Теоретическая часть:

#### Transformers

A transformer is used to transfer energy. Due to the transformer electric power may be transferred at a high voltage and reduced at the point where it must be used to any value. Besides, a transformer is used to change the voltage and current value in a circuit.



A two-winding transformer consists of a closed core and two coils (windings). The primary winding is connected to the voltage source. It receives energy. The secondary winding is connected to the load resistance and supplies energy to the load.

The value of voltage across the secondary terminal depends on the number of turns in it. In case it is equal to the number of turns in the primary winding the voltage in the secondary winding is the same as in the primary.

In case the secondary has more turns than the primary the output voltage is greater than the input voltage. The voltage in the secondary is greater than the voltage in the primary by as many times as the number of turns in the secondary is greater than the number of turns in the primary. A transformer of this type increases or steps up the voltage and is called a step-up transformer. In case the secondary has fewer turns than the primary the output voltage is lower than the input. Such a transformer decreases or steps down the voltage, it is called a step-down transformer.

Compare  $T_1$  and  $T_2$  in the diagram.  $T_1$  has an iron core. For this reason it is used for low-frequency currents.  $T_2$  has an air core and is used for high frequencies.

Common troubles in transformers are an open in the winding, a short between the primary and the secondary, and a short between turns. In case a transformer has a trouble it stops operating or operates badly. A transformer with a trouble should be substituted.

### Vocabulary

core		сердечник
winding	['waɪndɪŋ]	обмотка
turn		виток
to step up		повышать
to step down		понижать
frequency	['fri:kwənsɪ]	частота
due to	['dju:tə]	благодаря, из-за

### Вопросы и задания:

1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.
- b) Cover the left column and translate the Russian words back into English.

### 2. Put down the Russian for:

iron core	_____	primary winding	_____
closed core	_____	secondary winding	_____
input voltage	_____	step-up transformer	_____
output voltage	_____	step-down transformer	_____

### 3. Complete the sentences using the correct variant:

1. A transformer is used
  - a) to store charge.
  - b) to prevent the change of energy.
  - c) to transfer energy.
  - d) to change the voltage and current value in a circuit.
2. Electric power is transferred at a high voltage and reduced to any value
  - a) due to resistors.
  - b) due to capacitors.
  - c) due to transformers.
3. A transformer consists of
  - a) cores only.
  - b) the primary and the secondary windings.
  - c) a core and the primary and the secondary windings.
4. The function of the primary is
  - a) to prevent the change of voltage.
  - b) to supply energy.
  - c) to receive energy.
5. The function of the secondary is
  - a) to receive energy.
  - b) to supply energy.
  - c) to transfer energy.
  - d) to decrease the value of charge.
7. A step-down transformer is used
  - a) to step down the secondary voltage.
  - b) to step down the primary voltage.
8. A transformer with an iron core
  - a) is used for high-frequency currents.
  - b) is used for low-frequency currents.
9. A transformer with an air core is used
  - a) for high-frequency currents and for low-frequency currents.
  - b) for high-frequency currents only.
10. In a step-up transformer
  - a) the number of turns of the secondary winding is greater than the number of turns of the primary.
  - b) the number of turns of the primary winding is greater than the number of turns of the secondary.
11. A transformer should be substituted
  - a) in case it has an open in the winding.
  - b) in case it has a short between the primary and the secondary.
  - c) in case it has a short between turns.

### 4. Complete these sentences using *while*.

1. **The secondary winding** of a transformer is connected to **the load resistance**...
2. The **primary** winding **receives** energy...

3. A **step-down** transformer **decreases** the primary voltage... .
4. An **air** core transformer is used for **high**-frequency currents ... .
5. In a **step-up** transformer the number of turns of the **secondary** winding... .  
is greater than the number of turns of the **primary** winding ... .

**5. Pair work. Put these questions to your groupmate and ask him/her to answer them.**

1. What is a transformer used for?
2. What does a transformer consist of?
3. What is the function of the primary winding?
4. What is the function of the secondary winding?
5. What type of transformer is called a step-up transformer?
6. What type of transformer is used for high-frequency currents?
7. What type of transformer is called a step-down transformer?
8. What type of transformer is used for low-frequency currents?
9. What is the relation between the number of turns in the windings and the value of current?
10. What are common troubles in a transformer?
11. What should be done in case a transformer has a trouble?

**6. Read about current transformers. Answer the questions that follow.**

### **Current Transformers**

Current transformers are used for operating ammeters, wattmeters, and other measuring devices. They produce in the meters a current lower than the measured current but proportional to it.

Current transformers also insulate the instrument from the circuit which is being measured. This is necessary for high voltage circuits.

- **What is a current transformer used for?**
- **What type of current does it produce?**

**7. Read the text and find in it the answer to the question that follows it.**

### **High-Frequency Current**

Alternating current with frequency of 50 c/s is widely used in industry. Therefore this frequency is called an industrial frequency and the current, an industrial frequency current.

During sound transmission, current flowing in telephone wires changes with the frequency of sound oscillations, which ranges from 50 to 10,000 c/s. The currents of such frequencies are called audio- or low-frequency currents.

Radio transmission is based on the use of alternating currents with frequencies of hundreds, thousands, millions and even tens of million cycles per second. These currents called high-frequency currents are produced by means of an oscillatory circuit consisting of a coil and a capacitor. Moving along the turns now in one direction now in another, the electric charges oscillate in an oscillatory circuit.

- **By what means are high-frequency currents obtained?**

**8. Read the text and find in it the answer to the question that follows it.**



## Superconductivity

In the electric generating field, as well as in the electric-transmission and storage-technology areas, considerable attention is focused on the use of superconductivity conductors. Cooling an electric conductor to temperatures close to absolute zero ( $-273^{\circ}\text{C}$ ) results in the conductors' losing their resistance to electric current. Accordingly, their ohmic losses also drop greatly. Current densities of tens of millions amperes per sq. cm can be tolerated in such conductors.

Cryogenic technology being now mastered, one can foresee the possibility of supercooling not only generators but also underground transmission lines and storage coils.

- **Are these statements true or false?**

- a) Conductors can never lose their resistance to the flow of electric current.
- b) Generators and underground transmission lines can be supercooled.

### 9. Read the text and find in it the answer to the question that follows it.

#### Metals Used as Conductors

The use of electricity depends upon a means of conducting it from its source to the point where it is to be used. Copper has been used as a conductor since the beginning of the industry and no proper substitute has been found. Only one metal, silver, is more efficient, but it has too high cost to be extensively used.

Aluminium, because of its lightness, is used in common practice for transmission lines where long spans are necessary. It has, compared to other metals, a conducting capacity of about 60 per cent of that of copper.

- **Why cannot silver be extensively used?**

### 10. Think of three questions of your own about each of the given sentences. Put them down.

1. Electric charges are acted upon by forces when they move in the magnetic field.

---

2. Copper has been used as a conductor since the beginning of the industry.

---

3. Nuclear reactors decrease air and land pollution but they increase thermal and radiation pollution.

---

### 11. Use the required tense form. What are the meanings of the word time in the sentences?

1. The experiment (*repeat*) many times.

2. The power which (*radiate*) as light is almost three times as great as that radiated as heat.
3. It (*know*) that iron molecules are magnets at all times.
4. Under ordinary room lightning the resistance of transistors (*decrease*) millions of times.
3. Ruby crystals about ten centimetres long can (*intensify*) light ten times.
6. The density of a semiconductor laser radiation (*be*) hundreds of times as great as that of the ruby laser.
7. The power which (*transmit*) along a wire is the product of the voltage times the amperage.

**12. Copy the following sentences. Underline the predicates (ones in the Passive Voice with two lines). Translate the sentences into Russian.**

1. A gas-cooled reactor is a nuclear reactor in which the coolant is a gas.
2. The lowest temperature theoretically possible is called the absolute zero.
3. What do substation power supply circuits depend on?
4. The transmission lines are interconnected in switching stations. These network interconnections are referred to as buses.
5. In a power network the large blocks of electric power are transmitted on the grid of transmission lines. From the grid, power is being subdivided into smaller blocks and fed into the subtransmission parts of the power network. Finally, the consumers are being serviced from the distribution network.
6. The energy industry is undergoing considerable development.
7. The world power capacity is doubling about per decade.
8. Development of nuclear power plants for civil use began in the mid-1950s.
9. In order to meet demands for power during the day, utilities have been turning to other forms of hydroelectric systems.
10. In the electric generating field as well as in the electric transmission and storage-technology areas considerable attention is concentrated on the use of superconducting conductors because of their ability of losing their resistance under certain conditions, namely at temperatures close to absolute zero ( $-273^{\circ}\text{C}$ ).
11. The maximum voltage applied to a dielectric material without causing it to break down and expressed in volts per mm is termed its dielectric strength.
12. Electrical loads or consumers in power installations are the various arrangements and installations that are used to transform electric power into mechanical, heat and chemical power, or energy.

### **Electric Motors**

Motors are used for converting different forms of energy into mechanical energy.

The main part of a motor is a coil or armature. The armature is placed between the poles of a powerful magnet. When a motor is put into operation current starts flowing through the coil (armature) and the armature starts rotating.

Electric motors are used practically in every branch of industry, transport, and agriculture. Naturally, they are produced in many different designs. They are used in industrial plants, aim operate under different conditions.

Each motor is supplied with a nameplate which bears machine ratings: output power, voltage, the rated current, the starting current, the power factor, the efficiency, and the rated torque.

These motor ratings should be taken into consideration since they are necessary for the users. On them depends the length of motors' service life, which is normally equal to about 10 years, provided that the operating conditions are normal. Naturally, under abnormal conditions the service life becomes much shorter: motors operate poorly and may have different faults.

### **Vocabulary**

condition	[kən'dɪʃn]	условие
plant	[plɑ:nt]	завод
pole		полюс
torque	[tɔ:k]	вращение, момент вращения
poor	[puə]	бедный, плохой
nameplate	['neɪmpleɪt]	(заводская) табличка

- 13. a) Cover the right column and read the English words. Translate them into Russian and check your translation.**  
**b) Cover the left column and translate the Russian words back into English.**

- 14. Read the words and put down their Russian equivalents. Then translate them back into English.**

['ɪndəstri]	industry	_____
['sə:vɪs]	service	_____
['trænsɜ:t]	transport	_____
['mɔ:tə]	motor	_____
['præktɪkəl]	practical	_____
[pəu'tenʃəl]	potential	_____

- 15. Give the Russian for:**

magnet pole	_____
different conduit	_____
machine ratings	_____
rated torque	_____
service life	_____
poor operation	_____

- 16. Form adjectives and adverbs. Translate them into Russian.**

a. care – careful	_____
-------------------	-------

use –	_____	_____
power –	_____	_____
b.care – careless		_____
use –	_____	_____
power –	_____	_____
wire –	_____	_____
c.normal – normally		_____
practical –	_____	_____
potential –	_____	_____
abnormal –	_____	_____
poor –	_____	_____

**17. Answer these questions:**

1. What types of magnets are used in heavy industry?
2. How long is motors' service life under normal conditions?
3. Are motors used in every branch of industry?
4. What are the main types of motors in use nowadays?

**18. Complete the sentences using the correct variant:**

- |                                         |                                                                          |
|-----------------------------------------|--------------------------------------------------------------------------|
| 1. Motors are used                      | a) for transmitting energy.<br>b) for converting energy.                 |
| 2. Motor's main part is                 | a) the frame.<br>b) the armature.<br>c) the stator.                      |
| 3. The armature is placed               | a) between the poles of the magnet.<br>b) about the poles of the magnet. |
| 4. Motors' service life becomes shorter | a) under normal conditions.<br>b) under abnormal conditions.             |
| 5. Faulty motors operate                | a) normally.<br>b) poorly.                                               |

**19. Answer these questions. Use them in a talk with your groupmate:**

1. What are motors used for?
2. What is the motor's main part?
3. Where is the armature placed?
4. What ratings does the nameplate of a motor bear?
5. Under what conditions does a motor operate normally (poorly)?

**20. Read about energy resources of today. Write three questions about the text and ask your groupmate to answer them.**

### **Energy Resources of Today**

People are energy-rich today. Solar energy is considered to be a potentially limitless source of clean energy. The waters of the world contain potential fuel – in the form of a special isotope of hydrogen – deuterium. It is sufficient to power fusion reactors for thousands of years.

