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МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное
образовательное учреждение высшего образования
«СЕВЕРО-КАВКАЗСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ»
Пятигорский институт (филиал) СКФУ

Методические указания
по выполнению практических работ
по дисциплине «ИНОСТРАННЫЙ ЯЗЫК В СФЕРЕ
ПРОФЕССИОНАЛЬНОЙ КОММУНИКАЦИИ»
для студентов направления подготовки
13.03.02 Электроэнергетика и электротехника

**ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ**
Сертификат: 12000002A633E3D113AD425FB50002000002A6
Владелец: Шебзухова Татьяна Александровна
Действителен: с 20.08.2021 по 20.08.2022

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**ДОКУМЕНТ ПОДПИСАН
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ВВЕДЕНИЕ

Методические указания предназначены для студентов 1 курса очной формы обучения, которыми они могут пользоваться при подготовке к практическим занятиям. Практические занятия это - планируемая учебная, учебно-исследовательская, а также научно-исследовательская работа студентов, которая выполняется в аудиторное время под руководством преподавателя. В составе методических указаний к практическим занятиям предусмотрены рекомендации по подготовке к практическому занятию. При выполнении работы студенты могут использовать не только методические указания по решению задач, но и другие материалы учебно-методического комплекса.

Основной целью методических указаний по выполнению практических работ является повышение исходного уровня владения иностранным языком, достигнутого на предыдущей ступени образования, и овладение студентами необходимым и достаточным уровнем коммуникативной компетенции для решения задач межличностного и межкультурного взаимодействия.

Цель заключается в формировании у студентов навыков понимания, извлечения, обработки и воспроизведения информации.

Структура включает тексты различной направленности, упражнения и практические задания комплексного характера для закрепления основных знаний по тематике соответствующего занятия, что предполагает реализацию следующих целей:

- повышение уровня учебной автономии и способности к самообразованию;
- развитие когнитивных и исследовательских умений;
- развитие навыков чтения, понимания и перевода с английского языка на русский;
- развитие навыков устной речи на английском языке;
- закрепление профессионального лексического и грамматического материала при помощи различных упражнений.

Процесс изучения дисциплины «Иностранный язык в сфере профессиональной коммуникации» направлен на формирование компетенций УК-4 (способность к осуществлению деловой коммуникации в устной и письменной формах на государственном языке Российской Федерации и иностранном(ых) языке(ах)).

**ДОКУМЕНТ ПОДПИСАН
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СОДЕРЖАНИЕ ПРАКТИЧЕСКИХ ЗАНЯТИЙ

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

Практическое занятие № 1.

Тема 1. 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	ДОКУМЕНТ ПОДПИСАН	следствие
echo	ЭЛЕКТРОННОЙ ПОДПИСЬЮ	эхо
certification	Сертификат: 12000002A633E3D113AD425FB50002000002A6	длина
owner	Владелец: Шибзухова Татьяна Александровна	средний
medium	Действителен: с 20.08.2021 по 20.08.2022	

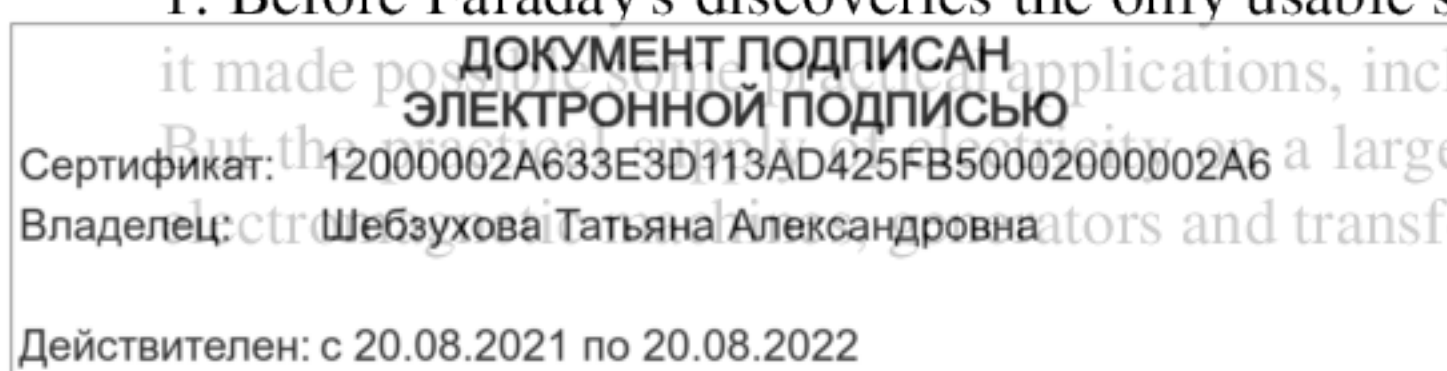
radar	радиолокационный
realize	понимать
scientist	ученый
theory	теория
ultraviolet	ультрафиолетовый
warn	предупреждать
light	свет
speed	скорость
electromagnetic	электромагнитный
existence	существование
discovery	открытие
communication	связь
wave motion	волновое движение
the long infra-red rays	длинные 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 функции 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 tide wave, heat wave, light wave, sound wave, sea wave, wave motion.
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 a number of applications, including the electric light and the electric telegraph. But the practical use of electricity on a large scale was only possible by the development of electric 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**¹ 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, употребите в ответ 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, используйте слова и словосочетания, предложенные в скобках (efficiency, rather than, main, convenience, cleanliness, advantage, power/weight ratio).

Практическое занятие № 2.

Тема 2. Generating an Electric Current: The History of Electrical Engineering.

ДОКУМЕНТ ПОДПИСАН ЭЛЕКТРОННОЙ ПОДПИСЬЮ	
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Тема 2. Generating an Electric Current: The History of Electrical Engineering in Russia /
Тема 2. Генерация электрического тока: История электротехники.
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**¹ 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**² 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**.³ 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**.⁴ 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.

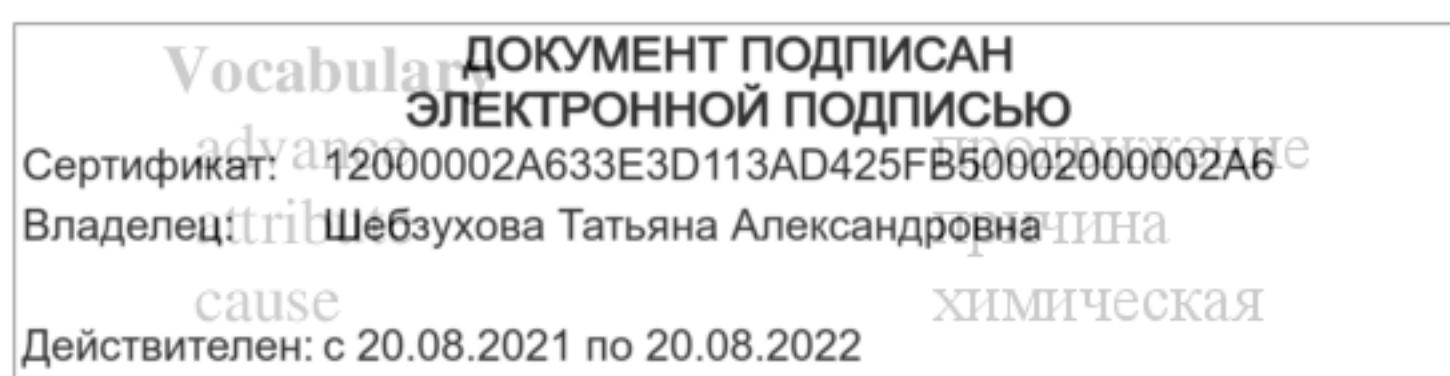
Примечания

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)



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	

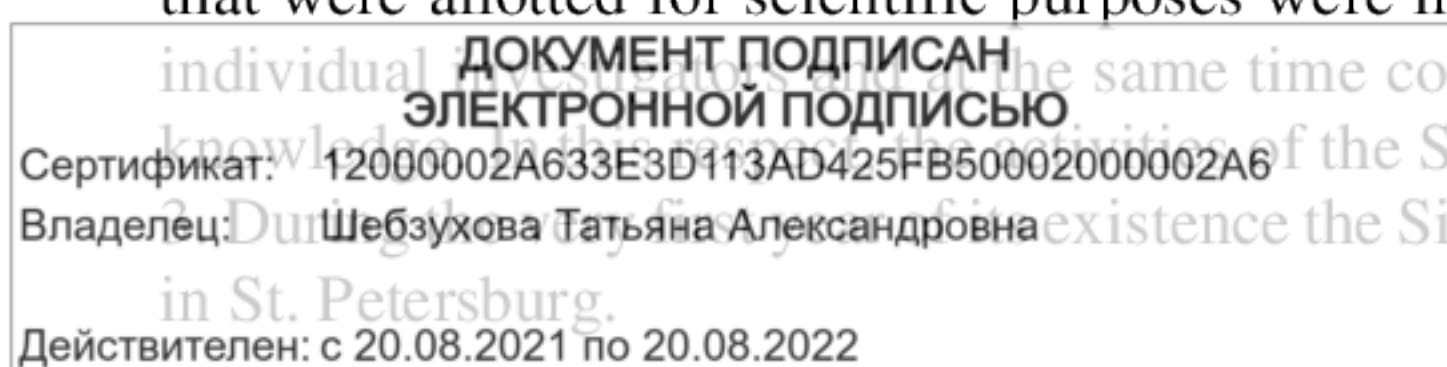
Вопросы и задания:

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. Вольта, 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 scientists and at the same time conduct a broad programme of spreading scientific knowledge. In the early years of the existence of the Sixth Department are especially characteristic.

During the early years 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

Практическое занятие № 3.

Тема 3. 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.

