КАЗАНСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ
ИНСТИТУТ МЕЖДУНАРОДНЫХ ОТНОШЕНИЙ, ИСТОРИИ И ВОСТОКОВЕДЕНИЯ
Кафедра английского языка в сфере высоких технологий

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RADIOPHYSICS AND ELECTRONICS

Учебное пособие по английскому языку
для студентов Института Физики,
обучающихся по специальности «Радиофизика – 03.03.03»

Казань – 2016

УДК
ББК

Принято на заседании кафедры английского языка в сфере высоких технологий
Протокол № 4 от 10 декабря 2015 года

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Radiophysics and Electronics / Т.В. Маршева, С.М. Переточкина, А.В.Фахрутдинова – Казань: Казан. ун-т, 2016. – 109 с.

Данное пособие предназначено для студентов, обучающихся по специальности «Радиофизика» и содержит материалы, дополняющие основной курс английского языка.

Пособие может быть использовано как для аудиторной работы, так и для самостоятельной работы студентов.

Предисловие

Настоящее учебное пособие предназначено для занятий со студентами 2 курса Института Физики Казанского (Приволжского) федерального университета по специальности, обучающихся по направлению 03.03.03 «Радиофизика». Основной целью данного пособия является повышение уровня владения иностранным языком, достигнутого на предыдущей ступени образования, и овладение бакалаврами необходимым уровнем коммуникативной компетенции в области профессиональной и научной деятельности, при общении с зарубежными партнерами, а также для дальнейшего самообразования.

Наряду с практической целью данный курс ставит образовательные и воспитательные цели: повышение уровня общей культуры и образования студентов, культуры мышления, общения и речи.

Задачами курса являются подготовка студентов-бакалавров к использованию английского языка как средства профессиональной деятельности.

В задачу данного пособия входит формирование навыков и умений самостоятельно работать с документами и специальной литературой на английском языке с целью получения профессиональной информации, поддержания профессиональных контактов и ведения исследовательской работы.

Учебное пособие разработано с учетом требований государственного стандарта высшего профессионального образования.

При отборе текстового материала в качестве основного критерия служила информативная ценность текстов и их соответствие специальности студентов. Большинство текстов пособия взято из оригинальной английской и американской литературы. В отдельных случаях тексты подвергались адаптации и сокращению.

Настоящее пособие состоит из 4 частей: Introduction, Unit 1 Electronics: Basics, Unit 2 Development of Electronics, Unit 3 Electronic Devices. Каждый раздел включает в себя 4 или 5 базовых текстов (кроме Introduction).

Подготовка к чтению базового текста начинается с введения и закрепления лексики (Vocabulary). Задания к тексту направлены на то, чтобы добиться полного и точного понимания текста. Контроль понимания осуществляется через вопросно-ответные упражнения. Упражнения, которые следуют после текста способствуют усвоению и запоминанию специальных терминов и таких научных областей как радиофизика и электроника. Кроме основных текстов в пособие включены различные по сложности дополнительные тексты и разработаны задания к ним, такой подход к организации материала позволяет вести дифференцированную подготовку студентов в зависимости от уровня подготовки на начальном этапе обучения профессиональной терминологии. Предложенные в учебном пособии письменные задания, направленные на отработку навыков перевода, позволяют совершенствовать навыки письменной профессиональной коммуникации.

Приложение включает в себя рекомендации по составлению аннотаций как на русском так и на английском языках, словарь сокращений и условных обозначений, глоссарий и другую необходимую информацию.

Contents

INTRODUCTION

PHYSICS: A FUNDAMENTAL SCIENCE

1. Practice reading the following words

physics	['fɪzɪks]	vacuum	['vækjuːm]
ancient	['eɪnʃənt]	molecule	['mɔlɪkjuːl]
natural	['næʧərəl]	hydrogen	['haɪdrəʤən]
phenomena	[fɪ'nɔmɪnə]	helium	['hiːlɪəm]
philosophy	[fɪ'lɔsəfɪ]	astronomer	[ə'strɔnəmə]
discipline	['dɪsəplɪn]	diameter	[daɪ'æmɪtə]
technique	[tek'niːk]	atmosphere	['ætməsfɪə]
macroscopic	[ˌmækrə'skɔpɪk]		

2. Read the following words and try to remember them

VOCABULARY

refer to	[rɪ'fɜː]	ссылаться
matter	['mætə]	вещество
interaction	[ˌɪntər'ækʃ(ə)n]	взаимодействие
embody	[ɪm'bɔdɪ]	включать (в себя)
curved	['kɜːvd]	изогнутый, кривой
large-scale	[ˌlɑːʤ'skeɪl]	большой, крупный
physicist	['fɪzɪsɪst]	физик
scientist	['saɪəntɪst]	ученый
distinctive	[dɪ'stɪŋktɪv]	отличительный
develop	[dɪ'veləp]	развивать
predict	[prɪ'dɪkt]	предсказывать, прогнозировать
observe	[əb'zɜːv]	наблюдать, следить
inquiry	[ɪn'kwaɪərɪ]	исследование, изучение
velocity	[vɪ’lɔsətɪ]	скорость, быстрота
projectile	[prə'ʤektaɪl]	брошенное тело

exist	[ɪg'zɪst]	существовать
core	[kɔː]	ядро
fuse	[fjuːz]	плавить, вплавлять, соединять
reflect on	[rɪ'flekt]	раздумывать, размышлять над (чем-л.)
assumption	[ə'sʌmpʃən]	предположение, допущение