**21. Read the text and find in it the answer to the question that follows it.**

### **Solar Energy**

The Sun radiates to our planet great amounts of energy. This energy input fuels all our biological processes and is the original source for hydropower, wind power, and fossil fuel resources. Environmentally and economically, the Sun is our greatest energy source. Why then is the direct use of solar energy so limited for industrial, domestic, commercial, and transportation purposes?

First, solar energy arrives in small quantities – only about one kW per square meter; second, it does not arrive at all during night hours. Third, it is very difficult to transform it into useful energy forms except low-grade heat.

- **Why is the direct use of solar energy limited nowadays?**

**22. Read the text and find in it the answers to the questions that follow it.**

The capacity of a capacitor is measured in farads. A capacitor has a capacity of one farad when a charge of one coulomb increases the potential between its plates by one volt.

The capacity depends on four things:

first, the higher the voltage used to charge the capacitor the more energy it will store;

second, the larger the size of plates and the greater their number the more energy will be stored;

third, the closer are the positive and negative plates the greater is the charge;

fourth, some insulators store greater charge than others.

- **What does the capacity of a capacitor depend on?**
- **Give the title to the text.**

**23. Read the following sentences, containing the Subjunctive Mood forms. Which of the sentences refer to the Present (the Future) and which to the Past?**

1. Zero-resistance transmission lines would be very economical!
2. Without these means of communication the scientists would have great difficulties in observing man-made satellites.

3. If thin wires had been used in this device the wires would have melted.
4. If the operators had used some additional components they would have been able to actuate the relay.
5. We know a moving magnet to induce a current in a wire, the effect being stronger if the wire were in the form of a coil.
6. It was a job one could have done much better.
7. Without the Sun there would be no light, no heat, no energy of any kind.
8. Oxygen is an element of greatest importance to the Earth as all living things would die without it.
9. If it were not for lasers a great number of technological developments would not have taken place.
10. In some hot countries the use of only one percent of the solar energy would serve an enormous source of energy.
11. No subject is more surprising than magnetism; what would you think if you found that on mixing ebonite and bakelite in some definite proportions a good conductor is formed or that a mixture of copper and iron forms a good insulator?

**24. Put down the title corresponding thematically to each of the given descriptions.**

1) *Titles:* Electric Motor; Synchronous Motor; Asynchronous Motor; Induction Motor.

- |  |                                                                                                                                                                              |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | 1. An a.c. motor in which the rotation takes place in synchronism with the rotating element of the generator supplying the operating current;                                |
|  | 2. A machine for transforming electric power into utilizable mechanical power;                                                                                               |
|  | 3. An a.c. motor in which the rotation is not synchronous with the rotating element of the generator supplying the driving current;                                          |
|  | 4. An asynchronous a.c. motor in which the current flowing in the winding of the secondary winding is induced electromagnetically by the current flowing in the primary one. |

2) *Titles:* Control Power T; Air-blast T; Oil-cooled T.

- |  |                                                                                            |
|--|--------------------------------------------------------------------------------------------|
|  | 1. A T which is cooled, when operating, by a flow of oil through its framework;            |
|  | 2. A T which is cooled, when operating, by a blast of air delivered through its framework; |
|  | 3. A T which serves as the source for a.c. control power for operating a.c. devices.       |

3) *Titles:* Feeder; Commutator; Converter.

- |  |                                                                                                                           |
|--|---------------------------------------------------------------------------------------------------------------------------|
|  | 1. A machine which operates by means of a rotating commutator to convert a.c. into d.c. for distribution;                 |
|  | 2. In an electric distributing system, a supply conductor carrying current from a power-house to main conductors, and not |

itself connected to motors, lamps, or translating devices;

3. A device for changing the direction of a current.

4) *Titles:* Series Generator; Shunt Generator; Turbo-alternator; Compound Motor.

1. A machine which generates an electric current (usually a dynamo electric generator, both a shunt winding and a series winding are on its field magnets);

2. A machine consisting of an a.c. generator mounted upon the shaft of a steam turbine;

3. A generator whose field-magnet winding is connected in series with or in succession to its armature;

4. A generator whose field-magnet winding is connected in shunt to, or in parallel with its armature.

### Faults of Motors and Ways of Their Repair

Motors may have different faults. A faulty motor does not start, or, when it is started, it operates at an excessive speed.

Its brushes may spark and its windings and the commutator may be overheated and burnt. Besides, a motor may produce an abnormal noise, etc. All these and other faults should be detected and repaired.

In case the motor does not start it may have different faults (see the table):

*Table*

<i>Possible causes of faults</i>	<i>Ways of repair</i>
1. Fuses are faulty.	1. Replace the fuses.
2. Motor is overloaded.	2. Reduce motor load.
3. Circuit in armature winding has an open.	3. Repair the armature winding.
<i>In case the motor, when started, stops:</i>	
1. Rheostat is shorted.	1. Check the rheostat and repair it.
2. Rheostat switches from one position to another.	2. Slow down operation of rheostat handle.
<i>Brushes may spark in case:</i>	
1. Motor is overloaded.	1. Reduce the load and remove overload.
2. Brushes are in poor condition.	2. Replace the brushes.
3. Pressure is low.	3. Adjust the pressure.

4. Pressure is excessive.	4. Adjust the pressure.
<i>In case the armature winding is overheated:</i>	
1. Motor is overloaded.	1. Remove the overload.
2. Ventilation fails to operate properly.	2. Check for slowing down the speed of the motor.
<i>In case of abnormal motor speed:</i>	
1. Motor is overloaded.	1. Reduce the load.
2. Rotor circuit has poor contact.	2. Repair the shorting mechanism.
<i>In case rotor brushes against stator:</i>	
Rotor brushes against stator.	Adjust air gap.

### Vocabulary

to repair	[rɪˈpeə]	ремонтировать
brush	[brʌʃ]	щетка
gap		зазор, люфт
spark		искра
speed		скорость
noise	[nɔɪz]	шум
slow		медленный
excessive	[ɪkˈsesɪv]	избыточный
check		проверка
to adjust		регулировать, подгонять

**25. a) Cover the right column and read the English words. Translate them into Russian and check your translation.**

**b) Cover the left column and translate the Russian words back into English.**

**26. Read the words and put down their Russian equivalents:**

[ˈkɒmjʊːtətə]      commutator      \_\_\_\_\_



['stɜrtə]	stator	_____
['rəʊtə]	rotor	_____
['kɒntækt]	contact	_____
[kən'tækt]	to contact	_____
['prəʊses]	process	_____

**27. Put down the verbs corresponding to the given nouns and translate them:**

check	to check	проверять
spark	_____	_____
brush	_____	_____
repair	_____	_____
slow ( <i>adj</i> )	_____	_____

**28. Put down the Russian equivalents of these word combinations. Translate them back into English (orally).**

air gap	_____
brush sparks	_____
slow speed	_____
excessive speed	_____
safety devices	_____

**29. Answer these questions:**

1. What do motors' faults result from?
2. Are there any faults that can be ignored?
3. What makes motors' service life shorter?
4. What does voltage supply stop result in?
5. What processes show the (dis)advantages of devices?

**30. Are the words: *spark, short, slow, brush, fault, load, test* nouns? Are they verbs? Translate the sentences into Russian:**

1. New motors are given a no-load and under a load tests.
2. When the motor is tested it should produce no abnormal noise.
3. In case this noise appears the motor must be disconnected.

4. This generator must be checked; one should give it a test.
3. The motor's brushes seem to be sparking. Can you see the sparks?
6. The windings of the coil are shorted. I have detected a short in the windings.
7. The armature rotates slowly; let's check it up!
8. The speed of rotation is too excessive; it must be slowed down.
9. In case the rotor brushes against the stator, the motor operates slowly. The faulty brushes should be replaced.

**31. Complete the sentences using the correct variant:**

- |                                |                                                                                      |
|--------------------------------|--------------------------------------------------------------------------------------|
| 1. A motor with a fault        | a) operates normally.<br>b) operates poorly.                                         |
| 2. Motor brushes spark in case | a) they are in normal conditions.<br>b) they are in poor conditions.                 |
| 3. Burnt commutator should be  | a) replaced.<br>b) repaired.                                                         |
| 4. Brushes may spade in case   | a) pressure is low.<br>b) pressure is excessive.                                     |
| 5. Air gap is adjusted in case | a) the rotor brushes against the stator.<br>b) the stator brushes against the rotor. |

**32. Answer these questions:**

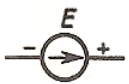













1. When does a motor operate poorly?
2. What should be done in case the motor is overloaded?
3. What should be done in case the fuses are faulty?
4. What should be done in case the rheostat is shorted?
5. What should be done in case the brushes spark?
6. What should be done in case the pressure is low?
7. What should be done in case the ventilation does not operate?
8. What should be done in case the rotor brushes against stator?

**33. Say a few words about your electrical engineering laboratory. Are there any faulty devices in it? Have a talk with your groupmate about the faults and the ways to repair them.**

**34. You know that all electrical devices and installations are constructed of a certain number of components. To these components belong electric power sources, wires, cables, buses, switches, fuses, resistors, rheostats, capacitors, transformers, motors and others.**

**35. Let us have a talk about these components. Speak with your groupmates about their types, their use, operation, possible faults and ways of their repair. Use the table below:**

<i>Circuit components</i>	<i>Symbols</i>

Electric energy source	
D.c. generator	
D.c. motor	
Chemical power source (primary or storage cell)	
Electric lamp	
Electric connection, removable and permanent	
Switches, single- and double-pole switches	
Fuse	
Load, resistor	
Safety earthing system	
Rheostat, or variable resistor	
Transformer, air-core T	
Iron-core T	
Capacitor, fixed C, variable C	

**36. Draw schemes of circuits and devices constructed from these components. Have a talk with your groupmates about them:**

1. Connect four resistors, two voltage sources and a switch in series. Speak about the construction and the operation of the circuit.
2. Connect several resistors and cells in series-parallel. Suppose that one of the resistors gets open; what does it result in? Suppose that a whole set gets open. What does it result in?
3. Measure the value of current (voltage, power, resistance) in the circuit. Use proper meters. Speak about the way you connect the meters to the circuit.
4. Take the proper components and construct an earthing protection system. Draw its scheme. Speak about its operation.
5. Draw a scheme of a thermal relay. What components are necessary for it?
6. Draw a scheme of an overhead transmission line. Speak about its operation. What are its possible faults?
7. Draw a scheme of a substation. Speak about its operation and about its possible faults. What are the ways of their repair?

**37. Put down the title corresponding thematically to each of the given descriptions.**

1) *Titles:* Conduction; Conductor; Conductivity; Sound; Circuit; Copper; Silver; Engine.

- |       |                                                                                                                                                   |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| _____ | 1. A device for converting one form of energy into another especially for converting other forms of energy into mechanical (i.e. kinetic) energy. |
| _____ | 2. The transmission of heat from places of higher to places of lower temperature in a substance.                                                  |
| _____ | 3. The reciprocal of the resistivity or specific resistance of a conductor.                                                                       |
| _____ | 4. A body capable of carrying an electric current.                                                                                                |
| _____ | 5. A red metal. It is unaffected by water or steam.                                                                                               |
| _____ | 6. The complete part with an electric current across it.                                                                                          |
| _____ | 7. White, rather soft metal. The best-known conductor of electricity.                                                                             |
| _____ | 8. A physiological sensation received by the ear. It is caused by a vibrating source and transmitted as a wave motion through air.                |

2) *Titles:* Electric Field; Direct Current; Alternating Current; Electromagnetic Radiation; Continuous Wave; Electromagnetic Spectrum.

- |       |                                                                                                                                                       |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| _____ | 1. Radiation consisting of waves of energy associated with electric and magnetic fields. This radiation is emitted by matter in units called photons. |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------|

- 
- 
- 
- 
- 
- 
2. The range of frequencies over which electro-magnetic radiations are propagated. The lowest frequencies are radio waves, increases of frequency produce infrared radiation, light, ultra-violet radiation, X-rays, gamma-rays and finally the radiation associated with cosmic rays.
  3. Radio or radar transmissions which are generated continuously and not in short pulses.
  4. An electric current flowing always in the same direction.
  5. A flow of electricity which, after reaching a maximum in one direction, decreases, finally reaching a maximum in the opposite direction, the cycle being repeated continuously. The number of such cycles per second is the frequency.
  6. The region near an electric charge, in which a force is acting on a charged particle.

3) *Titles:* Energy; Electrical Energy; Chemical Energy; Radiant Energy; Kinetic Energy; Potential Energy.