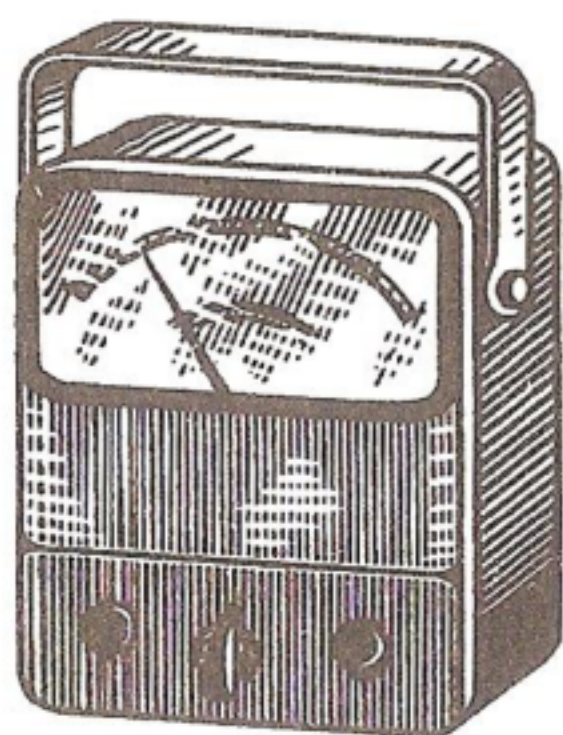
ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ

Сертификат: 12000002A633E3D113AD425FB50002000002A6

Владелец: Шебзухова Татьяна Александровна

Действителен: с 20.08.2021 по 20.08.2022

Теоретическая часть:



Meters

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. 3

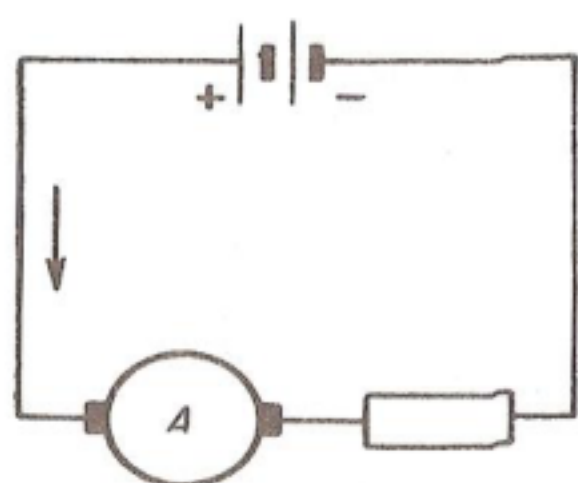


Fig. 4

Vocabulary

meter	['mi:tə]	измерительный прибор
battery	['bætəri]	батарея
scale	[skeɪl]	шкала
readings		показания на шкале(прибора)
terminal	['tə:mɪnəl]	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

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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. **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?

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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. $R_1 = 0.18$ ohm, $R_2 = 1.15$ ohms, $R_3 = 2$ ohms, $I = 10$ 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. $R_1 = 7,000$, $R_2 = 2,200$, $I = 110$ 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 cause a voltage drop in 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.

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Практическое занятие №4.
Тема 4. 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.

Теоретическая часть:

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.

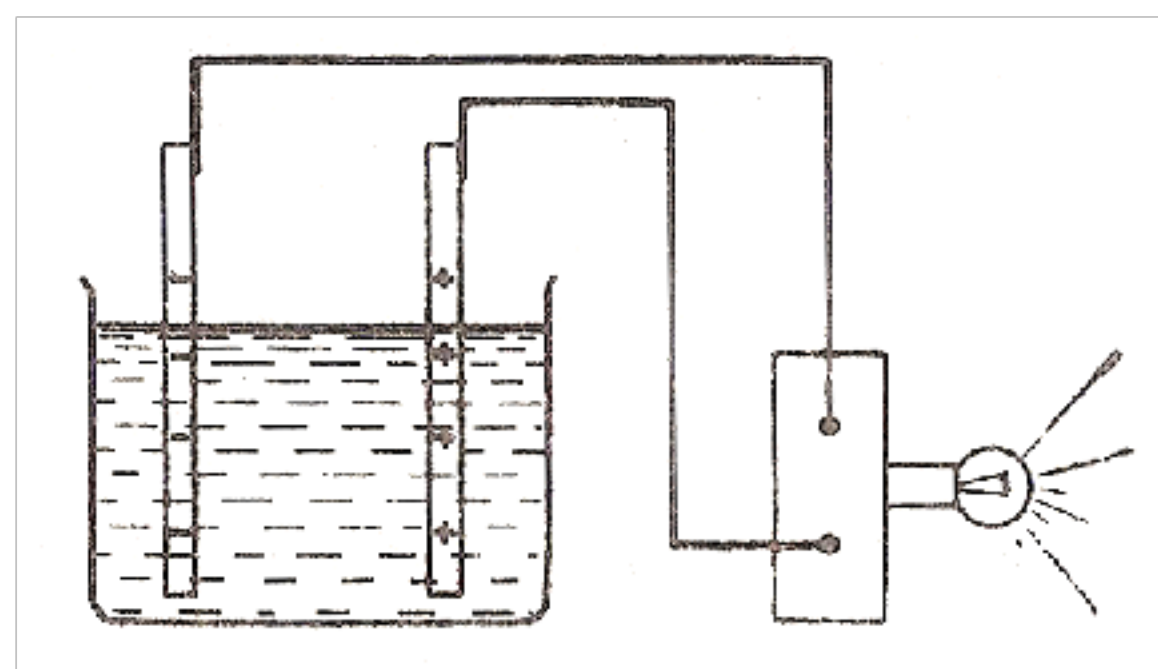
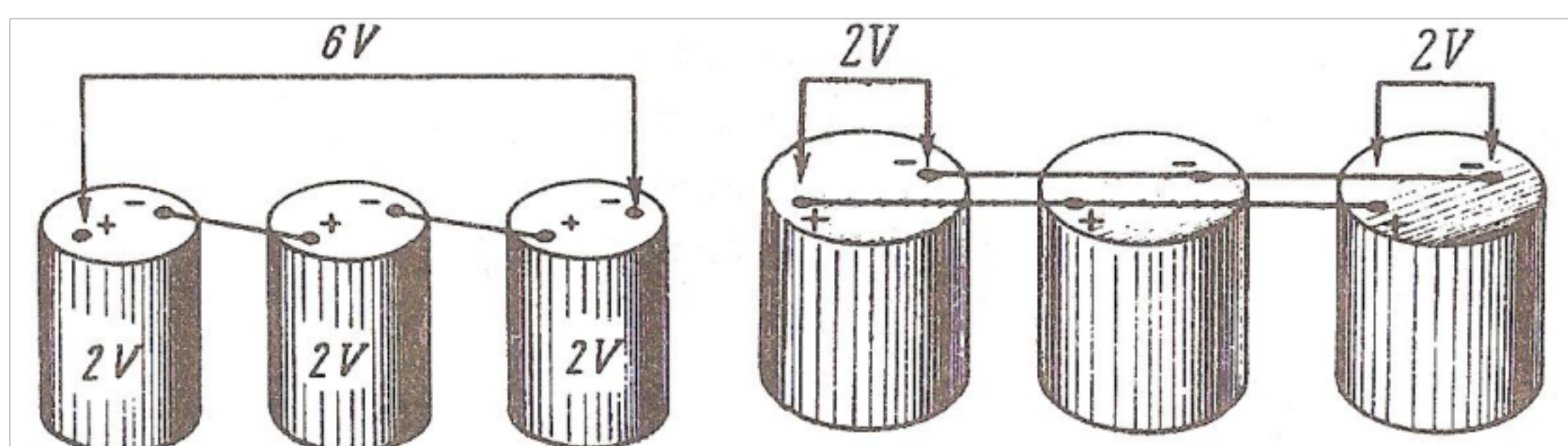


Fig 5.



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or operates badly. This cell should be substituted

Vocabulary

cell	[sel]	элемент
output	['autput]	емкость, мощность
bulb	[bʌlb]	электрическая лампа
to light	[laɪt]	зажигать, освещать
to increase	[ɪn 'kri:s]	увеличивать(ся), возрастать
to substitute		заменять
... and so on		и так далее
capacitor	[kə 'pæsɪtə]	конденсатор
insulator	['ɪnsjuleɪtə]	изолятор
frequency	['fri:kwənsi]	частота
distance	['dɪstəns]	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

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Вопросы и задания:

- a) Cover the right column and translate 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:

[ɪˈlektroʊd]	electrode	_____
[ɪˈlektroˌlaɪt]	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:

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- a) to increase the voltage output.
- b) to reduce the current capacity.
- c) to supply electric energy.

2. The terminals of a cell are used
 - a) to conduct current.
 - b) to increase voltage.
 - c) to connect the battery to a circuit.
3. When cells are connected in series
 - a) all the positive terminals are connected together.
 - b) all the negative terminals are connected together.
 - 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.
 - 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?

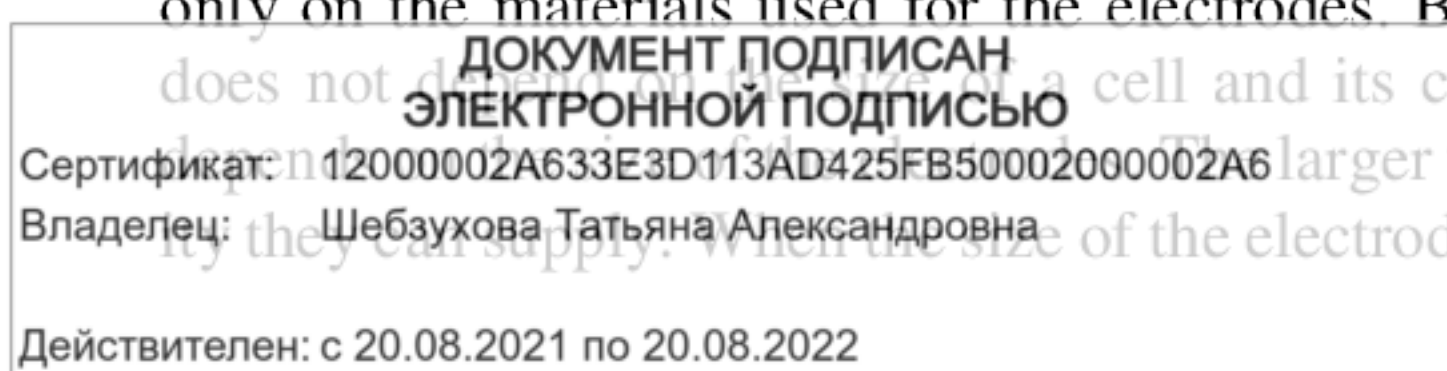
7. Solve these problems:

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 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.