3. Read the text about physics and answer the following questions

1. What is physics?
2. How was physics sometimes called in ancient times?
3. What have careful observations of some phenomena led the scientists to?
4. The models that scientists develop have predictive power. What does it mean?
5. What is the best way to understand the physical world?

UNDERSTANDING PHYSICS

So what is physics? In ancient times, the term *physics* referred to the study of the natural world and phenomena that took place in it. The study was sometimes called *natural philosophy*. A more modern definition of *physics* is that it is the study of matter and energy and the interactions between them, and the discipline of physics embodies a set of techniques to observe, model, and understand the natural world at its most basic level.

Over the millennia, scientists have found that objects seem to follow certain rules. A thrown ball follows a curved path through the atmosphere and back to the ground. An apple falling from a tree takes a certain amount of time to hit the earth. Careful observations of these *macroscopic*, or large-scale, phenomena have led physicists to formulate general rules about how things move and why they move in the way that they do. One of the distinctive aspects of any scientific discipline is that the models that scientists develop have predictive power; that is, any model that explains how things work should predict accurately how they will work the next time that the experiment is run, and should also be able to predict phenomena not yet observed. Thus, a physical model that explains where a thrown ball will fall should be able to predict where the ball will fall the next time it is thrown, perhaps at a slightly different velocity, or where a projectile other than a ball will fall.

It is important to keep in mind that physics, like any discipline, does not exist in a vacuum. It exists in relationship with all the other areas of human inquiry and understanding, and it is no better or worse than any of them. Certainly, a historian and a physicist look at the world in very different ways.

But even scientists in different disciplines look at the world in very different ways. A chemist might look at the Sun and be fascinated by the collections of atoms called *molecules* that are able to exist in the outer layers of the Sun's atmosphere. A physicist might look at the same Sun and marvel at the fact that the Sun's core is fusing 600 million metric tons of hydrogen into helium every second. An astronomer might reflect on the fact that the Sun has a diameter 109 times greater than that of Earth. In the case of a group of scientists, they all begin with the assumption that the best way to understand the physical world is to observe it, to model its behavior, to test the success or failure of these models.

4. Translate the following word combinations into Russian

1. the study of the natural world
2. phenomena
3. the study of matter and energy
4. to develop models
5. in an outer layers of atmosphere
6. to model the behavior

5. Find the English equivalents to the following word combinations in the text

1. множество методов
2. следовать определенным правилам

3. криволинейная траектория

4. прогнозирующая способность

5. точно прогнозировать

6. смотреть на мир по-разному

5. ***Match the following terms with definitions and translate them into Russian***

1. Physics	a. anything that takes up space.
2. Molecule	b. system of measurement in which all fundamental units are multiples of 10
3. Matter	c. study of matter, energy, and the laws governing their interactions.
4. Metric system	d. speed measured in particular direction.
5. Velocity	e. stable combination of two or more atoms.

6. ***Suffixes are used to form different parts of speech. Use your dictionary to find the other parts of speech***

physics – physical …

science, definition, observation, formulation

7. ***What are the singular forms of the following words?***

Phenomena, data, formulae

8. ***Match the words opposite in meaning***

ancient	failure
accurate	inner
success	similar
outer	inaccurate
certain	particular
curved	questionable (doubtful)

general	straight
different	modern

9. Practice reading the following words

chemistry	['kemıstrı]	hybrid	['haıbrıd]
biology	[baı'ɔləʤı]	engineering	[ˌenʤı'nıərıŋ]
biophysics	['baıəu'fızıks]		

10. Fill in the gaps with the following words*: biophysics, chemistry, biology, physics, engineering, organic chemistry*

PHYSICS IN RELATION TO THE OTHER SCIENCES

I. … (1) explains the interaction between matter and energy in the macroscopic world (objects the size of us, approximately) as well as the atomic and subatomic world. … (2) builds on many of the theories of physics to explain the interactions among the atoms that form compounds and molecules, and it is fundamentally concerned with the properties of matter. There is significant overlap between the disciplines of physics and chemistry in our study of the structure of the atom. As one's studies of the atom move more into the structure and properties of matter, the details of interactions between compounds, and the formation of molecules and reaction rates, then one is leaving physics and moving squarely into the discipline of chemistry.