- 
- 
- 
- 
- 
- 
1. The capacity for doing work.
  2. That part of the energy stored within an atom or molecule which can be released by a chemical reaction.
  3. The energy which a body possesses by virtue of its position. It is measured by the amount of work the body performs in passing from that position to a standard position in which the energy is considered to be zero.
  4. The energy which a body possesses by virtue of its motion.
  5. The energy that is transmitted in the form of radiation.
  6. The energy associated with electric charges and their movements. It is measured in watt seconds (joules) or kilowatt-hours.

4) *Titles:* Accumulator; Cell; Primary Cell; Solar Cell.

- 
- 
- 
1. Device for producing an electric current by chemical reaction.
  2. A storage battery. A device for «storing» electricity. An electric current is passed between two plates in a liquid; this causes chemical changes in the plates and the liquid. When the changes are complete, the device is charged.
  3. Semiconductor devices which are made from thin slices of silicon. Almost all Russian and American satellites have

used such cells to supply on-board electrical power. Although the efficiency of these cells is no more than 10%, they provide a reliable electric power source that lasts for years on a satellite.

- 
4. A device for producing an electromotive force and delivering an electric current as the result of a chemical reaction.

## **Раздел 5. Power Systems and Environmental Protection / Энергосистемы И защита окружающей среды**

### **Практическое занятие № 33 – 34. Тема 17. Complex of Energy Resources: Electric Power Consumers. Power Systems / Комплекс энергетических ресурсов: Потребители электроэнергии. Энергосистемы.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### **Теоретическая часть:**

##### **Electric Power Consumers and Power Systems**

An electric power consumer is an enterprise utilizing electric power. Its operating characteristics vary during the hours of day, days and nights, days of week and seasons.

All electric power consumers are divided into groups with common load characteristics. To the first group belong municipal consumers with a predominant lighting load: dwelling houses, hospitals, theatres, street lighting systems, mines, etc.

To the second group belong industrial consumers with a predominant power load (electric motors): industrial plants, mines, etc.

To the third group belongs transport, for example, electrified railways. The fourth consists of agricultural consumers, for example, electrotractors.

The operating load conditions of each group are determined by the load graph. The load graph shows the consumption of power during different periods of day, month, and year. On the load graph the time of the maximum loads and minimum loads is given.

Large industrial areas with cities are supplied from electric networks fed by electric power plants. These plants are interconnected for operation in parallel and located in different parts of the given area. They may include some large thermal and hydroelectric power plants.

The sum total of the electric power plants, the networks that interconnect them and the power utilizing devices of the consumers, is called a power system. All the components of a power

system are interrelated by the common processes of protection, distribution, and consumption of both electric and heat power.

In a power system, all the parallelly operating plants carry the total load of all the consumers supplied by the given system.

The building up of a power system is of great importance for the national economy. An economical utilization of the power plant installations and of the sources of power is achieved by interconnected operation of a series of power plants in a common power distribution system.

## Vocabulary

to achieve	[ə'tʃi:v]	достигать
to belong (to)		принадлежать, относиться (к)
to feed		снабжать, питать
to determine	[dɪ'tə:mɪn]	определять
to relate		относиться (к), быть связанным (с)
predominant	[pri'dɒmɪnənt]	преобладающий
graph	[gra:f]	кривая, график
national		народное хозяйство
auxiliary	[ɔ:g'zɪlɪəri]	вспомогательный, добавочный
breaker		выключатель, прерыватель
busbar		собирающая шина
feeder		фидер
flexible		гибкий
to comprise	[kəm'praɪz]	включать в себя
to distribute	[dɪ'strɪbjʊ:t]	распределять
as ... to		что касается
as well as		так же, как и
blade		лопасть
level		уровень
magnitude	['mæɡnɪtju:d]	величина
head	[hed]	(зд.) верх, верхушка

plant	[pla:nt]	станция, завод
runner		ротор
shaft	[ʃɑ:ft]	привод, вал
torotate	[rou'teit]	вращать(ся)
to influence		влиять
to fluctuate	['flʌktʃueɪt]	колебаться

**Вопросы задания:**

**1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.**

**b) Cover the left column and translate the Russian words back into English.**

**2. Read the words and put down their Russian equivalents. Then translate them back into English (orally).**

[,kærɪktə'rɪstɪk]	characteristic –	_____
[mju:'nɪsɪpl]	municipal –	_____
[ɪ'lektrɪfaɪ]	to electrify –	_____
['haɪdrəʊ]	hydro –	_____
['pɪəriəd]	period –	_____

**3. Distribute the words below into three columns:**

action	process	doer
--------	---------	------

utilizer, protect, distribution, utilize, protection, distributor, consumption, consume, utilization, consumer

**4. Put down the Russian equivalents of these word combinations. Translate them back into English (orally).**

<b>a. load graph</b>	_____
lighting load	_____
power load	_____
<b>b. power utilizing devices</b>	_____



parallelly operating plants \_\_\_\_\_

enterprises utilizing power \_\_\_\_\_

**5. Complete the sentences translating the words in brackets:**

1. Water-turbine (заводы) are called hydroturbines.
2. Load graph (определяет) the operating load (условия).
3. Economical (потребление) of electric power (достигается) by interconnected operation of power plants.

**6. Answer these questions:**

1. What enterprises are called electric power consumers?
2. When do their operating characteristics vary?
3. What consumers belong to the four different groups?
4. What conditions does the load graph determine?
5. What type of system is called a power system?
6. What processes interconnect the components of a power system?
7. In what way is an economical utilization of power installations achieved?

**7. Describe a power system and its operation.**

**8. Read and translate:**

**Substations**

A substation is designed to receive energy from a power system, convert it and distribute it to the feeders. Thus a substation serves as a distribution centre. Substations feed (supply) various consumers provided that their basic load characteristics are similar. Therefore the energy is distributed without transformation of the voltage supplied.

Common substations comprise isolators, switchgear buses, oil circuit breakers, fuses, power and instrument transformers and reactors.

Substations are classed into step up and step down ones. The step up substation includes transformers that increase the voltage. Connected to the busbars of the substation are the power transmission lines of power plants of the system.

As to step down substations, they reduce the voltage to 10 or 6 kV. At this voltage the power is supplied to the distribution centres and to the transformer substations of power consumers.

A transformer substation serves for transmitting and distributing electric power. It comprises a storage battery, control devices and auxiliary structures.

Transformer substations are classed into indoor and outdoor; both types are used for feeding industrial enterprises. Compared to other types of substations, transformer substations have certain advantages. They have flexible construction and easy and reliable operation. In case of a fault in the left-hand section, the main circuit breaker opens while the normally open section circuit breaker closes and puts the voltage of the section to normal. Power from a substation is delivered to distribution centres.

**9. Put down the Russian equivalents of these word combinations. Translate them back into English (orally).**

circuit breaker	_____
auxiliary units	_____
distribution centre	_____
flexible construction	_____
reliable operation	_____
switch gear bus	_____
hydraulic as well as solar sources of energy	_____
as to phase-word motors	_____

**10. Fill in *as well as*, *as to* and translate the sentences:**

1. Excessive starting current may result in fluctuations in the voltage ... in other faults of the motor.
2. ... A.C. motors they are subdivided into single- and three-phase motors.

**11. Complete the sentences using the correct variant:**

- |                                            |                                                                                |
|--------------------------------------------|--------------------------------------------------------------------------------|
| 1. A substation serves                     | a) to consume energy.<br>b) to distribute energy.<br>c) to convert energy.     |
| 2. A substation feeds consumers            | a) with various load characteristics.<br>b) with similar load characteristics. |
| 3. The lines of power plants are connected | a) to the busbars.<br>b) to the switchgear.                                    |
| 4. A substation comprises                  | a) the main elements.<br>b) the main and auxiliary elements.                   |
| 5. Flexible construction is                | a) an advantage.<br>b) a disadvantage.                                         |

**12. Pair work. Put these questions to your groupmate, and ask him/her to answer them.**

1. What does a substation serve for?
2. What type of consumers does a substation feed?
3. What parts are the power transmission lines connected to?
4. What components does a substation comprise?
5. What types are substations classed into?
6. What are advantages of a transformer substation?

### **Electric Power Plants**

1. Electric power is generated at electric power plants. The main unit of an electric power plant comprises a prime mover and the generator which it rotates. In order to actuate the prime mover energy is required. Many different sources of energy are in use nowadays. To these sources belong heat obtained by burning fuels, pressure due to the flow of air (wind), solar heat, etc.
2. According to the kind of energy used by the prime mover, power plants are divided into groups. Thermal, hydraulic (water-power) and wind plants form these groups.
3. According to the kind of prime mover, electric power plants are classed as
  - a) Steam turbine plants, where steam turbines serve as prime movers. The main generating units at steam turbine plants are the turbogenerators. Steam turbine plants belong to the modern, high-capacity class of power plants.
  - b) Steam engine plants, in which the prime mover is a piston-type steam engine. Nowadays no large generating plants of industrial importance are constructed with such prime movers. They are used only for local power supply.
  - c) Diesel-engine plants in them diesel internal combustion engines are installed. These plants are also of small capacity, they are employed for local power supply.
  - d) Hydroelectric power plants employ water turbines as prime movers. Therefore they are called hydroturbine plants. Their main generating unit is the hydrogenerator.
4. Modern wind-electric power plants utilize various turbines; these plants as well as the small capacity hydroelectric power plants are widely used in agriculture.
13. Переведите и запомните следующие словосочетания: small capacity hydroelectric power plant, diesel internal combustion engine, wind power plant, steam turbine plant, hydraulic power plant; solar generator, wind power, combustion engine, solid fuel, solar heat, prime mover; diesel-engine, water-power, wind-electric, piston-type, high capacity.
14. Прочтите и переведите текст; скажите, на каких станциях можно вырабатывать электроэнергию, используйте словосочетания due to, according to.
15. Прочтите текст еще раз и скажите, как называются станции, вырабатывающие электрическую энергию, исходя из источника движущей силы.
16. Расскажите, в чем состоит сходство и различие паротурбинных и паропоршневых установок.
17. Прочтите третий абзац текста и скажите, в чем состоит разница между паропоршневыми и дизельными установками.
18. В чем состоит сходство и различие в принципах работы паротурбинных и гидроэлектрических установок.
19. Прочтите текст и скажите, эксплуатация каких из упомянутых электростанций наиболее, по вашему мнению, благоприятна для окружающей среды, обоснуйте свое мнение, используя в ответе следующие словосочетания: In my opinion, I think, to my mind.
20. Расскажите, что вы знаете об электростанциях.

### **Практическое занятие № 35 – 36.**

#### **Тема 18. Electric Energy Production:**

#### **Hydroelectric Power Plants. Thermal Power-Station /**

#### **Производство электрической энергии:**

#### **Гидроэлектростанции. Тепловая электростанция.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах

на английском языке;читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:**навыками профессионального общения на английском языке;способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

### Теоретическая часть: Hydroelectric Power Plants

Hydroelectric power plants are built on rivers. Large-capacity hydroelectric power plants are commonly located at considerable distances from the consumers of electric power.

The production process at these plants is rather simple: the water flows into the hydroturbine runner, acts upon the runner blades and rotates the runner and the turbine shaft.

The generator shaft is connected to the turbine runner shaft. The difference in the water level influences the power capacity of a plant, i.e. the magnitude of the water head and the daily inflow of water fluctuates considerably according to the season.

The production process is different at power plants of different constructions and of different kinds. In atomic power plants, for example, it is not so simple as in hydroelectric plants.