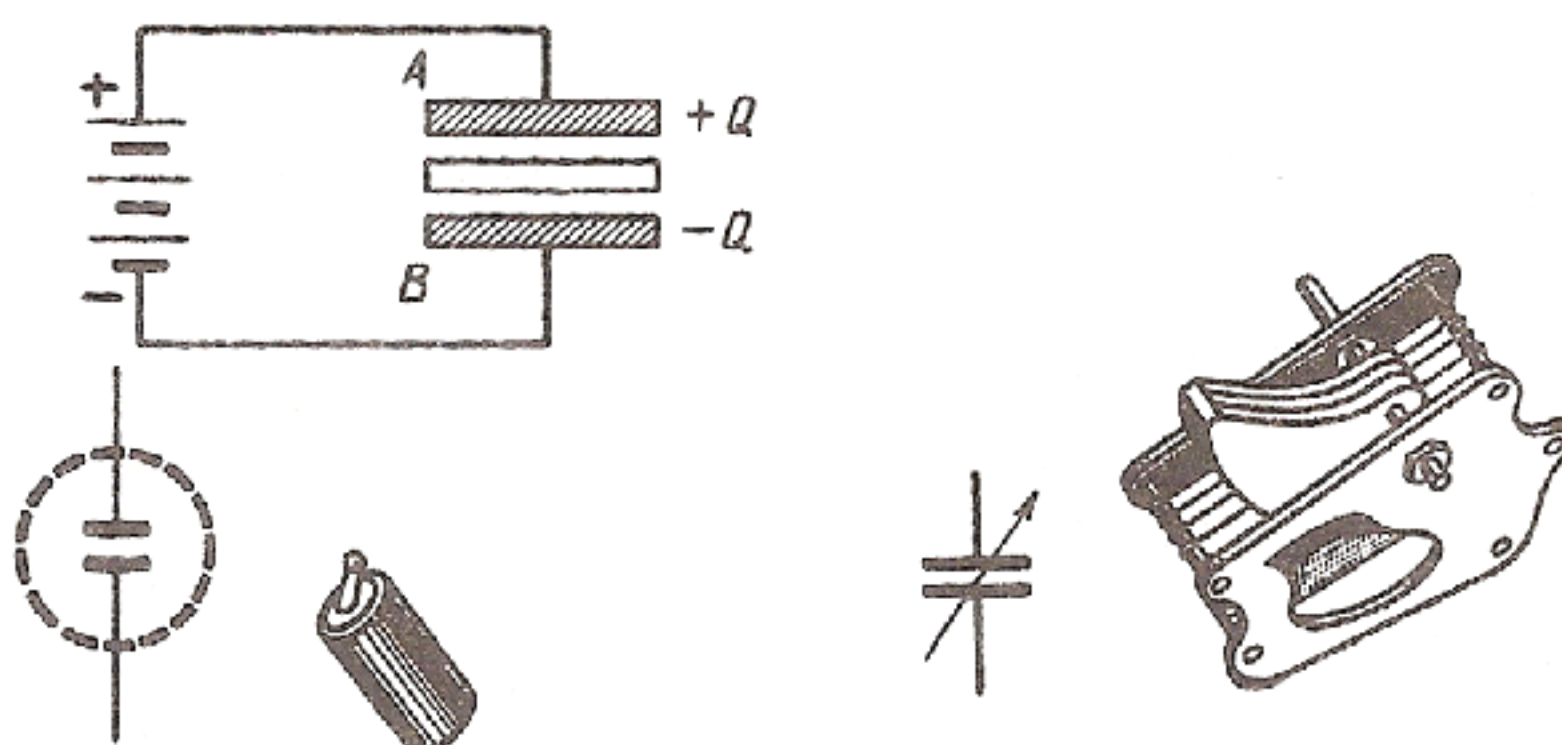


Fig. 8 Fig. 9

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°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 into English (orally).

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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

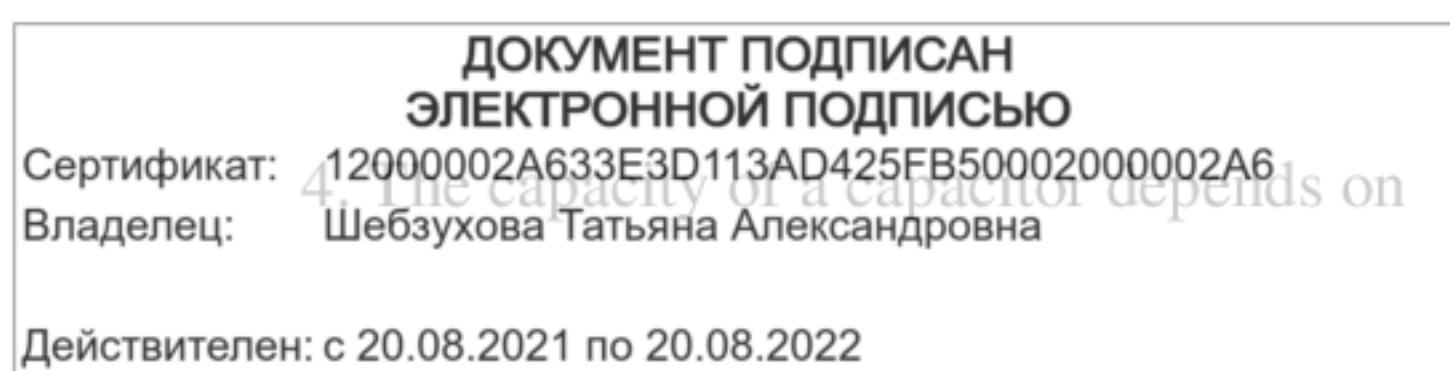
telephone and radio work

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.
b) to increase the voltage output.
c) to store energy. |
| 2. The main parts of a capacitor are | a) insulators only.
b) metal plates only.
c) metal plates and insulators between them. |
| 3. The function of insulators is | a) to store energy.
b) to isolate the metal plates.
c) to prevent a short between the metal plates. |
| 4. The capacity of a capacitor depends on | a) the size of the plates.
b) the distance between the plates.
c) the material of the insulators. |



- | | |
|---|--|
| 5. The capacity of a fixed capacitor | a) is constant.
b) is varied. |
| 6. The plates of a variable capacitor | a) can be moved.
b) cannot be moved. |
| 7. In order to charge a capacitor a voltage source is applied | a) to the metal plates.
b) to the insulators. |
| 8. The greater the distance between the plates, | a) the greater is the capacity of a capacitor.
b) the less is the capacity. |
| 10. Electrolyte capacitors have | a) a very low capacity.
b) a very high capacity. |
| 11. In case a capacitor has a trouble | a) it operates.
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.

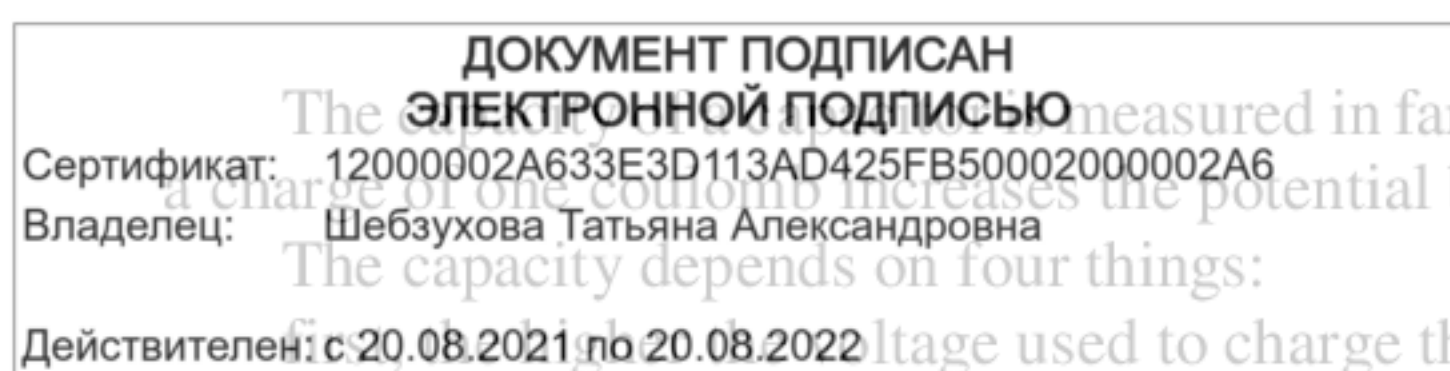
1. What is a capacitor used for?
2. What are the main parts of a capacitor?
3. What is the function of insulators?
4. What does the capacity of a capacitor depend on?
5. What is the difference between a fixed capacitor and a variable one?
6. What should be done in order to change a capacitor?
7. What 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:
1. The greater the distance between the plates, the less is the capacity.
2. The greater the area of the plates, the greater is the capacity.
3. The greater 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 № 5 Тема 5. 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.