II. Certain chemical compounds (those containing carbon) are called *organic compounds.* The study of organic compounds is referred to as … (3), and the gray area between chemistry and biology (sometimes referred to as *biochemistry*) involves the study of those particular molecules related to life processes. Once the scales of study are such that one is studying the smallest living things, then the discipline is generally considered to be … (4). Biologists study all living things, and there are now overlaps between the disciplines of physics and biology that go beyond the molecular scale. In fact, one of the fastest growing disciplines in departments of physics is the field of … (5), or the application of physics to biological phenomena. This hybrid field spans scales from the very small (the various microstructures that cells are able to make out of proteins) to the very large (the physics of flight in birds and insects, for example).

III. Another science related to physics is … (6), the general application of scientific principles to practical ends. The connection of physics to engineering is probably more obvious. Engineers build structures, among other activities, and these structures need to be able to withstand their own internal forces as well as those occasional forces that they may be subject to (e.g., earthquakes or wind shear). A thorough understanding of forces is essential to engineers, who then add specialized understanding of the properties of materials to design objects and structures that can survive in the physical world. For these reasons, and many others, a fundamental understanding of physics is useful to scientists in many disciplines, and a basic physics course is generally required of future chemists, biologists, and engineers.

14. Translate the text in writing according to variants

15. What discoveries marked the start of new era in physics? Write what you know about them. (100-150 words)

UNIT 1. ELECTRONICS: BASICS

Text 1

ELECTRIC CHARGE. THE ELECTRIC FIELD

1. Practice reading the following words

current	[ˈkʌrənt]	gravitational	[ˌɡrævɪˈteɪʃən]
electromagnetic	[ɪˌlektrəʊmægˈnetɪk]	magnitude	[ˈmæɡnɪtjuːd]
phenomena	[fəˈnɔmɪnə]	measure	[ˈmeʒə]
surround	[səˈraʊnd]	oppositely	[ˈɔpəzɪtlɪ]
equipment	[ɪˈkwɪpmənt]	coulomb	[ˈkuːlɔm]
characteristic	[ˌkærəktə'rɪstɪk]	electrified	[ɪˈlektrɪfaɪd]
apparently	[ə'pærəntlɪ]	consideration	[kənˌsɪdəˈreɪʃn]

2. Read and think about the meaning of the following international words

Static; electricity; electric; phenomena; coulomb; electrical force; conductor; insulator; grounding; electrified; gravitation; transferred.

3. Read the following words and try to remember them

VOCABULARY

current	[ˈkʌrənt]	ток
charge	[tʃɑːrdʒ]	заряд
straw	[strɔː]	солома
device	[dɪˈvaɪs]	устройство
store	[stɔː]	хранилище
natural	[ˈnætʃrəl]	натуральный
force	[fɔːs]	сила
emanate	[ˈeməneɪt]	исходить
terminate	[ˈtə:mɪneɪt]	завершать
strength	[streŋθ]	прочность
originate	[əˈrɪdʒɪneɪt]	происходить

plate	[pleɪt]	пластина
direction	[dəˈrekʃn]	направление
magnitude	[ˈmægnɪtjuːd]	величина, значение
attract	[əˈtrækt]	притягивать
harness	[ˈhɑːnəs]	использовать
amber	[ˈæmbə]	янтарь

4. Read and answer the questions

1) How did people discover electricity?

2) What materials did Greek scientists use in the first electrostatics experiments?

3) What does electrostatics study?

4) In what way is electric force similar to gravity?

5) What is the nature of electric field?

6) What are the units of measurement of electric field?

7) Where are field lines directed in electric field?

ELECTRIC CHARGE

Key words: static electricity, electric charge, electric current, amber, coulomb, electrical force, electric field, field lines

Electric charge, electric currents, batteries, and electromagnetic signals are so much a part of our daily lives that we barely notice them anymore. Most of the time, we are surrounded by electrical phenomena in both the natural world and the human-made world. We learned about the presence of electricity in the world through experimentation and observation, and we have learned how to harness, control, and store electrical power for our everyday use, as in the tiny batteries that power our watches and electronic equipment.

Long ago, Greek scientists discovered that a material called amber when rubbed with a cloth would attract small pieces of straw. In later centuries other materials were found to have this same characteristic. There was some property of the cloth that apparently was transferred to the amber when the two were rubbed together, and that property enabled the amber (for a brief time) to attract small pieces of straw. The amber had been *electrified*.

Electrostatics studies the nature of charge that is not moving, and set the stage for a consideration of moving charge that is needed to understand the electrical circuits in all the electronic devices that we use every day.

THE ELECTRIC FIELD

The electrical force, like gravity, can act between objects that are not physically in contact. In fact, any two charged particles will exert forces on each other; but even a lone charged particle is surrounded by what we call an *electric field* that is a direct result of its net charge.

The electric field (like the gravitational field of an object with mass) has both a magnitude and a direction; that is, it is a vector quantity.