#### Vocabulary

blade	лопасть
fluctuate	колебаться
head	голова
i.e. – id est [Id 'est] – that is	то есть, то же самое
influence	оказать влияние
level	уровень
magnitude	величина
runner	бегун
season	сезон

#### Вопросы и задания:

1. Переведите и запомните следующие словосочетания: fuel expenditure, water head, turbine blades, level influence, level change, blade size, runner blade, turbine shaft, generator shaft, water head magnitude, water level change influence, thermal power plant, hydroelectric power plant production process, plant's power capacity, regional power plant, large industrial region supply.
2. Прочтите и переведите текст; сравните особенности расположения гидростанций, паропоршневых и дизельных установок относительно потребителей электрической энергии.
3. **Put down the Russian equivalents of these word combinations. Then translate them back into English (orally).**

runner blade	_____
turbine runner	_____
turbine shaft	_____
water level	_____
water head	_____
large capacity power plant	_____
magnitude of the water head	_____

daily inflow of water

turbine runner shaft

**4. Complete the sentences using the correct variant:**

- |                                            |                                                                                                              |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| 1. Hydroelectric power plants are built    | a) on rivers.<br>b) on waterfalls.                                                                           |
| 2. Large-capacity power plants are located | a) at a short distance from consumers of power.<br>b) at a considerable distance from consumers of power.    |
| 3. The production                          | a) is very complex. process at the plants<br>b) is rather simple.                                            |
| 4. The power capacity of a plant           | a) remains constant.<br>b) changes considerably.<br>c) is influenced by the difference in the water level.   |
| 5. The daily inflow of water               | a) fluctuates according to the consumption.<br>b) fluctuates according to the season.                        |
| 6. The production process                  | a) depends upon the construction of the plant.<br>b) is the same at power plants of different constructions. |

**5. Pair work. Put these questions to your groupmate and ask him/her to answer them:**

1. On what sites are hydroelectric power plants built?
  2. Are large-capacity plants located far from consumers of power?
  3. Is the production process at the plants simple or is it complex?
  4. What influences the power capacity of a plant?
  5. According to what factors does the daily inflow of water fluctuate?
  6. Does the production process at the plant depend on its construction?
  7. Do you know that a thermal power plant seldom has an efficiency more than 40%?
- 
6. Прочтите текст еще раз и скажите, в чем, по вашему мнению, состоит сходство ветряных энергоустановок и гидроэлектростанций малой мощности.
  7. Прочтите третий абзац текста и скажите о факторе влияния на энергетическую мощность гидроэлектростанции.
  8. Расскажите о производственном процессе на гидроэлектростанции, используйте следующие глаголы в ответе: to flow into, to act upon, to rotate, to connect to, to influence, to fluctuate.
  9. Расскажите о сходстве и различии гидроэлектростанций малой и высокой мощности.
  10. Расскажите о конструкции гидроэлектростанции, используйте схему поперечного разреза, имеющуюся в тексте.
  11. Расскажите, какую информацию вы извлекли, прочитав текст Hydroelectric Power Plants.
  12. Переведите и запомните следующие слова и словосочетания: current, boiler, steam, equipment, generator, fuel, installation, mighty, generation, supply, integration, fan; power engineering, power system, power station, coal handling, boiler house, turbine house, flue gases, cooling water, at a number of thermal power stations, power machine building industry, heat-and-power plants, total power output, feed pump.

**13.** Прочтите и переведите текст; выпишите существительные в роли определения и расскажите о составляющих компонентах теплоэлектростанции.

### **Thermal Power-Station**

1. A modern thermal power-station is known to consist of four principal components namely, coal handling and storage, boiler house, turbine house, switchgear.
2. If you have not seen a power-station boiler it will be difficult for you to imagine its enormous size.
3. Besides the principal components mentioned above there are many additional parts of the plant. The most important of them is the turbogenerator in which the current is actually generated.
4. A steam turbine requires boilers to provide steam. Boilers need a coal-handling plant on the one hand and an ash-disposal plant on the other. Large fans are quite necessary to provide air for the furnaces. Water for the boilers requires feed pumps. Steam must be condensed after it has passed through the turbines, and this requires large quantities of cooling water. The flue gases carry dust which must be removed by cleaning the gases before they go into the open air.
5. A modern thermal power-station is equipped with one or more turbine generator units which convert heat energy into electric energy. The steam to drive the turbine which, in its turn, turns the rotor or revolving part of the generator is generated in boilers heated by furnaces in which one of three fuels may be used—coal, oil and natural gas. Coal continues to be the most important and the most economical of these fuels.
6. Large installations with mighty turbogenerators are operating at a number of thermal power-stations in Russia. It is necessary to point out that the power machine building industry has started to manufacture even greater capacity installations for thermal power-stations.
7. At present great attention is paid to combined generation of heat and electricity at heat-and-power plants and to centralized heat supply. One of the world's largest heat-and-power installations is operating at the Moskovskaya thermal power-station-25.
8. Thermal power-stations are considered to be the basis of power industry. More than 80% of the country's total power output comes from the above stations. It is necessary to say that separate power-stations in our country are integrated into power systems. Integration of power systems is a higher stage in scientific and technical development of power engineering.
- 14.** Прочтите четвертый абзац текста, выделите глаголы в неопределенной форме, определите их функции и скажите, что нужно для работы паровой турбины, используйте в ответе эти глаголы.
- 15.** Прочтите пятый абзац текста, обратите внимание на слово turn, расскажите о принципе работы турбогенератора.
- 16.** Прочтите текст и выпишите ключевые слова, относящиеся к устройству и работе теплоэлектростанции.
- 17.** Прочтите текст еще раз и скажите, какие источники энергии являются основой работы теплоэлектростанции.
- 18.** На основании знаний принципов работы атомной станции, гидростанции, теплоэлектростанции скажите о их воздействии на окружающую среду, используйте слова radiation, insulation, fluegases, headofwater, toflood.
- 19.** Расскажите, какой вклад в энергетику нашей страны вносят теплоэлектростанции.
- 20.** Расскажите о работе теплоэлектростанции.

**Solar Power Plant. Tidal Energy /**  
**Использование различных видов энергии:**  
**Солнечная электростанция. Энергия приливов.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

**Теоретическая часть:**  
**Solar Power Plant**

1. This project has supported the construction of a PV power plant, which is the first of its type in the world. All the components of the plant were developed during the previous projects and now, in this latest project, the size of the concentrators has been increased to full commercial dimensions. These new, modular units consist of two 75 metres long rows of PV cells. The new units use reflecting instead of refracting technology, have single-axis tracking and encapsulated modules.
2. The new plant, named EUCLIDES, has eight units, each with two rows of concentrators 72 metres long and 2.9 metres wide. The two rows in each unit share a single tracking carriage. Each unit is rated at 62 kWp, giving a total rating of 480 kWp. Each tracker has an output of 750 V. In the concentrator units themselves, the cells are interconnected and encapsulated, just like flat modules, and the concentration of optics are mirrors instead of the Fresnel lenses used in all previous PV units.
3. The new design provides a more constant output than that from flat panels, and this means that a better price should be obtained for the electricity produced.
4. There is a growing interest in green electricity (generated from renewable sources) among consumers. In the Netherlands, increasing demand from consumers for PV systems to supply electricity at their own premises offers an opportunity to market centralised PV system, which have, until recently, gained little support. More development work needs to be done to improve the appropriate technology for grid connected PV systems and this project will bring together Italian electricity company ENEL, with their expertise in the operation of centralised PV systems and the marketing expertise of Dutch energy company EDON. The technology will be demonstrated to the general public and commercial end-users.
5. The new system, the first ground-based central PV system in the Netherlands, will be installed on top of a concrete storage tank for drinking water, and will consist of three units, each with a capacity of 60 kWp, giving a total capacity of 180 kWp. This project aims to demonstrate the role that sales of green electricity can play in driving the development of PV, and other renewable projects.

**Vocabulary**

component	составная часть
dimension	измерение
encapsulate	инкапсулировать
Euclides	Евклид
expertise	экспертиза

kWp – kilowatt	кВт - киловатт
project	проект
project	проект
PV – Photovoltaic	PV - фотоэлектрический
renewable	возобновляемый
supply	поставка

### Вопросы и задания:

1. Переведите и запомните следующие слова и словосочетания: concentrator, technology, to reflect, to refract, to focus; previous project, latest project, reflecting technology, refracting technology, modular unit, photovoltaic power, photovoltaic power plant, single-axis tracking, encapsulated module, grid-connected PV system, solar technology, solar power, ground-based system, end-user.
2. Прочтите и переведите текст; выпишите ключевые слова, относящиеся к устройству PV plant (photovoltaic power plant) фотоэлектрической энергоустановки.
3. Прочтите второй и последний абзацы текста и объясните, какую информацию вы извлекли на основании числительных, использованных автором.
4. Из первых трех абзацев выпишите причастия (PI, PII) в роли определения, используйте их в описании устройства PV plant.
5. При переводе третьего абзаца обратите внимание на степени сравнения прилагательных и скажите, что нового вы узнали о достоинстве нового проекта с экономической точки зрения.
6. Прочтите четвертый абзац текста и скажите, какие источники энергии относятся к категории «зеленого» электричества, назовите их.
7. Скажите о перспективах сотрудничества компании ENEL и компании EDON, используйте в ответе слова expertise in the operation, marketing expertise, to supply, to improve.
8. В пятом абзаце текста содержится информация, выраженная с помощью глаголов в Future Simple, расскажите о работе, ведущейся в Нидерландах, в области использования солнечной энергии.
9. Выскажите свое мнение о перспективах развития солнечной энергии в мире, используя следующие выражения: as far as I know, I think, to my mind, in my opinion, to start with, the fact is, I believe.
10. Прочтите и переведите текст; выпишите ключевые слова, относящиеся к теме.

### Tidal Energy

1. Over the past three decades the feasibility of using ocean tides to generate electric power has been investigated at many sites.
2. By far the largest tidal plant in service is Rance (France), with a capacity of 240 MW and an annual output exceeding 500 GWh. Others include the 20 MW Annapolis plant in Canada, several small units in China with total capacity of about 5 MW and a 400 kW experimental unit near Murmansk in Russia.
3. Most designs, existing or proposed, have opted for a single tidal basin to create hydraulic heads and propeller turbines to extract energy therefrom. Linked and paired basins have also been considered. Innovative approaches have included extraction of energy directly from tide races using a variety of prime movers.
4. The main obstacle to development is economic. Capital costs are high in relation to output: a consequence of the low and variable heads available at even the best sites. Heads available at the turbine vary throughout each tidal cycle, averaging less than 70% of the maximum. As a result, installed capacity is underutilized, typical capacity factors tending to fall in the range 0.23 to 0.37. Low heads imply that civil as well as mechanical engineering components must be large in comparison to output. For such reasons, tidal plants are likely to be practicable only where ener-



gy is concentrated by large tides and where physical features permit construction of tidal basins at low cost.

5. Significant capital-cost reductions through improved design and construction techniques have been achieved over the past three decades. In China a somewhat different approach has been taken: tidal plants have been built as part of broader schemes of resource utilization – typically land reclamation or aquaculture.

6. In a world increasingly sensitive to environmental factors, tidal plants must avoid unacceptable impacts. Tidal power is non-polluting and in this respect superior to thermal generation. Beyond that, it is difficult to generalize. No serious long-term impacts are known to have been caused by the Rance tidal power plant, but large developments in the Bay of Fundy would, it has been predicted, perturb the tidal regime, with impacts on New England shorelines.

7. In recent years, commercial acceptance of combined-cycle generation based on combustion turbines has reduced the potential economic and environmental costs of meeting future capacity and energy demands through thermal plants wherever natural gas is available at competitive prices. This has tended to increase the economic bias against tidal power.

8. Another development with adverse implications for tidal power is the trend in many countries to adopt market pricing of electric energy and dispense with regulatory pricing. This in almost every case entails competition in the generation function. Under such conditions, competitors will be under strong compulsion to choose plant types having the shortest construction times and the lowest unit capital costs.

9. Such factors render construction of new tidal generation capacity unlikely during the near future, unless strong incentives such as emission caps or carbon taxes are imposed.

#### **Примечания**

to investigate – исследовать

to exceed – превышать

to extract – извлекать

innovative approach – новаторский подход

to imply – подразумевать

to predict – предсказывать

to perturb – нарушать

to dispense – распределять

TWh – Tera Watt hours

**11.** Переведите и запомните следующие слова и словосочетания: tidal, capacity, output, impact, reclamation, generation, annual, to opt, to extract, to meet; propeller turbines, combustion turbines, tidal power plant, prime movers, capital costs, capital-cost reductions, construction techniques, tidal cycle, land reclamation, non-polluting power, long-term impacts, combined-cycle generation, thermal plant, environmental factors, total capacity, hydraulic heads, tide race.

**12.** Прочтите третий абзац и скажите, что может препятствовать развитию использования энергии приливов, используйте слова in relation to, available at, as a result, as well as.

**13.** Скажите, как в Китае решена проблема затрат на использование энергии, вырабатываемой на приливных электростанциях.

**14.** Сравните влияние на окружающую среду приливных и тепловых электростанций, используйте слова non-polluting, superior to, difficult.

**15.** Что, по вашему мнению, может препятствовать развитию приливной энергетики, при ответе используйте глаголы to reduce, to increase, to adopt.