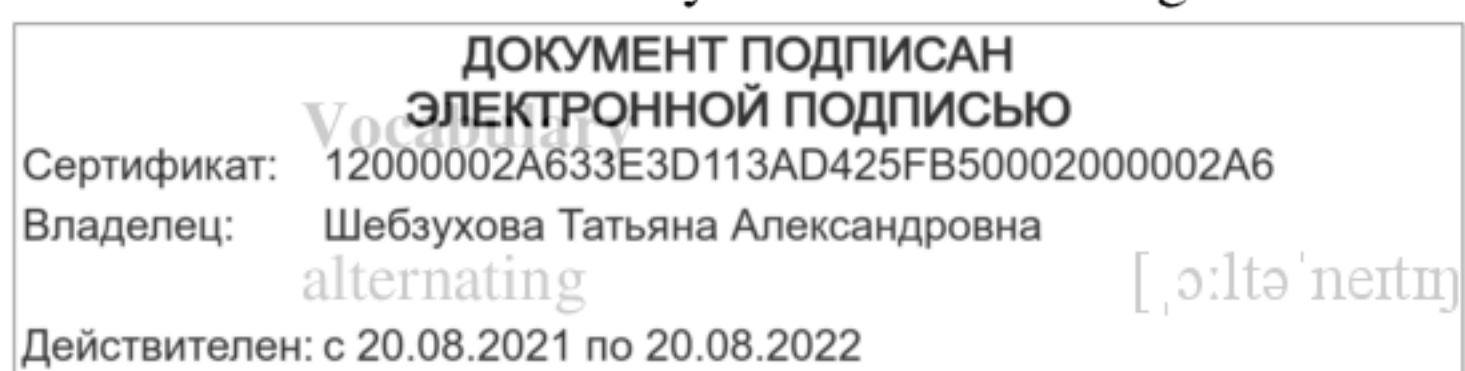
Теоретическая часть: Types of Current

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.



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	[fɑ: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:

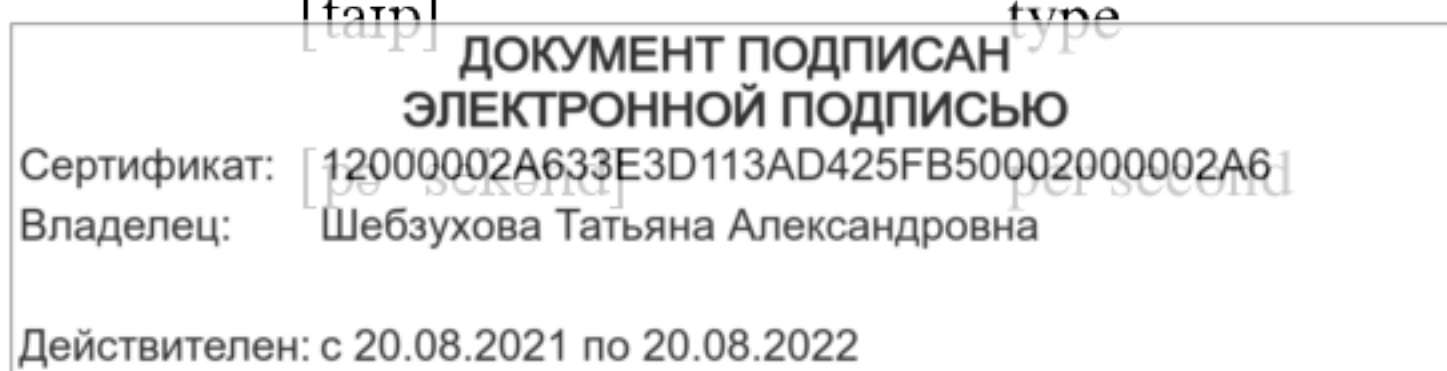
1.a) Cover the right column and read the English words. Translate them into Russian and check your translation.

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



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.
 - b) an alternating voltage source is applied.
3. In an alternating current circuit
 - a) current flows in one direction 60 times per second.
 - 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.
 - 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 ...

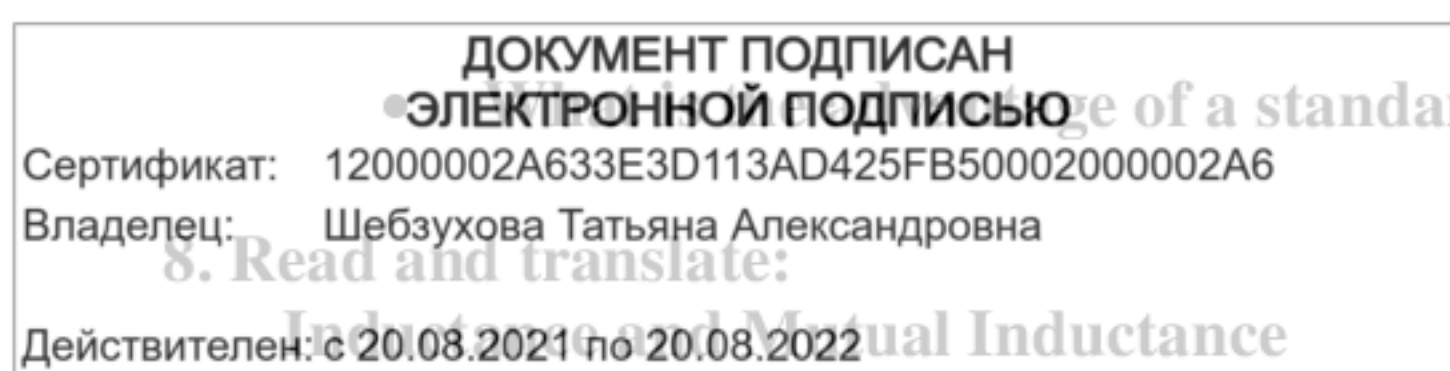
6. Answer the following questions:

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.



8. Read and translate:

Inductance and Mutual Inductance

... of a standard frequency?

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.

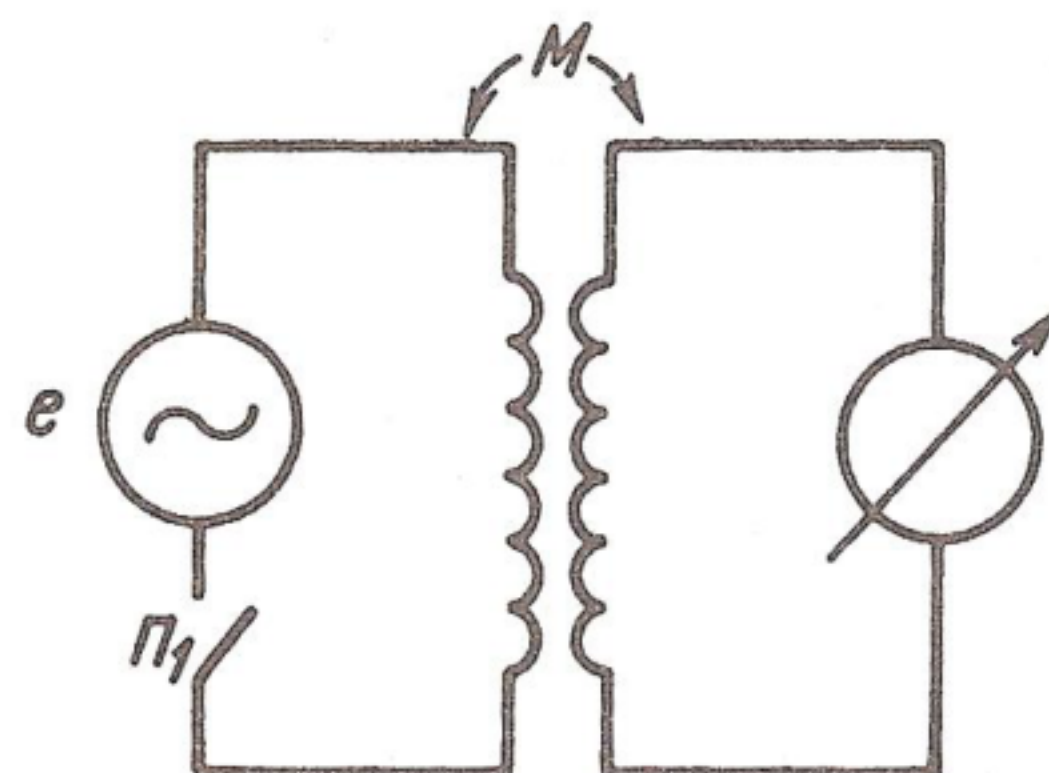


Fig. 12

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.

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Сертификат:	12000002A633E3D113AD425FB50002000002A6
Владелец:	Шебзухова Татьяна Александровна
Действителен: с 20.08.2021 по 20.08.2022	

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

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1. Which of the words are nouns and which are verbs?

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'vaɪs]	прибор
field	[fi:ld]	поле

loose	ДОКУМЕНТ ПОДПИСАН ЭЛЕКТРОННОЙ ПОДПИСЬЮ	[lu:s]	свободный, нежесткий
tight	Щебзухова Татьяна Александровна	[taɪt]	плотный

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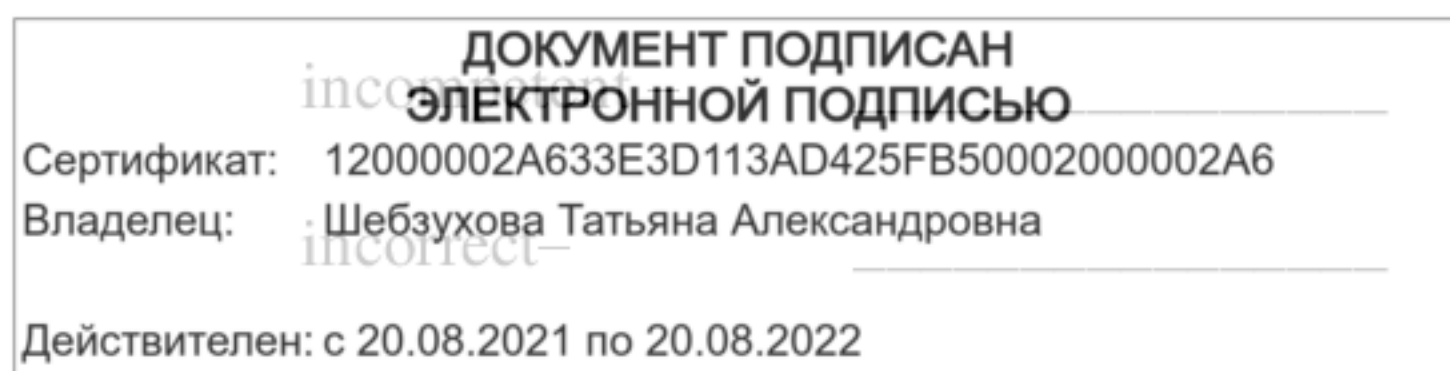
self-inductance		самоиндукция
to couple	['kʌpl]	соединять, сцеплять
to separate	['sepəreɪt]	отделять
to transfer	[træns 'fə:]	переносить
therefore	['ðeəfɔ:]	поэтому
filter	['fɪltə]	фильтр
bypass	['baɪpɑ:s]	шунт
choke	[tʃouk]	дроссель
high-pass	['haɪpɑ:s]	высокопроходной
low-pass	[lou 'pɑ:s]	низкопроходной
to oppose	[ə 'prouz]	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 витки
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



inactive – _____

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.
 - b) the primary circuit.
2. The circuit receiving its energy through a coupling is
 - a) the primary circuit.
 - b) the secondary circuit.
3. The function of a coupling element is
 - a) to separate the circuits.
 - b) to transfer energy.
 - c) to prevent a short between the circuits.
4. When the coupling is tight
 - a) the coils are separated.
 - b) the coils are close together.
5. When the coils are close together
 - a) the coupling is loose.
 - 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.
 - 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*.