The electric field is measured in units of force per unit charge, so that a charge q that experiences a coulomb force F is in an electric field of strength

$E = F/q$

where F is the coulomb force and q is the charge of the particle.

Because the electric field represents a vector quantity, we can draw *field lines* that represent: the motion that a positively charged particle would take if it were nearby. For this reason, positively charged particles have field lines emanating from them, and negatively charged particles have field lines that point toward them.

Electric field lines are always drawn as though they originate at positive charges terminate at negative charges. Figure 1 shows examples of field lines around a positive charge, a positive and a negative charge, and two oppositely charged plates.

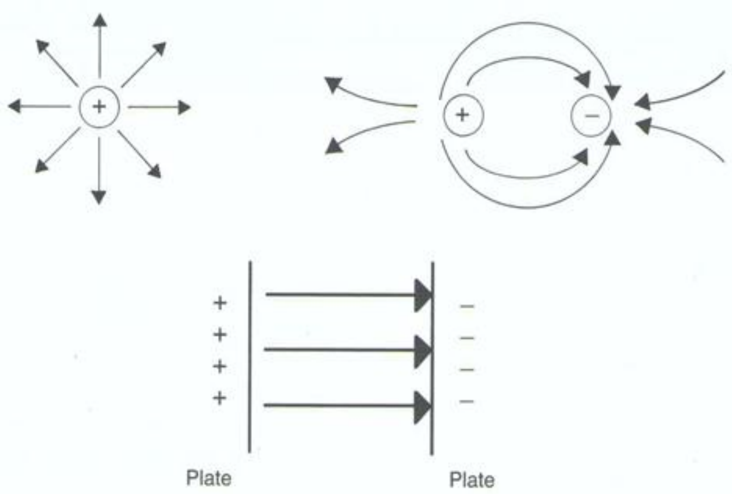

Figure 1

5. Match the words similar in meaning

1. vector	a. use
2. always	b. substance
3. harness	c. every time
4. emanate	d. direction
5. material	e. radiate
6. property	f. evidently
7. apparently	g. pass
8. transfer	h. feature

6. Match the words opposite in meaning

1. line	a. staying
2. moving	b. start
3. attract	c. dot
4. terminate	d. accept
5. transfer	e. repel
6. natural	f. long
7. presence	g. artificial
8. brief	h. absence

7. Find the English equivalents to the following word combinations in the text

1. электрическое поле
2. представлять собой векторную величину
3. прямой результат
4. электронные устройства
5. часть нашей повседневной жизни
6. кулоновская сила
7. природа неподвижного заряда
8. может действовать между объектами
9. наличие электричества
10. объект с массой
11. происходит в положительных зарядах
12. положительно заряженная частица
13. противоположно заряженные пластины

8. Reorder the words to make a sentence

1. forces, will, any, In fact, exert, two, other, charged, particles, on, each.
2. the, quantity, electric, represents, Because, a vector, field.
3. a direction, The, field, electric, has, a magnitude, both, and .
4. watches, The, batteries, tiny, power, our, electronic, and, that, equipment.
5. been, The, electrified, had, amber.

11.Match the following terms with definitions and translate them into Russian

1. gravity	a. directed segment, that is the segment that has shown the beginning (also called point of application) and an end
2. vector	b. the large size or importance of something
3. magnitude	c. the force that attracts objects towards one another,

	especially the force that makes things fall to the ground
4. property	d. an object that provides electricity for things such as radios, toys, or cars
5. battery	e. a quality of something

10. Use the key words of the text to make up the outline of the text

11. Give the summary of the text

12. Retell the text

Text 2

ELECTROMOTIVE FORCE AND ELECTRIC CURRENT

1. Practice reading the following words

potential	[pə'tenʃ(ə)l]	naturally	['næʧərəlɪ]
energy	['enəʤɪ]	dynamics	[daɪ'næmɪks]
gravity	['grævɪtɪ]	ampere	['æmpeə]
conductor	[kən'dʌktə]	artificial	[ˌɑːtɪ'fɪʃ(ə)l]
electromotive	[ɪˌlektrə(u)'məutɪv]	variety	[və'raɪətɪ]
alternating	['ɔːltəneɪtɪŋ]	circuit	['sɜːkɪt]
cycle	['saɪkl]		