**16.** Охарактеризуйте работу приливной электростанции на реке Рейнс и о перспективах воздействия такого типа станции на окружающую среду.

**17.** Выскажите свое мнение о будущем приливных электростанций и их доле в общем производстве электричества в нашей стране.

**Тема 20. Prospects for the Development of Geothermal Technology:  
Geothermal Development. Wind Energy /  
Перспективы развития геотермальных технологий:  
Геотермальное развитие. Энергия ветра.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

**Теоретическая часть:  
Geothermal Development**

1. Geothermal heat pumps, or ground-source heat pumps, for heating and cooling buildings are a rapidly growing example of a geothermal direct use application. The technology has developed almost without publicity in recent years to become a significant new factor in the supply equation. This is an electrically-based technology that allows high efficiency, reversible, water-source heat pumps to be installed in buildings in most geographical and geological locations (world-wide). The combination of increasing levels of electrical generation efficiency, with the impressive energy **amplification**<sup>1</sup> of geothermal heat pumps means that space heating can be delivered with effective efficiencies that **exceed**<sup>2</sup> 100%. The "additional" energy is supplied from the ground. In addition these systems also offer highly efficient cooling. The types of buildings that are using ground-source heating and cooling in this manner range from small utility or public housing, through to very large (MW-sized) institutional or commercial buildings. This technology can offer up to 40% reductions in CO<sub>2</sub> emissions against competing technologies. If all of the electricity is supplied from non-fossil sources, there are no CO<sub>2</sub> emissions associated with heating and cooling a building.

2. Recently, several large-scale **arrays**<sup>3</sup> have been installed to feed larger systems where suitable supplies of deep geothermal water are not available. In the largest development to date, 4000 units – each with its own borehole – have been established on a US Army base in Louisiana to provide heating and cooling. The concept was developed independently in the US and Europe and, although Sweden and Switzerland have installed many thousands of units to provide winter heating in houses, the pace of installation in the USA and Canada during the last fifteen years **has overtaken**<sup>4</sup> the European rate. There are now believed to be well over a quarter of a million installations in place in North America.

3. While the main activity is currently in the USA, there are a growing number of installations in Canada, Sweden, Switzerland, Austria and Germany. Smaller numbers are being installed in other European countries, and in Australia. The Geothermal Heat Pump Consortium currently has over 750 institutional, corporate and commercial members, and 40 international members from countries including Australia, Canada, China, Croatia, Finland, Germany, India, Japan, the Netherlands, Poland, Russia, Sweden, Turkey, and the UK.

4. Ground-source heat pumps are perhaps the first indication of the seventh age of geothermal technology, breaking the final barrier of geographical availability. To sum up: geothermal technology offers many benefits - clean, indigenous, firm energy - but suffers from economic uncer-

tainties and geographical limitations. These problems are being actively addressed and future prospects seem bright.

### **Примечания**

1 amplification – усиление;

2 exceed – превышают;

3 arrays – структуры;

4 has overtaken – обогнал.

### **Vocabulary**

amplification	усиление
application	применение
borehole	скважинный
commercial	коммерческая
efficiency	эффективность
geographical	географический
geological	геологический
geothermal	геотермальный
indigenous	местный
technology	технологии

### **Вопросы задания:**

1. Переведите и запомните следующие слова и словосочетания: application, generation, amplification, heating, cooling, installation, availability, uncertainty; to address, to include, to develop, to overtake, to range, to establish, to provide, to feed; geothermal heat pump, ground-source heat pump, water-source heat pump, electrically-based technology, electrical generation efficiency, non-fossil sources, large-scale arrays, geothermal technology, geographical limitation.

2. Прочтите и переведите текст; выпишите ключевые слова, относящиеся к сфере применения геотермальной энергии.

3. Выпишите из всего текста существительные в роли определения, относящиеся к геотермальной технологии.

4. Из первого абзаца текста выпишите условное предложение о связи экологии и производства электричества.

5. Прочтите второй абзац текста, обратите внимание на слово date и подберите соответствующий английский синоним.

6. Прочтите третий абзац текста, обратите внимание на слова the pace и the rate, объясните, о чем идет речь.

7. Прочтите четвертый абзац и скажите, на каких континентах идет интенсивное развитие геотермальной энергии, обратите внимание на произношение географических названий.

8. Прочтите пятый абзац и скажите, какую информацию вы извлекли из порядковых числительных, использованных в тексте.

9. В последнем абзаце автор дает оценку перспективам развития геотермальной технологии, выразите свое мнение по этому вопросу, используйте в ответе I think, to my mind, I am sure that, there is no reason to deny и т.д.

10. Расскажите, что вы знаете о геотермальной энергии и геотермальной технологии.

11. Переведите и запомните следующие слова и словосочетания: development, speed, installation, technology, turbine, average, mean, monitoring, impact; wind turbine, wind farm, the former... the latter, offshore wind energy, floating jack-up barge, the grid network, electronic control system, expensive grid strengthening measures, the average annual output, mean wind speeds, standard turbine, enhanced rotor diameter, rock-socketed steel, monopole foundations.

12. Прочтите и переведите текст; выпишите ключевые слова, относящиеся к использованию энергии ветра.

### **Wind Energy**

1. Wind turbines are now a relatively common sight across Europe, with countries such as Denmark, the Netherlands, Germany, UK, Spain and latterly France, all investing in wind farms. Off-shore wind development, although far less advanced, is the greatest prize in this field. However, relative costs of offshore compared to **onshore**<sup>1</sup> are higher.
2. This project is aimed to demonstrate the economic as well as a technical viability of offshore wind energy. The former was achieved through the innovative use of a floating **jack-up**<sup>2</sup> barge which reduced the time and costs of installation. The latter was achieved mainly through the incorporation of new electronic control systems which improved the **compatibility**<sup>3</sup> with the grid network, and reduced the need for expensive grid strengthening measures.
3. Five turbines were installed, about 4 km off the coast of Gotland. Each turbine is rated at 500 kW. The average annual output is some 8 GWh/y, from mean wind speeds of 8 m/s. Rock-socketed steel mono-pile foundations, to water depths of 5 to 6.5 m were used to secure the turbines. Total construction time was only 35 days. Monitoring of impacts on local flora and fauna, such as the seal population, is also being carried out.
4. Wind energy developments have, in the past, been concentrated in areas of the world which offer higher than average wind speeds. Often, this means that developments take place in remote and/or sensitive areas. A technology which can increase the economic attractiveness of utilizing sites with lower wind speeds would be invaluable (бесценный). This project will design, manufacture, install, test and measure the impact of two 1 MW turbines which have been specially adapted for use in low wind speed areas. The aim is to increase power production by up to 22%, compared to a standard turbine, mainly through the technological adaptations which allow for an enhanced rotor diameter, with a swept area of 2,830 m<sup>2</sup>, and an increase in tower height from 50 to 70 m. The new turbine is installed at a site in Central Sweden.

#### **Примечания**

1 onshore – береговой;

2 jack-up – самоподнимающийся;

3 compatibility – совместимость

**13.** В первом абзаце текста обратите внимание на степени сравнения прилагательных и скажите, какую информацию о ветряных разработках они дают.

**14.** Прочтите второй абзац текста и расскажите о внебереговых ветряных разработках, используя глаголы to aim, to achieve, to reduce, to improve.

**15.** Расскажите, что обеспечивает устойчивость конструкций ветряков на побережье о-ва Готланд и о достоинствах данного сооружения.

**16.** Расскажите о разработках ветряков для районов с низкой скоростью ветра, используйте технические характеристики.

**17.** Прочтите текст еще раз и расскажите, какую новую для себя информацию вы извлекли, используйте следующие словосочетания: I don't think...; I am sure that...; There is no reason to deny...; I am in complete agreement...

### **Практическое занятие № 41 – 42.**

#### **Тема 21. Nuclear Energy and the Environment:**

#### **Atomic Power Plants.**

#### **Environmental Protection /**

#### **Ядерная энергия и окружающая среда:**

#### **Атомные электростанции.**

#### **Защита окружающей среды.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального ан-

глийского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

### **Теоретическая часть:**

#### **Atomic Power Plant**

Atomic power plants are modern installations. They consist of several main units and a great number of auxiliary ones.

In a nuclear reactor uranium is utilized as a fuel. During operation process powerful heat and radioactive radiation are produced. The nuclear reactor is cooled by water circulation. Cooling water circulates through a system of tubes, in which the water is heated to a temperature of 250-300°C. In order to prevent boiling of water, it passes into the reactor at a pressure up to 150 atmospheres.

A steam generator includes a series of heat exchangers comprising tubes. The water heated in the reactor is delivered into the heat exchanger tubes. The water to be converted into steam flows outside these tubes. The steam produced is fed into the turbogenerator.

Besides, an atomic power plant comprises a common turbogenerator, a steam condenser with circulating water and a switchboard.

Atomic power plants have their advantages as well as disadvantages. The reactors and steam generators operate in them noiselessly; the atmosphere is not polluted by dust and smoke. As to the fuel consumption, it is of no special importance and there is no problem of fuel transportation.

The disadvantage of power plants utilizing nuclear fuel is their radiation. Radioactive radiation produced in the reactors is dangerous for attending personnel. Therefore, the reactors and steam generators are installed underground. They are also shielded by thick (up to 1.5 m) concrete walls. All their controls are operated by means of automatic devices. These measures serve to protect people from radioactive radiation.

#### **Vocabulary**

exchanger	[ɪks'tʃeɪndʒə]	теплообменник
steam		пар
tube		труба, лампа
dust		пыль
attending personnel	[ˌpə:sə'nel]	обслуживающий персонал
to deliver		поставлять
to pollute		загрязнить
to shield	[ʃiːld]	защищать
concrete	[ˈkɒ:ŋkri:t]	бетон

environment	[ɪn 'vaɪərənmənt]	окружающая среда
fission	[ 'fɪʃən]	расщепление
(stainless) steel		(нержавеющая) сталь
vessel		сосуд
waste		отходы
to confine	[kən 'faɪn]	заключать
to release	[rɪ 'li:z]	выпускать, освобождать
to withstand		противостоять
to dispose		устранять, убирать

**Вопросыизадания:**

1. a) Cover the right column and read the English words. Translate them into Russian and check your translation.  
b) Cover the left column and translate the Russian words back into English.

2. Put down the Russian equivalents of these word combinations. Then translate them back into English (orally).

a. auxiliary units	_____
steam generator	_____
heat exchanger	_____
fuel consumption	_____
b. water to be heated in the reactor	_____
water to be converted into steam	_____
steam to be fed into the turbogenerator	_____
c. the polluted atmosphere	_____
utilized nuclear fuel	_____
shielded concrete walls	_____

### 3. Complete the sentences using the correct variant:

- |                                       |                                                                   |
|---------------------------------------|-------------------------------------------------------------------|
| 1. A nuclear reactor is used in       | a) wind-power plants.<br>b) atomic power plants.                  |
| 2. A nuclear reactor is cooled by     | a) water circulating in tubes.<br>b) oil circulating in tubes.    |
| 3. Water is passed into the reactor   | a) at a low pressure.<br>b) at a high pressure.                   |
| 4. High pressure                      | a) activates boiling of water.<br>b) prevents boiling of water.   |
| 6. Circulating water flows            | a) inside the heat exchangers.<br>b) outside the heat exchangers. |
| 7. Attending personnel is shielded by | a) thick concrete walls.<br>b) thick metal walls.                 |

### 4. Pair work. Put these questions to your groupmate and ask him/her to answer them:

1. What are the main units of an atomic power plant?
2. By what means is the nuclear reactor cooled?
3. At what pressure does the water pass into the reactor?
4. What types of power plants pollute the air with dust and smoke?
5. Why is it necessary to protect attending personnel?
6. By what means is it done?

### 5. Read and translate:

#### Protection Against Environmental Pollution

Any operating nuclear power plant releases fission products into the environment, which causes environmental pollution.

To prevent the harmful effects of nuclear power release, the nuclear power plants are supplied with protective installations that serve as barriers to the pollution.

First, the nuclear fuel and the fission products are confined within sealed tubes made of stainless steel or zirconium. Then the assembly of tubes is placed in a steel reactor vessel. And finally the steel reactor vessel is placed in a large steel and concrete housing.

As to the hot radioactive waste products they are disposed in heavily shielded cylinders. The cylinders are buried 305 to 610 metres underground.