1. The circuit **receiving** energy is the secondary circuit... .
2. The coupling is **loose** when the coils are **separated**... .
3. 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

ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ

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 Владелец: Шебзухова Татьяна Александровна

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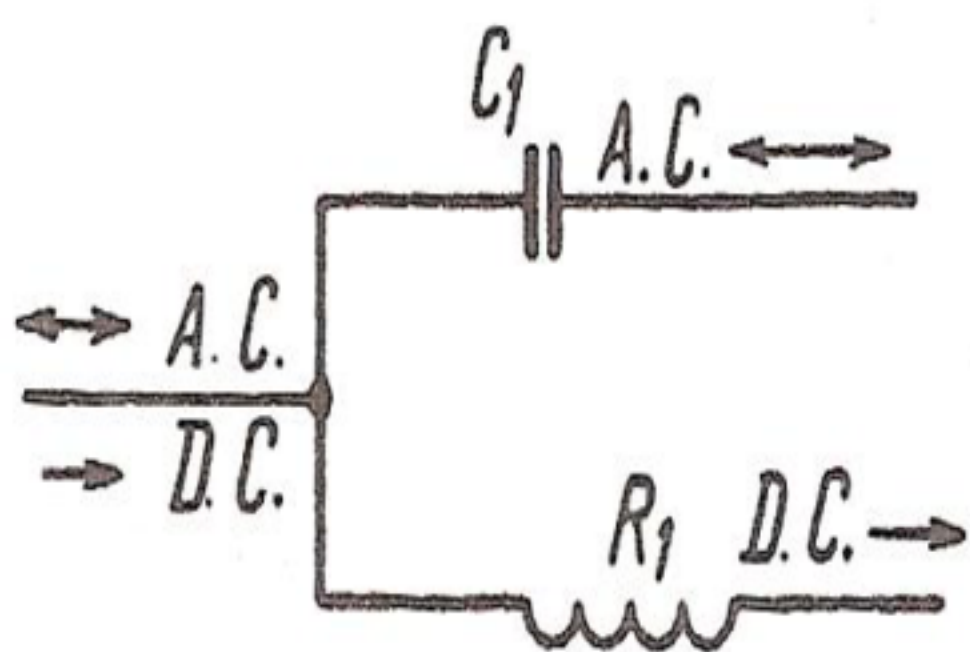


Fig. 13

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.
 - b) to transfer energy from the primary to the secondary.
 - c) to separate low frequencies from high frequencies.
2. A filter consists of
 - a) a resistor and a transformer.
 - b) a choke coil and a capacitor.
 - c) an inductance coil and a capacitor.
3. Direct current easily passes
 - a) through a choke coil.
 - b) through a capacitor.
4. Alternating current easily passes
 - a) through a capacitor.
 - 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.
 - 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.
 - b) an inductance coil is used as a bypass.
7. In a high-pass filter
 - a) an inductance coil is used as a bypass.
 - 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

rectify	['rektɪfaɪ]	выпрямить
eliminate	[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.

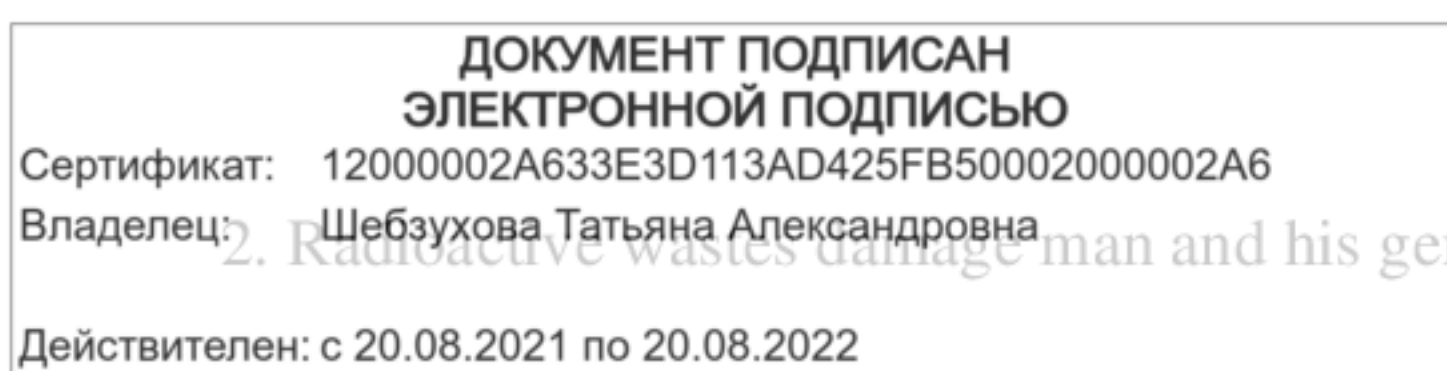
- What is the difference between a choke input filter and a capacity input filter?

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.

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.

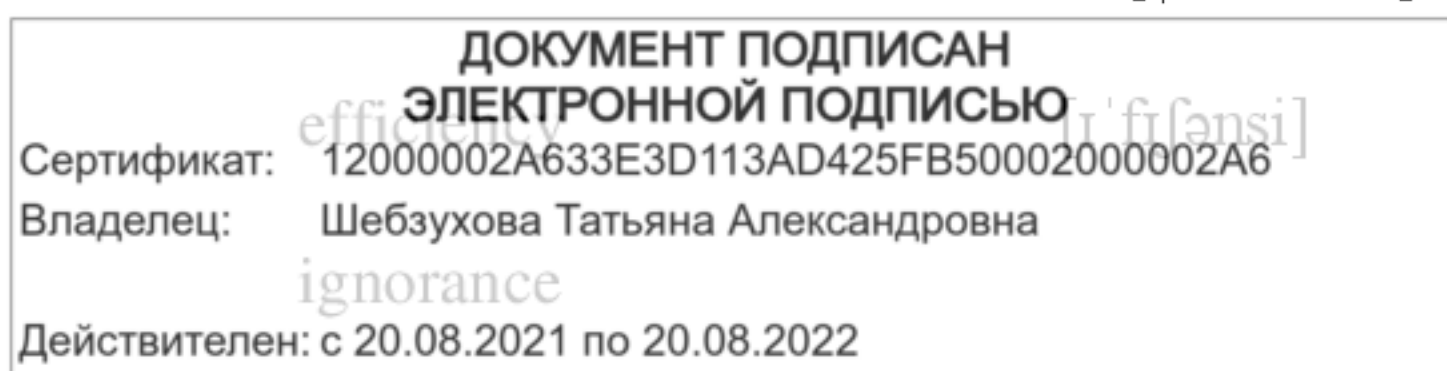
Loads include electric heaters, electric motors, incandescent lamps, etc. Motors convert electric energy into mechanical, incandescent lamps and heaters convert electric energy into light and heat. Utilizing devices or loads convert electric energy into thermal, mechanical or chemical energy.

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	[di'livə]	питать, подавать
according to	[ə'kɔ:dɪŋtə]	согласно
etc. = et cetera	[,et'setərə]	и так далее



отдача, эффективность

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

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:

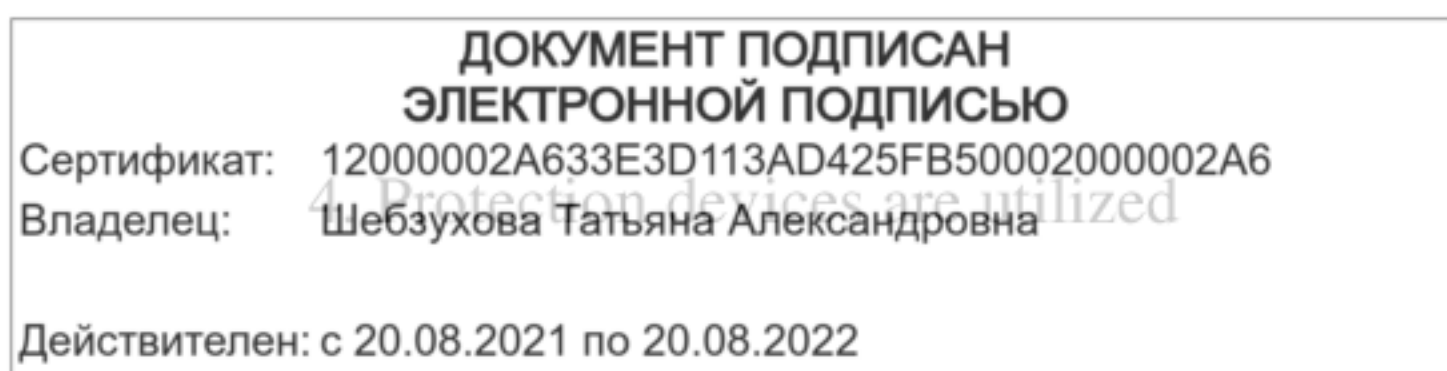
a. convertible values, protected power source, various fuses, variable resistors, chemical cells

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.
b) power sources, load and wires. |
| 2. Power sources are used | a) to produce electric energy.
b) to deliver it to the loads. |
| 3. Electric conductors are used | a) to connect the circuit elements.
b) to deliver electric power. |
| | a) in some circuits.
b) in any circuit. |



5. A switch is utilized

a) in some circuits.