2. Read the following words and try to remember them

VOCABULARY

suspend	[sə'spend]	вешать, подвешивать
attach	[ə'tæʧ]	прикреплять
exert	[ɪg'zɜːt]	прилагать усилия
charge	[ʧɑːʤ]	заряд
potential difference	[pə'tenʃəl 'dɪfərəns]	разность потенциалов; электрическое напряжение
maintain	[meɪn'teɪn]	поддерживать, сохранять
internal	[ɪn'tɜːn(ə)l]	внутренний
rub	[rʌb]	тереть, натирать
transfer	[træns'fɜː]	переносить, перемещать
cease	[siːs]	переставать, прекращать
provide	[prə'vaɪd]	снабжать; давать
electromotive force	[ɪˌlektrəu'məutɪv 'fɔːs]	электродвижущая сила
measure	['meʒə]	измерять
power	['pauə]	питать (электро) энергией
outlet	['autlet]	штепсельная розетка

terminal	['tɜːmɪnəl]	клемма; ввод/вывод
rate	[reɪt]	рассчитывать; подсчитывать
sustain	[sə'steɪn]	поддерживать; обеспечивать;
swing	[swɪŋ]	размах, амплитуда колебания
lightning	[ˈlaɪtnɪŋ]	молния
equalize	[ˈiːkwəlaɪz]	уравнивать
circuit	['sɜːkɪt]	цепь, контур; схема
direct current (DC)	[dɪˈrekt ˈkʌrənt]	постоянный ток
alternating current (AC)	[ˈɔːltəneɪtɪŋ ˈkʌrənt]	переменный ток
imply	[ɪmˈplaɪ]	означать

3. What do the letters "emf" stand for? Is there similar abbreviation in the Russian language? Skim the text and find the answer to the question

ELECTROMOTIVE FORCE AND ELECTRIC CURRENT

Picture an old-fashioned shower: a bucket of water suspended over your head, perhaps from the branch of a tree, with a rope attached that you pull to release the water in a stream. The water flows downward in this case because of the force of gravity.

The water above your head has a type of potential energy that called *gravitational* potential energy. The water got that potential energy through the work exerted in pulling the bucket up into the branch above your head.

We can think of *electrical potential energy* in the same way. Static charge is charge that does not flow; however, if charge is able to flow (because of the presence of a conductor), it will flow from higher to lower potential, in the same way that water flows downhill.

In the production of lightning, for example, an *electric current,* or flow of electrons, results when the potential difference between the cloud and the ground gets sufficiently large.

Once potential difference is equalized, because of the flow of electrons, the current will stop flowing. To keep a current flowing there must be a way to artificially (or naturally) maintain a potential difference between two points. In the case of lightning, the potential difference is maintained by the internal dynamics of certain types of clouds. Rubbing a glass rod with silk transfers electrons from the rod to the silk, which creates a potential difference between these two materials. Touching the rod to another material will cause a current of electrons to flow from the object into the glass rod (since it has a deficit of electrons). Once the rod has been discharged, though, current will cease to flow. We measure current as a flow rate, in units of charge per unit time. An *ampere* (commonly called an *amp,* and abbreviated A) is a flow rate of 1 C/s. If a current of 100 A is flowing (and this is a large current by the way!), that means that 100 C are passing a given point in a conductor every second.

The electric currents that surround us in our daily lives are maintained through artificial means and are able to provide a more steady flow of electrons, a more steady current. We say that any device that maintains a potential difference provides an *electromotive force (emf).* Electromotive force is measured in volts, just like potential difference. The batteries that power all the personal electronics that we use, and the electrical generators that provide the current available at the outlets in our homes, provide the potential difference that allows charge to flow.

There are two basic types of current, direct current (DC) and alternating current (AC). *Direct current* refers to electron flow in a single direction with time. Batteries of all varieties provide direct currents. Batteries have a positive and a negative terminal, and are rated in the voltage (potential difference) that they can sustain. Car batteries, for example, are typically 12 V DC. Batteries that power your CD player may be 1.5 V DC, and you may need two of them to provide the power that your CD player requires.

The electrons that flow in *alternating currents* do not push electrons in a single direction but, rather, move back and forth, in a motion similar to the motion of a swing (simple harmonic motion). Because the electrons are constantly changing direction, this implies that the voltage of the emf changes as well. The rate of change of the direction of the current (and voltage) in an AC circuit is measured in cycles per second (1/s) or hertz (Hz). In the United States, the current varies at a rate of 60 cycles per second, or 60 Hz, and maintains a voltage of 110 to 120 V.

***4.* Answer the following questions**

1. What makes the water flow downward in an old-fashioned shower?
2. What type of energy does the water have in this case?
3. Why does the author describe the shower?
4. In what case will the current stop flowing?
5. What must be done to keep a current flowing?
6. Describe the experiment with a glass rod and silk. Why is it described in the text?
7. What is ampere?
8. What provides an electromotive force?
9. What is emf measured in?
10. What does direct current refer to?
11. What current is produced in batteries?
12. How do electrons that flow in alternating current move?
13. What is measured in cycles per second?