### 6. Put down the Russian equivalents of these word combinations. Then translate them back into English (orally):

- |                 |       |
|-----------------|-------|
| nuclear fuel    | _____ |
| nuclear fission | _____ |
| steel vessel    | _____ |
| reactor vessel  | _____ |

fission release	_____
sealed tubes	_____
concrete housing	_____
waste products	_____
nuclear waste	_____
shielded cylinders	_____

**7. Complete the sentences using the correct variant:**

- |                                             |                                                                                            |
|---------------------------------------------|--------------------------------------------------------------------------------------------|
| 1. A nuclear power plant releases           | a) liquid products.<br>b) fission products.                                                |
| 2. Operating nuclear power plants           | a) pollute the environment.<br>b) prevent the pollution.                                   |
| 3. The protective power plant installations | a) produce the release of fission products.<br>b) prevent the release of fission products. |
| 4. The sealed tubes are made of             | a) bronze.<br>b) stainless steel.                                                          |
| 5. The fission products are confined        | a) within sealed tubes.<br>b) within open tubes.                                           |
| 6. The steel reactor vessel is placed       | a) in a concrete housing.<br>b) in a zirconium housing.                                    |
| 7. The waste products are disposed          | a) in an open vessel.<br>b) in shielded cylinders.                                         |

**8. Pair work. Put these questions to your groupmate and let him/her answer them:**

1. What kind of products does the operating nuclear power plant release?
2. What installations are used to prevent the harmful effects of a nuclear power plant operation?
3. What material are the tubes made of?
4. Where are the fission products confined?
5. In what part of the installation is the reactor vessel placed?
6. In what way are the hot radioactive waste products disposed?

**9. Give the English equivalents of the prepositions and conjunctions in brackets and translate the sentences.**

1. The energy (для) a nuclear power plant comes (из) the heat released (вовремя) fissioning of uranium (в) a nuclear reactor.



2. There are two main differences (между) a nuclear power plant and a steam-electric power plant. The nuclear power plant uses a nuclear fuel (вместо) a fossil fuel, and it uses a reactor (вместо) a boiler.
3. (Из-за) their high fuel consumption gas turbines are more expensive to operate than steam turbines.
4. The radioactive pollution produced (в) a reactor has all three forms: gaseous, liquid and solid.
3. The beta particles are dangerous for man (таккак) they penetrate deep (в) the matter.
6. Pump-turbine units are used (какдля) pumping the water (так и для) driving electric generators.

**10. Put down the title corresponding thematically to each of the given descriptions.**

1) *Titles:* Nuclear Fuel; Nuclear Power; Nuclear Reaction.

- |       |                                                                                                                                                                                                                                                                                                                                           |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| _____ | 1. A substance which undergoes nuclear fission or nuclear fusion in a nuclear reactor, a nuclear weapon, or a star.                                                                                                                                                                                                                       |
| _____ | 2. Any reaction which involves a change in the nucleus of an atom, as distinct from a chemical reaction which only involves the orbital electrons. Such reactions occur naturally – on the Earth, in radioactive elements, and in the stars, as thermonuclear reactions. They are also produced in nuclear reactors, and nuclear weapons. |
| _____ | 3. Electric or motive power produced from a unit in which the primary energy source is a nuclear reactor.                                                                                                                                                                                                                                 |

2) *Titles:* Pressured-Water Reactor (PWR); Boiling-Water Reactor (BWR).

- |       |                                                                                                                                                                                                                                                                                                                              |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| _____ | 1. This is a pressure-vessel reactor fuelled with enriched uranium. The reactor is a thermal one, moderated and cooled with ordinary (light) water. The heat in the reactor is extracted by the boiling water as it passes through the core, and the steam is passed directly to the turbine of the energy conversion cycle. |
| _____ | 2. The primary reactor vessel of this reactor is operated at considerable overpressure, which suppresses boiling of the cooling water.                                                                                                                                                                                       |

3) *Titles:* Nuclear Fusion; Nuclear Fission; Nuclear Charge; Nuclear Energy.

- |       |                                                                                                                                                                                                                                                                                                                         |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| _____ | 1. Energy released during a nuclear reaction as the result of the conversion of mass into energy. Energy of this kind is released in nuclear reactors and nuclear weapons.                                                                                                                                              |
| _____ | 2. A reaction between light atomic nuclei as a result of which a heavier nucleus is formed and a large quantity of nuclear energy is released. The temperatures necessary for fusion reactions are extremely high. Reactions of this kind are believed to be the source of the energy of the stars (including the Sun). |

- 
3. A nuclear reaction in which a heavy atomic nucleus (e.g. uranium) splits into two approximately equal parts, at the same time emitting neutrons and releasing very large amounts of nuclear energy.
- 
4. The positive electric charge on the nucleus of an atom. Numerically it is equal to the atomic number of the element, to the number of protons in the nucleus, and to the number of electrons surrounding the nucleus in the neutral atom.

4) *Titles:*            Analog Computer; Computer; Digital Computer; Central Processing Unit.

- 
1. The central electronic unit in a computer which processes input information, and information from the store, and produces the output information. This unit and the store form the central part of the computer.
- 
2. A computer in which numerical magnitudes are represented by physical quantities such as electric current, voltage, or resistance.
- 
3. An electronic device which accents data, applies a series of logical processes to it, and supplies the results of these processes as information. The device is used to perform mathematical calculations at a very high speed. This makes them useful for various purposes, such as office calculations, control of industrial processes, and the control of flight paths.
- 
4. A computer which operates on data in the form of digits rather than the physical quantities.

**11. Read the texts and find in them the answers to the questions that follow.**

**a) Windscale Accident**

Throughout the years, accidents causing a release of radioactive material to the environment have occurred. Since World War II all over the world large scale nuclear facilities have been built and operated both for civil and defense purposes. Some of the sites on which these facilities were located are heavily contaminated with radioactive substances.

One of the first nuclear reactor accidents of environmental concern was the Windscale accident in October 1957. During the accident the military air-cooled graphite-moderated natural-uranium reactor used for plutonium production caught fire during the liberation of energy in the graphite. Emission from the Windscale lasted for 18 hours. Radioactive material was detectable in many parts of Western Europe but the majority of it was deposited in the United Kingdom.

- **How long did the emission from the Windscale reactor last?**
- **What did the emission result in?**

**b) Chernobyl Accident**

The accident, which was of global concern was the accident in Ukraine in the Chernobyl power plant located in Polesye on the River Pripyat.

On 26 April, 1986, Unit 4 of the Chernobyl nuclear plant suffered a major accident. The Chernobyl 4 reactor was a graphite-moderated, light-water-cooled system. The installed electrical generating capacity was 1 GW. The accident followed some engineering tests of a generator.

During the tests, basic operating safety rules were being violated. Most control rods were withdrawn from the core and the safety systems were switched off. Two explosions and a fire that followed them damaged the reactor and the containment building. The graphite started to burn. Explosive energy was released, which resulted in the 1000 ton cover plate of the reactor being lifted up.

A prolonged release of large quantities of radioactive products transported by the cloud from Chernobyl was detected not only in northern and southern Europe but also in Canada, Japan, and the US.

The major part of the release took place over the period of about ten days. There were two peaks in release rate (26th April and 5th May). Later on, the release continued for many weeks at a lower rate before the destroyed reactor was finally sealed, which took place some five months later.

Initially the cloud of radioactive material was carried over the Baltic Sea into Scandinavia. After a few days the wind direction rotated clockwise and the cloud travelled eastwards across the USSR and southwards to Turkey.

The total mass of the radioactive particles released in the accident was about 6000-8000 Kg. More than half of it was deposited near the plant but the rest travelled thousands of kilometres (see Fig. 26).

There is no doubt that the nuclear plant accidents offer a number of lessons to be learnt.

At present, over 200 nuclear power reactors for commercial electricity production operate in Europe.

The accident at the Chernobyl nuclear plant has shown that largescale accidents in nuclear power plants can lead to contamination of the entire continent.

- **What was the cause of the Chernobyl accident?**
- **What was the path of the radioactive material released in the accident?**
- **What can accidents at the nuclear plants lead to?**
- **Make a talk on the Chernobyl accidents.**

#### **Практическое занятие № 43 – 44.**

#### **Тема 22. The Ways of Using Renewable Energy in Future: Nuclear Reactor and Power Generation.**

#### **The Use of Wastes. /**

#### **Способы использования возобновляемой энергии в будущем:**

#### **Ядерный реактор и производство электроэнергии.**

#### **Использование отходов.**

**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:**навыками профессионального общения на английском языке;способами пополнения профессиональных знаний из оригинальных источников на английском языке.  
**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### **Теоретическая часть:**

A **nuclear power plant (NPP)** is a thermal power station in which the heat source is one or more nuclear reactors generating nuclear power.

Nuclear power plants are base load stations, which work best when the power output is constant (although boiling water reactors can come down to half power at night). Their units range in power from about 40 MWe to almost 2000 MWe, typical of new units under construction in 2005 being in the range 600-1200 MWe.

As of 2005 there are 441 nuclear power reactors in operation around the world [1], which together produce about one-sixth of the world's electric power

Electricity was generated for the first time by a nuclear reactor on December 20, 1951 at the EBR-I experimental station. On June 27, 1954, the world's first nuclear power plant that generated electricity for commercial use was officially connected to the Soviet power grid at Obninsk, Kaluga Oblast, Russia. The Shippingport Reactor (Pennsylvania) was the first commercial nuclear generator to become operational in the United States.

Nuclear power plants are classified according to the type of reactor used. However some installations have several independent units, and these may use different classes of reactor. In addition, some of the plant-types below in the future may have passively safe features.

Fission power reactors generate heat by nuclear fission of fissile isotopes of uranium and plutonium.

They may be further divided into three classes:

- **Thermal reactors** use a neutron moderator to slow or *moderate* the rate of production of fast neutrons by fission, to increase the probability that they will produce another fission and thus sustain the chain reaction.
- **Fast reactors** sustain the chain reaction without needing a neutron moderator.
- **Subcritical reactors** use an outside source of neutrons rather than a chain reaction to produce fission. As of 2004 this was a theoretical concept, and no prototype had been proposed or built to generate electric power by this means, although some laboratory demonstrations and several feasibility studies had been conducted.

Although some of the earliest nuclear power reactors were fast reactors, they have not as a class achieved the success of thermal reactors.

Fast reactors have the advantages that their fuel cycle can use all of the uranium in natural uranium, and also transmute the longer-lived radioisotopes in their waste to faster-decaying materials. For these reasons they are inherently more sustainable as an energy source than thermal reactors. See fast breeder reactor. Because most fast reactors have historically been used for plutonium production, they are associated with nuclear proliferation concerns.

More than twenty prototype fast reactors have been built in the USA, UK, USSR, France, Germany, Japan, and India, and as of 2004 one was under construction in China.

### **Vocabulary**

nuclear power plant	атомная электростанция
nuclear fission	ядерное деление
to transmit	передавать
thermal reactors	тепловые реакторы
fast reactors	быстрые реакторы
greenhouse gas	парниковый газ
stock piling of fuel	складирование топлива
current	ток
running costs	эксплуатационные расходы
leakages	leakages
disposal	удаление
to classify	классифицировать
the chain reaction	цепная реакция
an accident	несчастный случай
to claim	требовать
a reactor	реактор

### **Вопросы и задания:**

#### **1. Прочитайте и переведите текст.**

#### **Advantages and disadvantages**

Advantages of NPPs are:

- Essentially no greenhouse gas emissions
- Does not produce air pollutants such as carbon monoxide, sulfur dioxide, mercury, nitrogen oxides or particulates
- The quantity of waste produced is small
- Small number of accidents
- Low fuel costs
- Large fuel reserves
- Ease of transport and stockpiling of fuel
- Future designs may be small and modular (SSTAR, etc.)

Disadvantages are:

- Nuclear waste produced is dangerous for thousands of years
- Consequences of an accident might be disastrous
- Risk of nuclear proliferation associated with some designs
- High capital costs
- In the past long construction periods, imposing large finance costs and delaying return on investment
- High maintenance costs
- High cost of decommissioning plants
- Current designs are all large-scale

Nuclear power is highly controversial, enough so that the building of new nuclear power stations has ceased in Europe (except Finland). Almost all the advantages and disadvantages are disputed in some degree by the advocates for and against nuclear power.