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

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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:

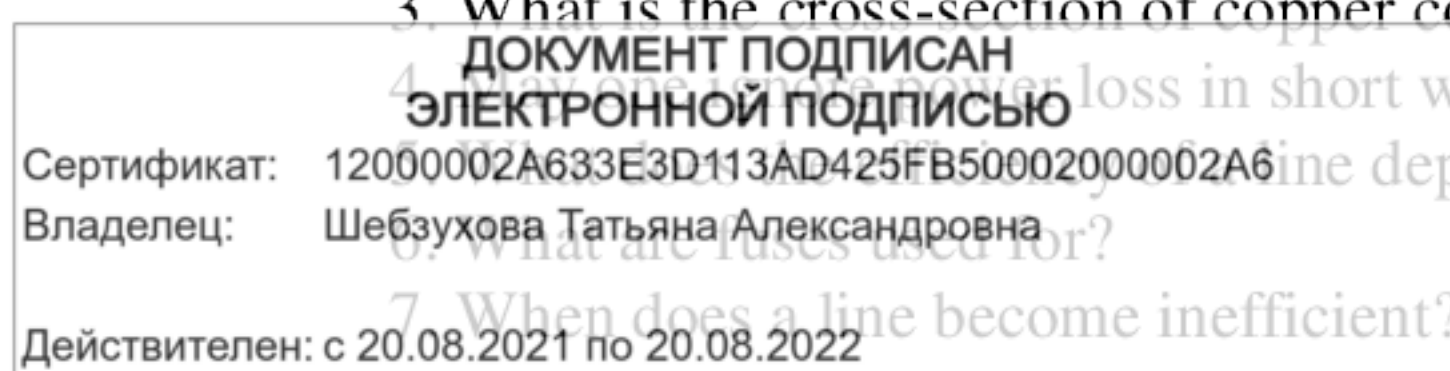
- | | |
|--|---|
| 1. Aluminium is used due to its | a) high cost.
b) low cost and high efficiency. |
| 2. Cross-section of different conductors | a) varies.
b) is the same. |
| 3. Power loss can be ignored | a) in short wires.
b) in long wires. |
| 5. Electric lines nowadays are | a) efficient.
b) inefficient.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

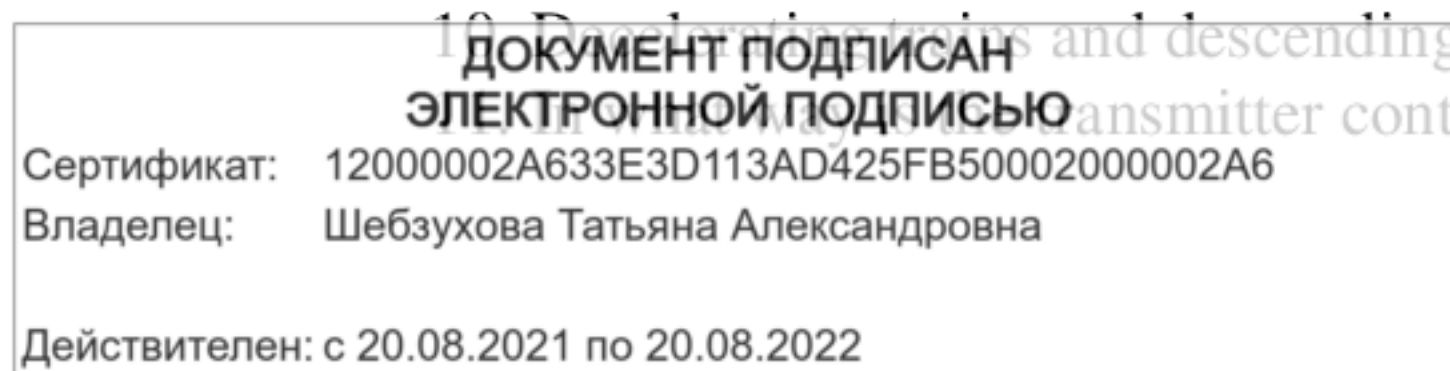
14. Copy the sentences below and underline participles. Say what forms of participles are used. Translate the examples into Russian in writing.

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. Descending and descending elevators use negative, or braking, torque.
11. 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.

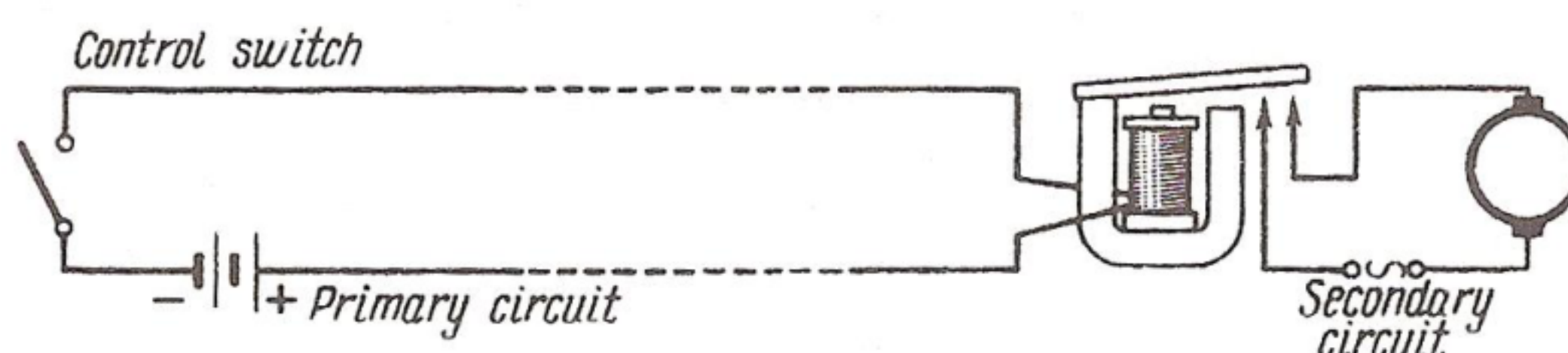


Fig. 18

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

['vɛəriəs]

различный, разнообразный

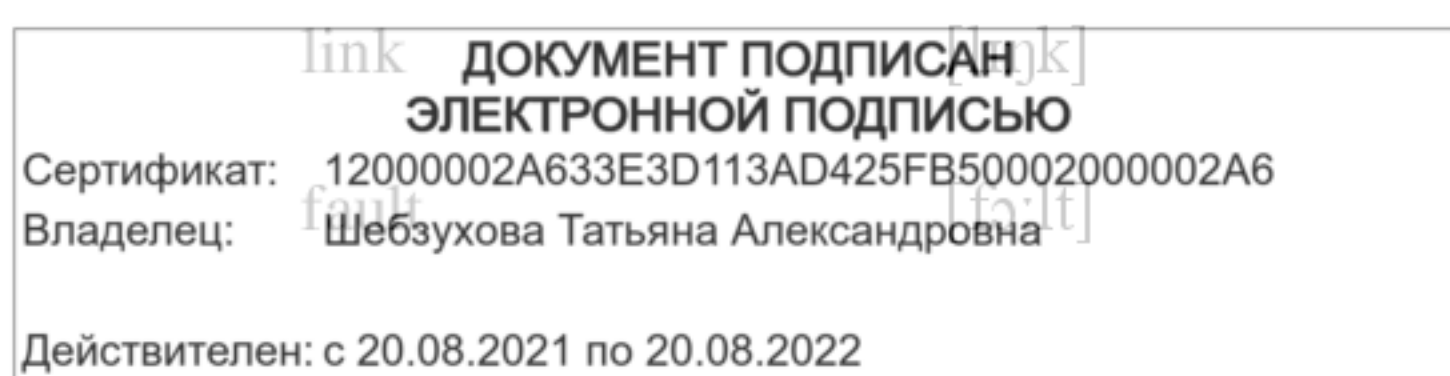
fuse

[fju:z]

плавкий предохранитель

звено, связь

дефект, неисправность



faulty		неисправный
equipment	[ɪ'kwɪpmənt]	оборудование
installation	[ˌɪnstə'leɪʃn]	установка; <i>pl.</i> сооружения
to protect	[prə'tekt]	защищать, предохранять
to utilize	[ˈjuːtɪlaɪz]	использовать
to equip	[ɪ'kwɪp]	оборудовать, снабжать
to serve		служить
to melt		плавить
up to		вплоть до

Вопросы и 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).

[ɪ'leɪ]	relay	_____
[ɪ'lektroʊ'mæɡnɪt]	electromagnet	_____
[ˈɑːməʃ]	armature	_____
[ˈkɒntækt]	contact	_____
[ˈsɪstəm]	system	_____
[ˌɔːtə'mætɪk]	automatic	_____
[ˈpænl]	panel	_____

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

Model: automatic – automatically

wide – _____

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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 _____