5. Translate the following word combinations into Russian

1. force of gravity
2. static charge
3. flow of electrons
4. to maintain a potential difference
5. steady flow of electrons

6. to provide the power

7.to push electrons in a single direction

8. to vary at a rate

6. Find the English equivalents to the following word combinations in the text

1. потенциальная энергия
2. создавать разность электрических потенциалов
3. ток перестанет течь
4. скорость потока
5. единица заряда
6. постоянный поток электронов
7. постоянный ток
8. переменный ток
9. автомобильный аккумулятор
10. двигаться возвратно-поступательно
11. движение маятника
12. гармоническое движение

7. Match the following words with definitions and translate them into Russian

1. gravitational potential energy	a. Smallest indivisible particle with negative charge.
2. charge	b. Difference in electric charge between two objects; a charge will tend to move from the area of higher potential to the area of lower potential.
3. electron	c. Energy associated with position in a gravitational field, or the amount of work an object can perform by returning to its original position.

4. gravity	d. Property of matter that is a measure of its excess or deficit of electrons.
5. potential difference	e. Attractive force between objects with mass; the curvature of space-time induced by the presence of mass.
6. ampere (amp)	f. Charge that does not flow.
7. volt	g. Rate of flow equal to one coulomb of electric charge per second.
8. static charge	h. Measure of potential difference.

8. What do the letters in the following abbreviations stand for?

AC, DC, emf, GPE.

9. Retell the text

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

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

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

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

Text 3

RESISTANCE AND OHM’S LAW

1. Practice reading the following words

tendency	['tendənsɪ]	atomic	[ə'tɔmɪk]
abbreviate	[ə'briːvɪeɪt]	superconductor	['s(j)uːpəkənˌdʌktə]
omega	['əumɪgə]	electricity	[ˌelek'trɪsətɪ]
diagram	['daɪəgræm]	ampere	['æmpeə]

2. Read the following words and remember them

VOCABULARY

resist	[rɪ'zɪst]	оказывать сопротивление
conductor	[kən'dʌktə]	проводник
insulator	['ɪnsjəleɪtə]	диэлектрик
lattice structure	['lætɪs 'strʌkʧə]	решетчатая структура
pathway	['pɑːθweɪ]	путь
involve	[ɪn'vɔlv]	включать в себя
superconductor	[ˈsuːpəkəndʌktə]	сверхпроводник
random	['rændəm]	хаотичный; беспорядочный
sufficiently	[sə'fɪʃəntlɪ]	достаточно
credit	[ˈkredɪt]	приписывать

3. Read the text and find the answers to the following questions

1. What is called resistance?
2. What does the resistance of a material depend on?
3. What materials are called superconductors?
4. What is an electrical circuit?
5. What relationship among current, voltage, resistance in a circuit did Ohm discover?

6. What is the unit of resistance the equivalent of?
7. What doubles the current?

RESISTANCE AND OHM'S LAW

Almost all materials resist the flow of current to some degree. Electrons move more easily through some materials than they do through others. Conductors allow electrons to pass more easily than do insulators.

The tendency for certain materials to slow the passage of electrons is called its *resistance.* Resistance is measured in ohms [abbreviated with the Greek letter omega (Ω)] after the German physicist Georg Simon Ohm (1787-1854). The resistance of a material depends on its atomic structure (metals, for example, allow electrons to pass easily through their lattice structure) as well as its temperature. Raising the temperature of materials produces more random motion in their electrons, and this random motion keeps current from flowing easily. Conversely, lowering the temperature of materials can reduce their resistance, allowing current to flow more easily. There are even materials, called *superconductors,* that at sufficiently low temperatures have almost no resistance to the flow of electricity.

An *electrical circuit* is any pathway that allows electrons to flow. Simple circuits can involve very few elements. A flashlight is a simple circuit, involving only an emf (the battery) a resistor (the bulb). Figure 1 shows a diagram of this simple electrical circuit.

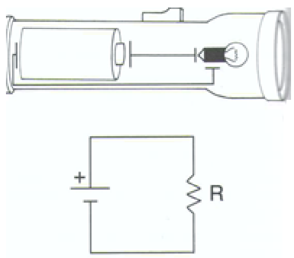

Figure 1. A Flashlight and its Equivalent Circuit

Georg Ohm is also credited with discovering the relationship among current, voltage, resistance in a circuit. He found by experiment that the current in a circuit is directly proportional to the applied voltage (the emf), and is inversely proportional to the resistance. We can write this relationship, called *Ohm's law*, as

$$I = V/R$$

where I is the current (in amperes), V is the voltage (in volts), and R is the resistance (in ohms). Therefore, the unit for resistance, the ohm, is the equivalent of volts per ampere, or $1\ \Omega = 1\ V/A$.

Thus, doubling the voltage of a circuit (while keeping resistance the same) doubles the current. Halving the resistance of a circuit (while keeping voltage the same), also doubles the current.