The cost benefits of nuclear power are also in dispute. It is generally agreed that the capital costs of nuclear power are high and the cost of the necessary fuel is low compared to other fuel sources. Proponents claim that nuclear power has low running costs, opponents claim that the numerous safety systems required significantly increase running costs.

Disposal of spent fuel and other nuclear waste is claimed by some as an advantage of nuclear power, claiming that the waste is small in quantity compared to that generated by competing technologies, and the cost of disposal small compared to the value of the power produced. Others list it as a disadvantage, claiming that the environment cannot be adequately protected from the risk of future leakages from long-term storage.

**2. Найдите в тексте английские эквиваленты следующих слов и выражений. На базе текста составьте с ними предложения:** источник тепла, атомные реакторы, экспериментальная станция, энергетические системы, классифицировать, ядерное деление, нейтронное замедление, учения, по этим причинам, преимущества и недостатки, ртуть, накопление топлива.

**3. Закончите предложения в соответствии с текстом, используя следующие слова и выражения:** to the type of reactor used, into three classes, to become operational in the United States, are also in dispute, were fast reactors.

1. The Shippingport Reactor (Pennsylvania) was the first commercial nuclear generator.....
2. Nuclear power plants are classified according.....
3. They may be further divided.....
4. Although some of the earliest nuclear power reactors .....
5. The cost benefits of nuclear power.....

**4. Составьте предложения из следующих слов и словосочетаний:**

1. the chain, Fast reactors, a neutron, reaction, without, needing, moderator.
2. produced, for thousands, Nuclear, is, dangerous, of years, waste.
3. proliferation, Risk, of nuclear, designs, associated, with, some.
4. designs, Current, large-scale, are, all.
5. Nuclear, controversial, power, is, highly,

**5. Согласитесь или не согласитесь со следующими высказываниями. Обоснуйте свое мнение, пользуйтесь текстом:**

1. Nuclear power plants are base load stations, which work best when the power output is constant.
2. As of 2005 there are 551 nuclear power reactors in operation around the world.
3. Nuclear power plants are classified according to the type of reactor used.
4. Fission power reactors generate heat by nuclear fission of fissile isotopes of uranium and plutonium.
5. They may be further divided into five classes.

**6. Найдите в тексте слова, которые соответствуют следующим определениям и в соответствии с прочитанным текстом письменно составьте с ними предложения:**

- the splitting of the nucleus of an atom to produce a large amount of energy.
- Coal, oil, or petrol that is burned in order to provide power.
- A place, where investigations are made.
- An amount of money that is needed in order to buy something.
- A possibility that something unpleasant might happen.

**7. Каждое слово в английском языке имеет несколько значений, которые зависят от контекста и ситуации, в которых оно применяется, также оно может быть как глаголом, так и существительным, поэтому вам предлагается выполнить следующие задания:**

- Пользуясь англо-русским словарем, изучите статьи о слова "dispute" и "agree"
- Выпишите сложные слова и производные, приведенные в статьях;
- Укажите количество определений, приведенных в статьях;
- Выпишите из текста предложения с данными словами и укажите, какое из значений они имеют в данном контексте.

**8. Соедините слова левой колонки с подходящим определением в правой и составьте свои предложения с этими словами:**

- |                   |                   |
|-------------------|-------------------|
| 1. Type           | 1.a supplement to |
| 2. Different      | 2. Structure      |
| 3. in addition to | 3 quick           |
| 4. Fast           | 4. kind, sort     |
| 5. construction   | 5. various        |

**9. Ответьте на вопросы.**

1. What is a nuclear power station?
2. How many nuclear reactors are there in operation now?
3. When was electricity generated by the world's first nuclear power plant?
4. Where was electricity generated by the world's first nuclear power plant?
5. What was the first commercial nuclear generator?
6. How many reactors are there? Name them.
7. What are Fast reactors? Describe them
8. What are the advantages of NPP?
9. What are the disadvantages of NPP?

**10. Прочтите и переведите текст:**

#### **The Ways of Using Renewable Energy in Future**

Presenting five of the most imaginative new ideas for alternative energy sources. Each is under intensive current study, mostly with Government funding. "Power tower" to generate electricity from steam using water heated by solar energy. Heliostats – the bank of computer controlled mirrors at the base of tower – focus sun's rays on pipes containing water, located in the cylinder at top of tower. Steam under pressure then drives a turbine generator at base. Now in the preliminary experiment ' stage, an operating tower generating electricity for a city of 5,000 homes may be built by 1980. One of the biggest problems will be developing heat storing capacity for cloudy days. Four major firms are competing in the study: Honeywell, McDonnell Douglas, Martin-Madietta and Boeing. Space colonies powered by solar energy, reflected by hinged mirrors along the sides. Designed by Gerard K. O'Neill, the colonies; are about 19 miles long and four miles in

diameter. "Giromill" to generate electricity from wind energy. Vertical windmills offer several advantages over conventional, horizontal axis versions: they are more stable in high winds, do not have to be adjusted for changes in wind direction and may be cheaper to build. Blades are tapered like an airplane wing. A typical Giromill to create 100 kilowatts of electricity in a 15 mile per hour wind (about right to service 40 homes) would have blades 130 feet high, mounted on a rotor with a diameter of 100 feet. In high winds, blades could be released to rotate freely. The McDonnell Douglas Corporation has won a contract to study the design. Ocean Thermal Energy Plant OTEP ships may help solve the food crisis as well as the energy crisis. By using the energy derived from ocean thermal gradients to make ammonia, at about one-third the present cost, OTEP ships could help compensate for expected fertilizer and natural gas shortfalls a decade hence. Johns Hopkins University Applied Physics Laboratory is studying the possibilities. One of the keys to developing new energy technologies is materials research. IBM has developed a new type of light absorbing surface – shown here in electron micrograph – made of vapor-deposited tungsten. Some 96 per cent of the light incident at the appropriate angle is absorbed, and the material can hold its heat at high operating temperatures (more than 900 degrees F.).

#### **Примечания**

preliminary – предварительный

imaginative – изобретательный

hinge – прикреплять на петлях; висеть; вращаться на петлях

axis – ось, pl. axes

taper – суживать(ся) к концу; заострять

release – освободить, (тех.) расцеплять

fertilizer – удобрение

shortfall – (разг.) дефицит, недостача

tungsten – вольфрам

#### **11. Прочтите и выполните письменный перевод текста:**

##### **The way one city plans to make use of its wastes**

A futuristic structure just completed here is described as "the first full-scale pyrolysis solid-waste disposal and resource-recovery system in the world. " Using the latest technology, this plant is designed to handle 1000 tons of refuse daily, more than half the total collected by the city. At the moment, it is being tested to work out the "bugs" in its unique design. When in full operation, now expected within six months, trash will roll in by truck at a rate of 50 tons per hour. After shredding, it will be baked at 1,800 degrees Fahrenheit. Gases from this "pyrolysis" will be mixed with air and burned to produce steam expected to meet half the heating, air-conditioning needs of many downtown buildings. Mineral harvest. Solids remaining after pyrolysis will be culled for usable products. Around 70 tons of iron and steel will be extracted daily with huge magnets. Another 170 tons of "glassy aggregate" will be recovered, to be used primarily for road building. Remaining will be about 80 tons of carbon char residue, which be buried in a landfill or possibly used as a solid conditioner.

*(U.S. News World Report, Washington, D.C.)*

#### **Примечания**

futuristic – футуристический

pyrolysis – пиролиз

shred – крошить; резать/рвать на клочки

downtown – деловой район города

char – что-либо обуглившееся; обжигать, обугливать(ся).

#### **Практическое занятие № 45.**

##### **Тема 23. Electricity Meters / Счетчики электроэнергии**



**Цель:** формирование у студентов коммуникативной компетенции для осуществления профессиональной коммуникации.

**В результате освоения темы студент должен:**

**знать:** лексику профессиональной направленности; нормы употребления лексики английского языка в профессиональной сфере; особенности грамматики профессионального английского языка;

**уметь:** осуществлять профессиональную коммуникацию в устной и письменной формах на английском языке; читать и переводить специальную литературу для пополнения профессиональных знаний;

**владеть:** навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

**Актуальность темы:** обусловлена необходимостью овладения УК-4.

#### **Теоретическая часть:**

An **electricity meter** is generally taken to be a device which measures the amount of electrical energy supplied to a customer of an electricity company. The most common type is more properly known as a (kilo)watt-hour meter or a joule meter.

Modern electricity meters operate by continuously measuring the instantaneous voltage (volts) and current (amperes) and finding the product of these to give instantaneous electrical power (watts) which is then integrated against time to give energy used (joules, kilowatt-hours etc).

The most common type of electricity meter is the electromechanical induction meter. This consists of an aluminium disc which is acted upon by two coils. One coil is connected in such a way that it produces a magnetic flux in proportion to the voltage and the other produces a magnetic flux in proportion to the current. This produces eddy currents in the disc and the effect is such that a force is exerted on the disc in proportion to the product of the instantaneous current and voltage. A permanent magnet exerts an opposing force proportional to the speed of rotation of the disc - this acts as a brake which causes the disc to stop spinning when power stops being drawn rather than allowing it to spin faster and faster. This causes the disc to rotate at a speed proportional to the power being used.

The aluminium disc is supported by a spindle which has a worm gear which drives the register. The register is a series of dials which record the amount of power used. The dials may be of the cyclometer type where for each dial a single digit is shown through a window in the face of the meter, or of the pointer type where a pointer indicates each digit. It should be noted that with the dial pointer type, adjacent pointers generally rotate in opposite directions due to the gearing mechanism.

Some newer meters are solid state and display the power used on an LCD. Most solid-state meters use a current transformer to measure the current. This means that the main current-carrying conductors need not pass through the meter itself and so the meter can be located remotely from the main current-carrying conductors, which is a particular advantage in large-power installations. It is also possible to use remote current transformers with electromechanical meters though this is less common.

Solid state meters can also record other parameters of the load and supply such as maximum demand, power factor and reactive power used etc.

#### **Vocabulary**

an electricity meter

счетчик электроэнергии

to measure	измерять
in proportion	в пропорции
to rotate	вращать
a surplus	избыток
customers	клиенты
facilitated	облегченный
multiple registers	несколько регистров
to permit	разрешить
electricity grid	электросеть
accurate measurement	точное измерение
electricity retailers	продавцы электроэнергии
different tariffs	разные тарифы
domestic meters	бытовые счетчики
demand	спрос
constant load applications	приложения с постоянной нагрузкой

### Вопросы и задания:

**1. Найдите в тексте английские эквиваленты следующих слов и выражений. На базе текста составьте с ними предложения:** катушка, магнитный поток, вихревые токи, вращать, винтовой привод, противоположная сторона, дефицит, соответствующий, тарифы, количество энергии, запасы, длина времени.

### Variable-rate meters

Electricity retailers may wish to charge customers different tariffs at different times of the day. This is because there is generally a surplus of electricity at times of low demand, such as during the night. Such tariffs are facilitated by time of use meters which incorporate or are connected to a time switch and which have multiple registers. The popularity of such tariffs has declined in recent years, at least in the domestic market, due to the deficiencies of storage heaters and the low cost of natural gas.

Domestic variable-rate meters normally only permit two tariffs ("peak" and "off-peak") and in such installations a simple electromechanical time switch may be used. Large commercial and industrial premises may use electronic meters which record power usage in blocks of half an hour or less. This is because on most electricity grids there are demand surges throughout the day, and the power company may wish to give incentives to large customers to reduce demand at these times. These demand surges often corresponding to meal times or, famously, to intervals in popular television programmes.

### Other types of electricity meter

In addition to the types of meter described above which directly measure the amount of energy used, other types of meter are available.

Meters which measure the amount of charge (coulombs) used, known as amp-hour meters, were used in the early days of electrification. These were dependant upon the supply voltage remaining constant for accurate measurement of energy usage which is not a likely circumstance with most supplies.

Some meters measured only the length of time for which current flowed, with no measurement of the magnitude of voltage or current being made. These were only suited for constant load applications.

Neither type is likely to be found in electricity retail use today.

**2. Закончите предложения в соответствии с текстом, используя следующие слова и выражения:** the electromechanical induction meter, for which current flowed, the power used on an LCD, the instantaneous voltage (volts), tariffs at different times of the day.

1. Modern electricity meters operate by continuously measuring ....
2. The most common type of electricity meter is .....
3. Some newer meters are solid state and display.....
4. Electricity retailers may wish to charge customers different....
5. Some meters measured only the length of time .....