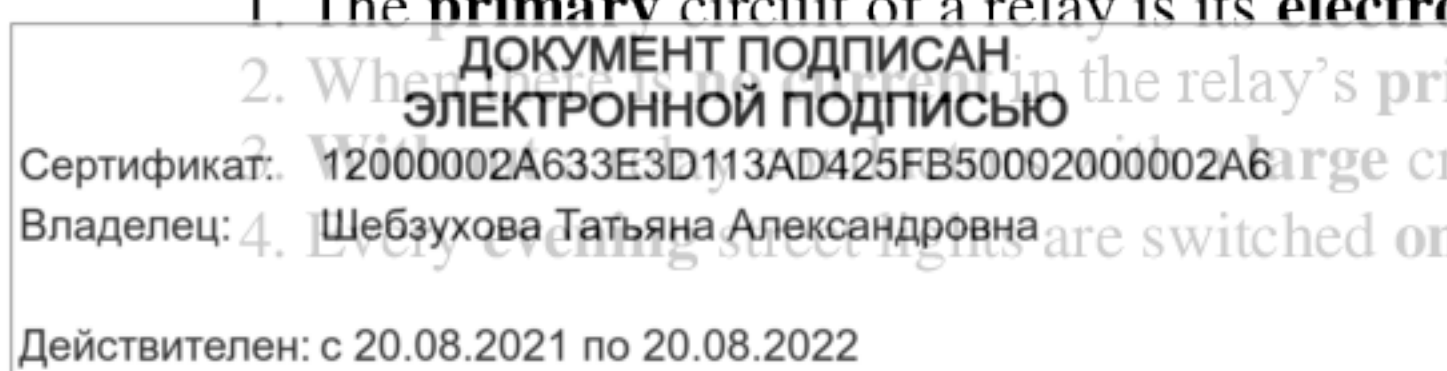
relay's primary circuit _____

19. Complete the sentences using the correct variant:

- | | |
|--|---|
| 1. The main parts of a relay are | a) an electromagnet, a capacitor, and a spring.
b) an electromagnet, an armature, and a spring. |
| 2. When current starts flowing | a) the spring opens the contacts.
b) the spring closes the contacts. |
| 3. The spring pulls the armature | a) when there is current in the primary circuit.
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.
b) have a small cross-section. |
| 5. Street lights are switched on and off | a) by means of relays.
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 **current** flows in the relay's **primary** circuit the contacts **open**
3. Wires 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 _____ fusible link _____

ЭЛЕКТРОННОЙ ПОДПИСЬЮ _____ faulty protection device _____

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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 the words and phrases both ... and, in case, up to:

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1. Both solid and gaseous insulators are highly in use.
2. In case a fuse gets faulty it should be replaced by a new one.

3. Capacitors of very high capacity – up to 1000 and more mF – are utilized in modern installations.

29. Complete the sentences using the correct variant:

- | | |
|--------------------------------|---|
| 1. A fuse serves | a) as a load.
b) as a protection. |
| 2. Fuses are used | a) for d.c. only.
b) for both a.c. and d.c. |
| 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:

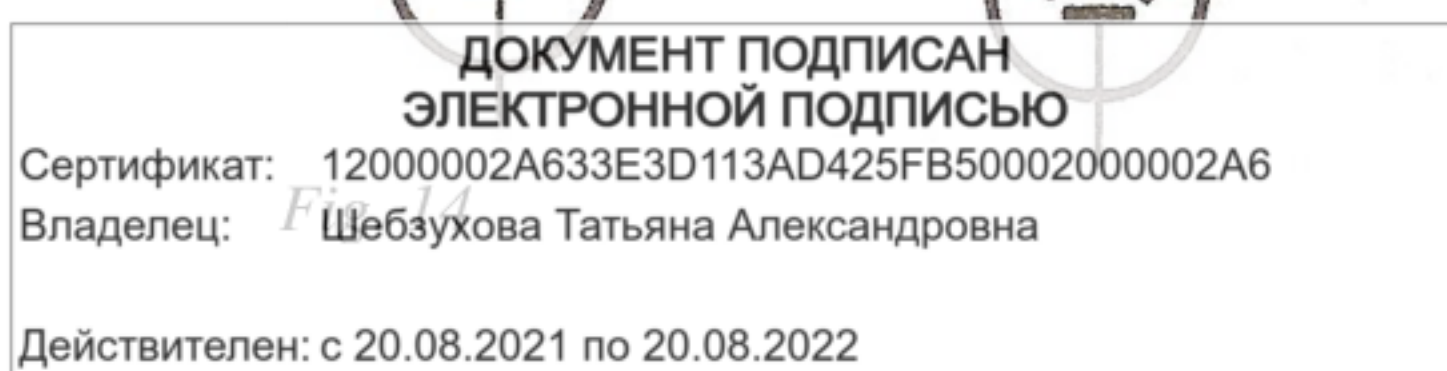
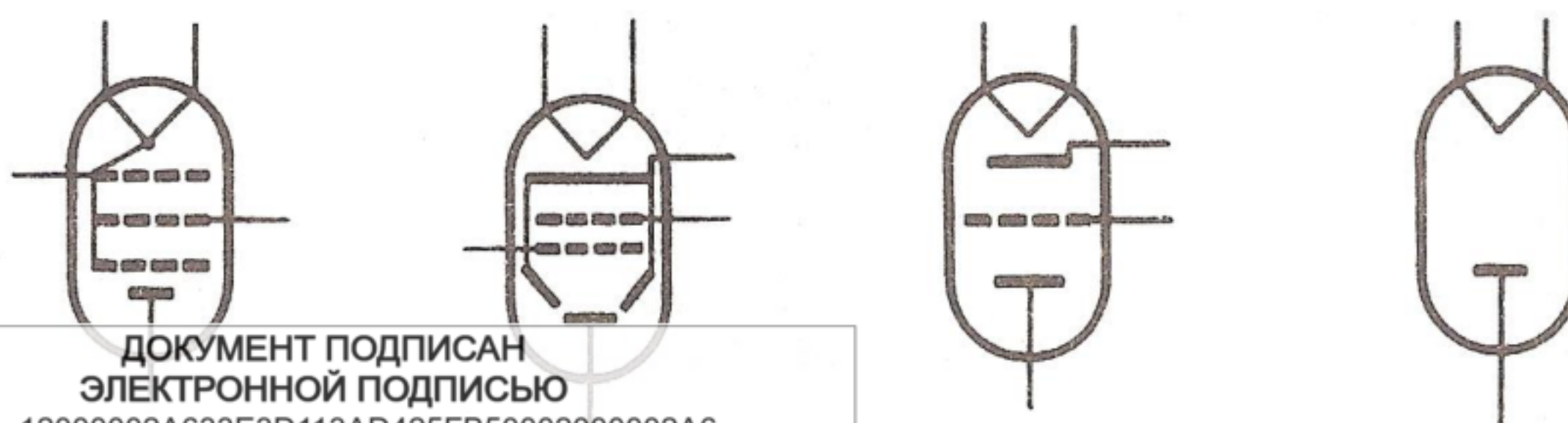
1. What does a fuse serve for?
2. For what type of current are fuses used?
3. What should be done in case of a faulty fuse?
4. What principle is fuse protection based on?

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.



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.

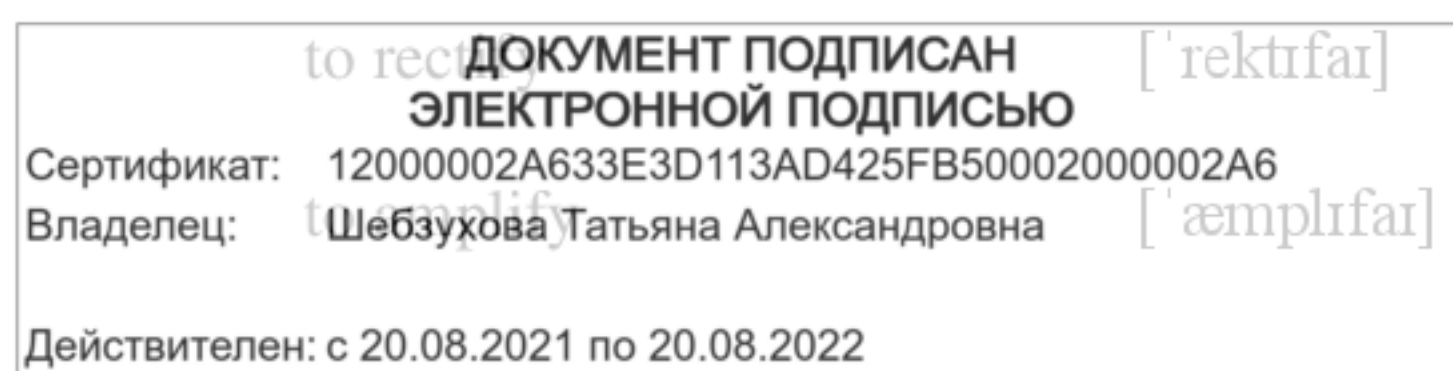
Common troubles in tubes are an open heater and low emission. These troubles result from constant use or from some other reason. In case a tube has a trouble it stops operating or operates badly. A tube with a trouble should be replaced by another one.

Vocabulary

tube	[tju:b]	электронная лампа
bulb	[bʌlb]	баллон
grid		сетка
screen		экран
to contain	[kən'tein]	вместать
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	[hɑ:f]	половина

выпрямлять

усиливать



to convert	[kən've:t]	преобразовывать, обра- щать
by means of		посредством, с помощью
that is why		вот почему
to put into operation		приводить в действие, за- пускать
half		половина

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.

<i>Model:</i>	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'roud]	_____	glass	[glɑ:s]	_____
pentode	[pen'toud]	_____	oscillator	['ɒsɪlətə]	_____
pulse	[pʌls]	_____	electron	[ɪ'lektrɒn]	_____
cycle	['saɪkl]	_____	radio	['reɪdɪəu]	_____

35. Complete the sentences using the correct variant:

ДОКУМЕНТ ПОДПИСАН
1. А ЭЛЕКТРОННОЙ ПОДПИСЬЮ

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

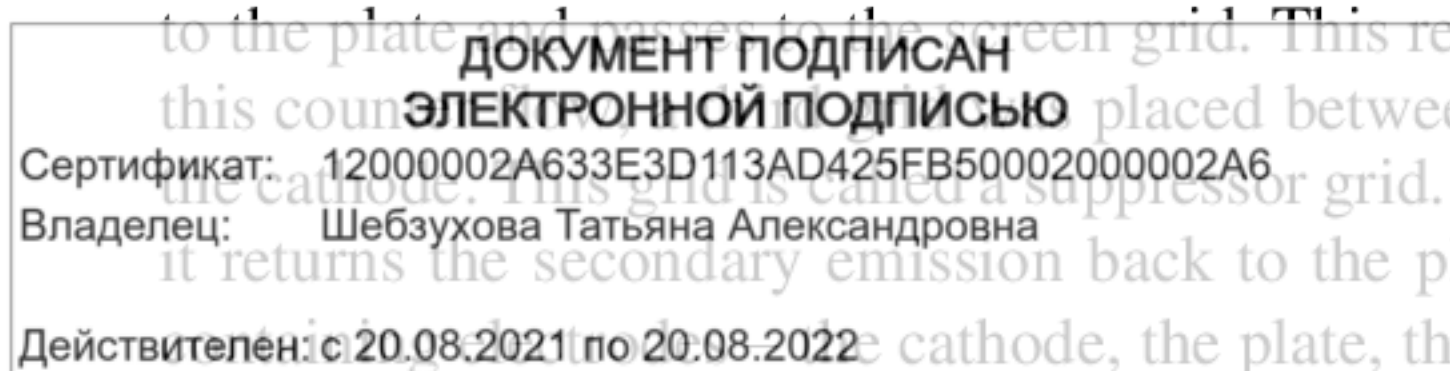
36. Answer the following questions:

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 suppressor grid is 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 contains five 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:

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- | | |
|---|--|
| 1. Electron tubes are used | a) as amplifiers only.
b) as oscillators only.
c) as rectifiers, amplifiers and oscillators. |
| 2. A.c. is converted into d.c. | a) by means of a rectifier.
b) by means of an amplifier. |
| 4. In order to put a rectifier into operation | a) d.c. is applied.
b) a.c. is applied. |
| 5. A half-wave rectifier passes currents | a) during positive and negative half-cycles.
b) during positive half-cycles of the applied voltage. |
| 6. Rectified current is | a) direct oscillating current.
b) direct pulsating current. |
| 7. Pulsations are eliminated | a) by means of a choke coil.
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?