4. Translate the following word combinations into Russian

1. to produce more random motion
2. directly proportional to the applied voltage
3. inversely proportional to the resistance
4. to double the voltage of a circuit

5. Find English equivalents to the following word combinations in the text

1. в какой-то степени,
2. замедлять движение электронов
3. повышение температуры
4. снижение температуры
5. при достаточно низкой температуре
6. мешать току течь свободно
7. вменять что-л. в заслугу кому-л. (являться заслугой)
8. уменьшение сопротивления в цепи в два раза

6. ***Match the following words with definitions. Translate the definitions into Russian***

1. resistance	a. Smallest indivisible particle with negative charge.
2. electron	b. A potential difference that causes electric charges to flow.
3. electromotive force (emf)	c. Capacity of an object or material to impede motion; also, the capacity of a material to impede the motion of charge.
4. superconductor	d. Rate of flow equal to one coulomb of electric charge per second.
5. electric circuit	e. Material that allows electric charge to pass freely, with little resistance.
6. conductor	f. Substance that at low temperature has almost no resistance to the passage of current.
7. ampere	g. Complete path of an electric current, including a source of potential difference and usually including various components (e.g., resistors, diodes).

7. ***Suffixes are used to form different parts of speech. Use your dictionary to find the other parts of speech. Translate the words into Russian***

To resist – resistance …

to conduct, to insulate, to discover.

8. ***Write down the key words and give the summary of the text***

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

RHEOSTAT

A rheostat is a resistor whose resistance value may be varied. Thus, a rheostat is a variable resistor. It is used to change the resistance of circuits, and in this way to vary the value of current. A rheostat consists of a coil and a switch.

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

1. What type of resistor is a rheostat?
2. What is a rheostat used for?
3. How does a rheostat vary the value of current?
4. What elements does a rheostat consist of?
5. In what way are the terminals connected with the load?
6. What is the function of the switch?

Text 4

SERIES AND PARALLEL CIRCUITS

1. Practice reading the following words

charge	[ʧɑːʤ]	inversely	[ˈɪnˈvɜːslɪ]
element	['elɪmənt]	electrical	[ɪˈlektrɪkəl]
calculate	[ˈkælkjʊleɪt]	circuit	[sɜ:kit]
general	[ˈʤenərəl]		

2. Read the following words and try to remember them

VOCABULARY

supply	[səˈplaɪ]	подавать, питать
way	**[**wei]	способ
series	[siəri:z]	последовательное соединение
bulb	[bʌlb]	лампа
source	[sɔ:s]	источник
decrease	[ˈdiːkriːs]	снижение, уменьшение
connect	[kəˈnekt]	соединять
resistance	[ri’zistens]	сопротивление
value	[vælju:]	значение
resistor	[rɪ'zɪstə]	резистор
parallel	[pærəlel]	параллельное соединение
voltage	['vəultɪʤ]	напряжение
drop	[drɔ:d]	падение
path	[pa: θ]	путь
conductor	[kənˈdʌktə]	проводник
restrictive	[rɪ'strɪktɪv]	ограничительный

3. What is the difference between series and parallel circuits? Read the text and answer the following questions

1. What elements does a circuit consist of?
2. What is the function of a voltage source (a conductor, a resistor)?
3. What type of circuit is used in order to have the same value of voltage in all the elements?
4. How do we sometimes call the voltage decrease?
5. Why should the voltage drop across the parallel resistors be the same?
6. What is happening with the current when resistors are in parallel?

SERIES AND PARALLEL CIRCUITS

The circuit consists of a voltage source, a resister, and a conductor. A voltage source supplies current. A resistor reduces current. A conductor connects the elements of the circuit.

Elements in a circuit can be connected in two different ways, or in a combination of ways. When elements are added in such a way that charge must flow through one element before flowing through another, we say that they are connected in *series*. For example, if two bulbs are connected to a battery as illustrated in Figure1, they are connected in series. When resistors (such as lightbulbs) are placed in a circuit in this way, the total resistance is equal to the sum of the individual resistances, and the current flowing through each resistor in series is the same.

In Figure 1 for example, if each bulb has a resistance of 500 Ω, then the total resistance of the circuit is 500 Ω + 500 Ω = 1000 Ω, or 1 kΩ . If the bulbs are connected to a 2-V battery as shown, then we can also calculate the total current to be $I = V/R$, or $I = 2\ V/1000\ \Omega = 0.002$ A, or 2 mA.

The voltage decrease (sometimes called a voltage "drop") across any resistor in series can be determined using Ohm's law, and in general, the voltage drop is proportional to the resistance.

Thus, in the example circuit in Figure 1, there is a current of 2 mA flowing through each resistor. The voltage drop across each resistor, then, is determined from

$V = IR$

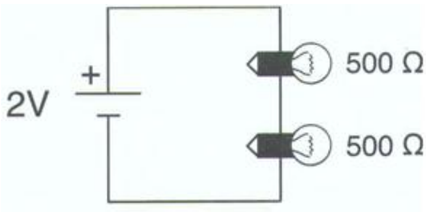

Figure 1

or $V = 0.002\ \text{A} \times 500\ \Omega = 1\ \text{V}$

Because in this example all the resistors have the same value of resistance, each has the same voltage drop across it.