**3. Составьте предложения из следующих слов и словосочетаний:**

1. This, an aluminium, of, disc, which, is acted, consists, upon by two coils.
2. a series, The register, is, of dials, which, the amount, record, of power used.
3. meters, Solid, state, can, parameters, also record, other of the load
4. normally, Domestic, variable-rate, permit, meters only, two tariffs
5. suited, These, were, constant, only, for, load applications.

**4. Письменно переведите абзац:** «An electricity meter ... due to the gearing mechanism.»

**5. Согласитесь или не согласитесь со следующими высказываниями. Обоснуйте свое мнение, пользуясь текстом:**

1. The most common type is more properly known as a (kilo) watt-day meter.
2. The aluminium disc is supported by a spindle which has a worm gear.
3. The dials may be of the cyclometer type.
4. Most solid-state meters use a water transformer to measure the current.
5. Domestic variable-rate meters normally only permit one tariffs

**6. Найдите в тексте слова, которые соответствуют следующим определениям и в соответствии с прочитанным текстом письменно составьте с ними предложения:**

- a thick spiral of wire through which an electrical current is passed.

- is a unit of measurement of electrical power

- People who buys electricity.

- people who sell electricity

- A need for electricity

**7. Каждое слово в английском языке имеет несколько значений, которые зависят от контекста и ситуации, в которых оно применяется, также оно может быть как глаголом, так и существительным, поэтому вам предлагается выполнить следующие задания:**

- Пользуясь англо-русским словарем, изучите статьи о слова “gear” и “brake”
- Выпишите сложные слова и производные, приведенные в статьях;
- Укажите количество определений, приведенных в статьях;
- Выпишите из текста предложения с данными словами и укажите, какое из значений они имеют в данном контексте.

**8. Соедините слова левой колонки с подходящим определением в правой и составьте свои предложения с этими словами:**

- |               |                              |
|---------------|------------------------------|
| 1. Device     | 1. benefit.                  |
| 2. to measure | 2. permanent.                |
| 3. to produce | 3. mechanism.                |
| 4. Advantage  | 4. to find the size of smth. |
| 5. Constant   | 5. to generate.              |

**9. Письменно кратко изложите содержание текста на русском языке.**

**10. Ответьте на вопросы.**

1. What is an electrical meter?
2. What is the most common type of meter?
3. What does the aluminium disc have?
4. What is the register?
5. What does LCD mean?
6. What can solid meter also record?
7. How many tariffs do domestic variable-rate meters permit?
8. What types of electrical meter do you know?
9. What kind of meter do you have at your home?

**11. Перескажите текст.**

## СПИСОК РЕКОМЕНДУЕМОЙ ЛИТЕРАТУРЫ

### Перечень основной литературы

1. Луговая А.Л. Английский язык для студентов энергетических специальностей: учеб. пособие / А.Л. Луговая. – 5-е изд., стер. – М.: Высш. шк., 2009. – 150 с.: ил.

2. Макеева М.Н. Английский для бакалавров (в области техники и технологий): учебное пособие / М.Н. Макеева, О.Н. Морозова, Л.П. Циленко. – Тамбов: Изд-во ФГБОУ ВПО «ТГТУ», 2012. – 80 с.

### Перечень дополнительной литературы

1. Кадулина Л.Б. Английский язык для инженерных факультетов. English for Engineering Faculties: учебное пособие / Л.Б. Кадулина, Л.Е. Лычковская, Е.Р. Менгардт, О.И. Тараканова. – Томский государственный университет систем управления и радиоэлектроники, 2015. – 350 с.

2. Мошкина Т.Г. Английский язык для курсантов военных специальностей радиотехнических направлений: учебное пособие / Т.Г. Мошкина, О.В. Шагалина. – Красноярск: Сиб. федер. ун-т., 2011. – 140 с.

### Перечень ресурсов информационно-телекоммуникационной сети «Интернет», необходимых для освоения дисциплины

1. <http://biblioclub.ru> ЭБС – «Университетская библиотека онлайн»;
2. [www.elibrary.ru](http://www.elibrary.ru) – Научная электронная библиотека e-library;
3. [www.library.stavsu.ru](http://www.library.stavsu.ru) – Электронная библиотека и электронный каталог научной библиотеки СКФУ;
4. [www.window.edu.ru](http://www.window.edu.ru) – Информационная система «Единое окно доступа к образовательным ресурсам».

Приложение 1

## СПИСОК НАИБОЛЕЕ ЧАСТО ВСТРЕЧАЮЩИХСЯ СОКРАЩЕНИЙ

**A, a** – ampere – ампер

**Å** – Angstrom – ангстрем (10<sup>-8</sup> см, 10<sup>-10</sup> м)

**A.C. (a.c.)** – alternating current – переменный ток

**a.f.** – audio frequency – звуковая частота

**A.F.C.** – automatic frequency control – автоматическая подстройка частоты (АПЧ)

**a-hr** – ampere-hour – ампер/час

**°C** – centigrade – градус Цельсия

**Cal** – kilogram-calorie – большая калория

**cm, p. s.** – centimeters per second – см/с

**c.p.** – candle power – свеча

**c.p.s.** – cycles per second – герц

**db** – decibel – децибел

**D.C. (d.c.)** – direct current – постоянный ток

**dia.** – diametre – диаметр

**dm.** – decimeter – дециметр

**e.g.** – exempli gratia – например  
**emf** – э.д.с.  
**etc.** – и т.д.  
**F** – farad 1) фарада, 2) градус Фаренгейта  
**f.s.d.** – full size detail – деталь в натуральную величину  
**g** – грамм  
**g. r.** – gear ratio – передаточное число, отношение  
**h. f. (r. f.)** – high frequency (ratio frequency) – звуковая частота  
**hi-fi** – high fidelity – высокая точность звуковоспроизведения  
**h. p.** – 1) horsepower – лошадиная сила;  
 2) high pressure – высокое давление  
**h. v.** – high voltage – высокое напряжение  
**i.c.** – internal combustion – внутреннего сгорания (*о двигателе*)  
**i.e.** – id est = that is – то есть  
**i. f.** – intermediate frequency – промежуточная частота  
**Kc/ s** – kilocycles per second – килогерц  
**kg** – kilogram – килограмм  
**kgf** – kilogram force – килограмм (кг, ед. силы)  
**kg/sq. cm** – kilogram per square centimetre – атмосфера  
 (ед. давления)  
**kV/a-hr** – kilovolt ampere-hour – киловольтампер/час  
**kW** – kilowatt – киловатт  
**kW – hr** – киловатт/час  
**j** – joule – джоуль  
**lb.** – pound – фунт  
**lit.** – litre – литр  
**lm** – lumen – люмен  
**l.p.** – low pressure – низкое давление  
**l.v.** – low voltage – низкое напряжение  
**m** – metre – метр  
**m** – milli- – милли-  
**μ** – micro- – микро-  
**mA** – milliamperе – миллиампер  
**μA** – microampere – микроампер  
**Mc/s** – megacycles per second – мегагерц  
**μfd** – microfarad – микрофарада  
**μH** – microhenry – микрогенри  
**mi** – mile – миля  
**min.** – minute – минута  
**mm Hg** – миллиметр ртутного столба  
**No.; Nos** – number(s) – номер(а)  
**pc., pcs** – piece(s) – штука (и)  
**pf** – picofarad – пикофарада  
**ppm** – parts per million – частей на миллион  
**p.s.f.** – pounds per square foot – фунтов на кв. фут  
**p.s.i.** – pounds per square inch – фунтов на кв. дюйм  
**Qty** – quantity – количество  
**r. f.** – radio frequency – высокая частота, радиочастота  
**r.p.m.** – revolutions per minute – оборотов в минуту  
**r.p.s.** – revolutions per second – оборотов в секунду  
**sc.** – scale – шкала  
**sec.** – second – секунда

**St. Std** – State Standard (ГОСТ)  
**Std** – Standard (ОСТ)  
**s.w.** – specific weight – удельный вес  
**t – ton** – тонна  
**tf** – ton force – тоннасила  
**tm** – tonmoment – тоннамомент  
**V** – вольт  
**v.f.** – video frequency – видеочастота  
**vs** – versus – против  
**v.v.** – variable voltage – переменное (регулируемое) напряжение  
**W** – watt – ватт  
**w.g.** – wire gauge – проволочный калибр  
**yd.** – yard – ярд

## Приложение 2

### ЕДИНИЦЫ ИЗМЕРЕНИЯ (UNITSOFMEASUREMENT)

#### *Меры длины (Linear Measures)*

Дюйм inch in. 2.54 cm  
 Фут foot ft(12 in.) 30.48 cm  
 Ярд yard yd(3ft) 91.44 cm  
 Миля mile mi.(1760yd) 1609.33 m  
 Миляморская nautical mile naut.mi.(6080ft) 1853.18 m (knot)

#### *Меры веса (Measures of Weights)*

Драхма dram dr. 1.77 g  
 Унция ounce oz (16 dr.) 28.35 g  
 Фунт pound lb.(16 oz) 435.59 g  
 Стоун stone st. (14 lb.) 6.53 kg  
 Квартер quarter qr (28 lb.) 12.7 kg  
 Центнер hundredweight hwt (112 lb.) 50.8 kg  
 Тоннабольшая ton t (20 hwt) 1016.048 kg

#### *Меры объема жидких и сыпучих тел (Measures of Volume)*

Джилл gill 0.14 l

Пинта pint pt (4 gills) 0.57 l

Кварта quart qt (2 pt) 1.14 l

Галлон gallon gal. (4 qt) 4.55 l

Бушель bushel bsh. (8 gal.) 36.37 l

Кворттер quarter qr (8 bsh.) 290.94 l

**Мерыплощади (Square Measures)**

Кв. дюйм square inch sq. in. 6.45 cm<sup>2</sup>

Кв. фут square foot sq. ft (144 sq. in.) 9.29 cm<sup>2</sup>

Кв. ярд square yard sq. yd (9 sq. ft) 0.836 cm<sup>2</sup>

Акр acre ac. (4840 sq. yd) 0.4 hectare

Кв. миля square mile sq. mi. (640 ac.) 2.59 km<sup>2</sup>

**Мерыобъема (Cubic Measures)**

Куб. дюйм cubic inch c. in. 16.39 cm<sup>3</sup>

Куб. фут cubic foot c. ft (1728 c. in.) 28.32 cm<sup>3</sup>

Куб. ярд cubic yard c. yd (27 c. ft) 764.53 dm<sup>3</sup>

Тонна регистровая register ton reg.t. (100 c. ft) 2.83 m<sup>3</sup>

**Time**

60 seconds = 1 minute

60 minutes = 1 hour

24 hours = 1 day

7 days = 1 week

**Angles**

60 seconds (60'') = 1 minute (1')

60 minutes (60') = 1 degree (1°)

90 degree (90°) = 1 right angle

360 degree (360°) = 1 circle

4 right angles = 1 circle

1 кВт (kW) = 1,36 л.с. (h.p.)

1 л.с. (h.p.) = 0,736 кВт (kW)

1 кВт.ч (kWhr) = 860 ккал (kcal)

1 ккал (kcal) = 0,001163 кВт.ч (kWhr)

Приложение 3

## ЛАТИНИЗМЫ

(латинские слова и выражения,  
употребляемые в оригинале без перевода)

**ibidem (ib., ibid) = in the cited source** –тамже

**in situ = at the site** – наместе

**per se = by itself** – самопосебе

**conditio sine qua non = indispensable condition** –непременноеусловие

**via = through** – путем

**in vitro = in a test tube** – впробирке

**statusquo = initialcondition**– исходноеположение, в первоначальном виде

**sui generis = in its kind** – всвоемроде

**ergo = consequently** – следовательно

**proviso = on condition that** – приусловии

**sic! = important!** – важно; подлинник

**c. = circa** ['sWkq] – примерно, около

**i.e. = id est** – то есть

**etc. = et cetëra** – ит. д.

**e.g. = example gratiä** – например



**viz. = videlicet** – а именно, то есть  
**v.v. = vice versa** – наоборот  
**v.s. = vide supra** – см. выше  
**v.i. = vide infra** – см. ниже  
**vid. = vide** – смотри  
**u.i. = ut infra** – как указано ниже  
**p.m. = post meridiem** – послеполудня  
**a.m. = ante meridiem** – дополудня  
**p.a. = per annum** – в год  
**n.l. = non licet** – недопустимо  
**c.v. = curriculum vitae** – жизнеописание