<div style="border: 1px solid black; padding: 5px;"> <p>ДОКУМЕНТ ПОДПИСАН ЭЛЕКТРОННОЙ ПОДПИСЬЮ Сертификат: 12000002A633E3D113AD425FB50002000002A6 Владелец: Шебзухова Татьяна Александровна Действителен: с 20.08.2021 по 20.08.2022</p> </div>	1. Communication is used 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.

Раздел 4. Variety of Electric Motors / Многообразие электродвигателей

Практическое занятие № 7.

Тема 7. 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:

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Electromagnetic Machines

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**¹ 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*.

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3. Назовите вещества, применяемые в гальванических элементах.
4. Расскажите о применении железа в электротехнике.
5. Назовите материалы, применяемые 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**¹ 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**.²
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

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12. Прочтите текст и обратитесь к следующим словам: battery-powered, high-frequency, «squirrel-cage», two-speeds, far-reaching, pole-amplitude – скажите, с 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 № 8.

Тема 8. 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. Each motor is usually attached to its frame. The nameplate bears machine ratings. To use the motor safely, you must know its rated power, the rated current, the starting current, the power factor, the efficiency, the rated torque.

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frame. The nameplate bears machine ratings. To use the motor safely, you must know its rated power, the rated current, the starting current, the power

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

Вопросы и задания:

1. Переведите и запомните следующие слова и словосочетания: 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 причине многообразия электрических моторов, используя because of в ответе.

3. Прочтите пятый абзац текста, обратите внимание на отрицательные приставки прилагательных и скажите о сроке службы электрических 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.

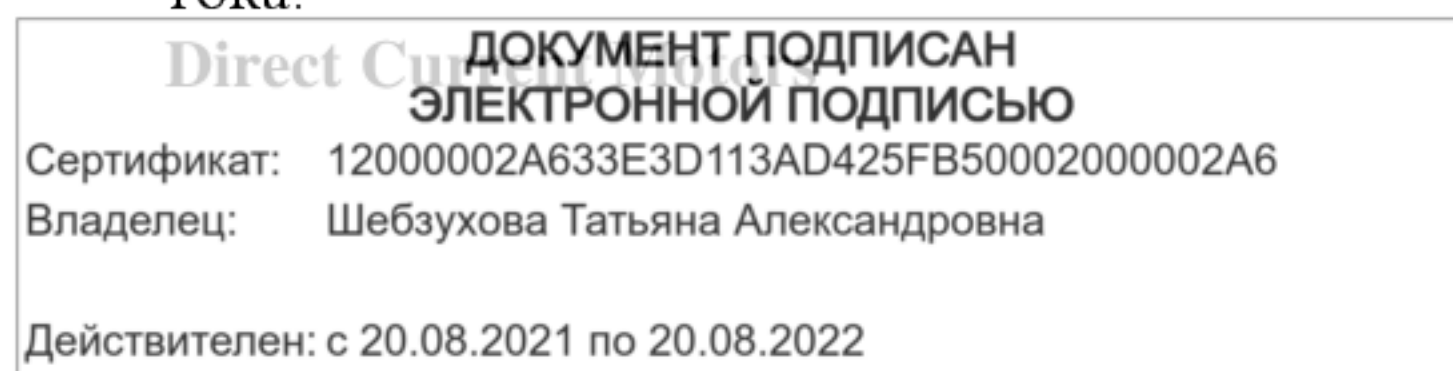
7. Скажите, какая разница между номинальным и пусковым током.

8. Расскажите о возможных сроках службы электрических двигателей.

9. Выпишите из текста термины, относящиеся к электротехнике.

10. Переведите и запомните следующие словосочетания: starting current, starting torque, armature current, starting rheostat, prime mover, rated value, line voltage, automatic control system, stationary part, rotating part, coil section; to operate at no-load, to result in fluctuation, to prevent fault, to be attached to, to be actuated by.

11. Прочтите и переведите текст; расскажите о сфере применения двигателей постоянного тока.



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 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

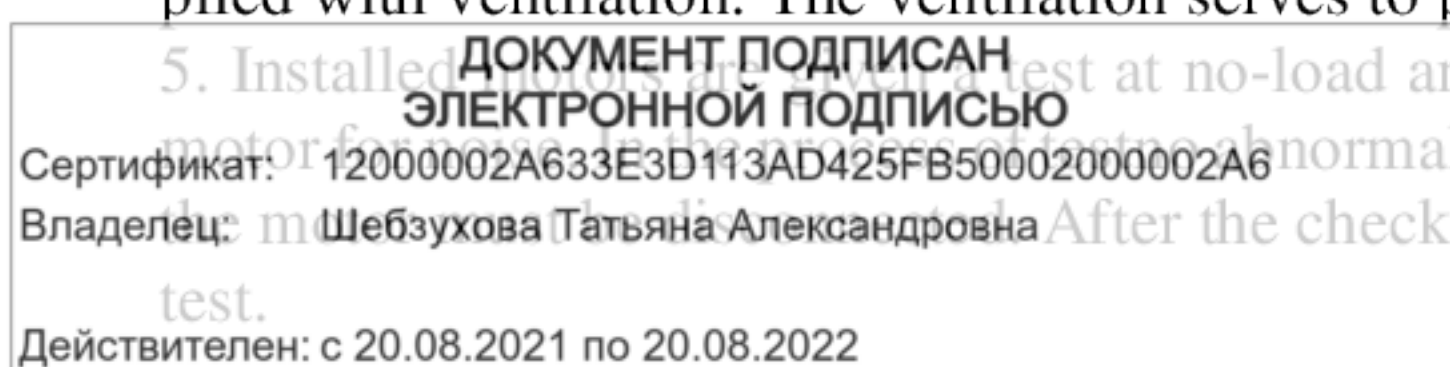
1. A. c. motors are subdivided into single- and three-phase motors. The single-phase motors are used in refrigerators, washing machines, floor polishes, etc.

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 at no-load and under a load. No-load test serves to check the noise should be heard. In case this noise appears, 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 «no»; скажите, какую информацию вы получили о методах 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 №9.

Тема 9. 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;

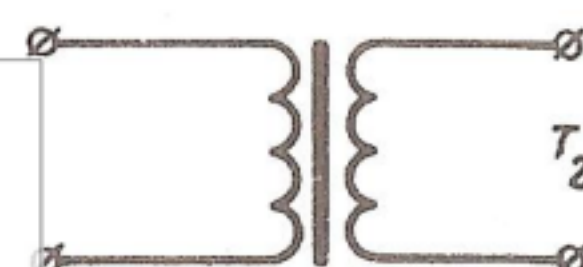
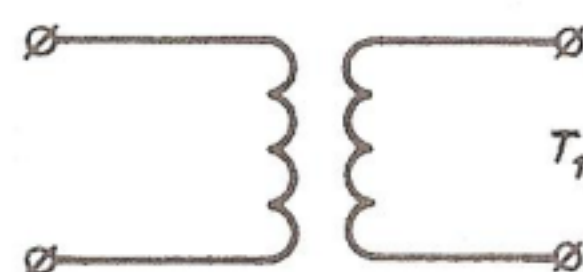
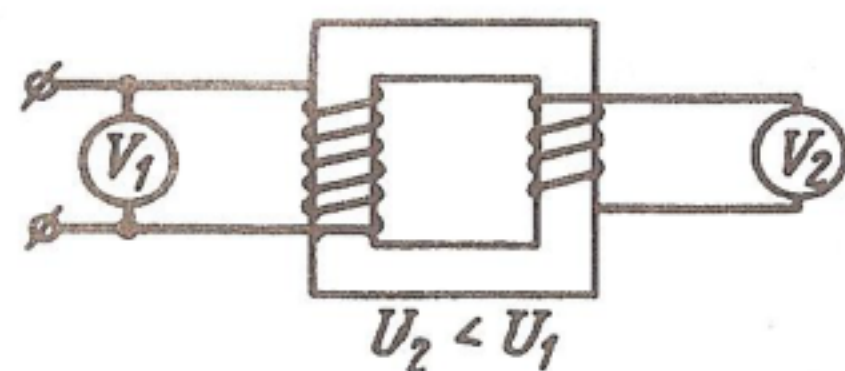
владеть: навыками профессионального общения на английском языке; способами пополнения профессиональных знаний из оригинальных источников на английском языке.

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.



ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ
Сертификат: 12000002A633E3D113AD425FB50002000002A6
Владелец: Шебзухова Татьяна Александровна
Действителен: с 20.08.2021 по 20.08.2022

Fig. 10

Fig. 11

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	_____
		step-up transformer	_____
		step-down transformer	_____

input voltage

output voltage

3. Complete the sentences using the correct variant:

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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*.

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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...