When resistors are added to a circuit in such a way that current can flow through one or the other resistor, we say that the resistors are in *parallel.* Any devices that are connected to the same two points in a circuit are connected in parallel. The resistances of resistors in parallel add together in a different way from that of in series. The resistances of two resistors in parallel add such that

$1/R_{tot} = 1/R_1 + 1/R_2$

Thus, if the same two bulbs in Figure 1 were placed in parallel, the circuit would look as drawn in Figure 2. If the resistance of each resistor is 500 Ω, then the total resistance is

$1/R_{tot} = 1/500\ \Omega + 1/500\ \Omega$

or

$1/R_{tot} = 2/500\ \Omega$

so that

$R_{tot} = 250\ \Omega$

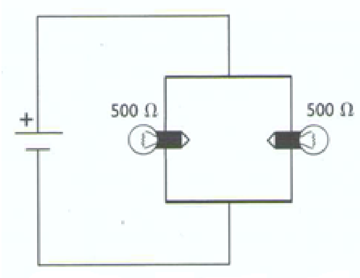

Figure 2

When resistors are in parallel, the voltage drop across them must be the same (because they are connected to the same two points in the circuit), but the current flowing through each resistor is now inversely proportional to the resistance of that resistor, according to Ohm's law. Imagine the higher-resistance element in the circuit to be like a restrictive pipe that will not let water pass easily. As a result, the water (current) takes the path of least resistance. Electrical current also takes the path of least resistance.

4. Translate the following word combinations into Russian

1. connected in series
2. total resistance
3. total current
4.voltage drop
5. the resistances of resistors
6. inversely proportional
7. electrical current
8. restrictive pipe

5. Find the English equivalents to the following word combinations

1. наименьшее сопротивление
2. при добавлении элементов
3. обратно пропорционально
4. заряд должен проходить

5. двумя разными способами

6. соединены последовательно

7. добавлены к схеме

8. соединены параллельно

9. общее сопротивление

10. согласно закону Ома

11. должны быть одинаковыми

12. элемент с высоким сопротивлением

6. Match the words opposite in meaning

1. drop	a. disable
2. easy	b. the most
3. the least	c. hard
4. different	d. rise
5. add	e. the same
6. connect	f. subtract
7. series	g. increase
8. decrease	h. directly
9. inversely	i. parallel

7. ***Fill in the gaps with the following words****: circuits, parallel circuit, breaks, switch, series circuit, battery, connection, parallel*

TYPES OF ELECTRIC CIRCUITS

There are different ways of categorizing electric … (1). One way is series versus parallel circuits. A … (2) is a circuit where the components are connected in one continuous loop. A … (3) is a circuit where the components are connected in separate branches. Most real life circuits are combinations of these two concepts, since each type has advantages. When something … (4) in a series circuit, the whole circuit stops working. This does not happen with … (5)

circuits. A series circuit can therefore be useful for safety features like fuses, but not so useful for Christmas lights. Series circuits are also cheaper to produce.

COMPONENTS OF ELECTRIC CIRCUITS

There are many different components you might find in an electric circuit, including batteries, switches, bulbs, resistors, and capacitors.

A … (6) is a device that stores energy in chemical form. When it is connected to a circuit, it releases that energy to provide power to other components that are connected.

A … (7) is something you can use to break a circuit at a particular point. Electrical devices will not work unless there is a complete loop between them and both sides of a power source (such as a battery). So if you cut the … (8) anywhere in the loop, the power stops. This is how light switches turn lights on and off unless there is a complete loop between them and both sides of a power source (such as a battery).

Adapted from http://study.com/academy

8. Insert prepositions and translate the sentences into Russian

1. Elements … a circuit can be connected in two different ways, or … a combination … ways.

2. … the bulbs are connected … a 2-V battery … shown, then we can also calculate the total current to be $I = V/R$, or $I = 2\ V/1000\ \Omega = 0.002$ A, or 2 mA.

3. The voltage decrease (sometimes called a voltage "drop") across any resistor … series can be determined using Ohm's law, and … general, the voltage drop is proportional … the resistance.

4. When resistors are added… a circuit … such a way that current can flow … one or the other resistor, we say that the resistors are … parallel.

5. The resistances … resistors … parallel add together … a different way … that of … series.

6. As a result, the water (current) takes the path … least resistance.

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

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

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

10. Divide the text into logical parts and give subtitles to each part

11. Give the summary of the text

12. Retell the text

Text 5

A CAPACITOR

1. Read the following international words

electronics	[ɪlekˈtrɔnɪks]	resistor	[rɪˈzɪstə]
ceramic	[sɪˈræmɪk]	electrostatic	[ɪlektrəʊˈstætɪk]
component	[kəmˈpəʊnənt]	generator	[ˈʤenəreɪtə]
electrode	[ɪˈlektrəʊd]	radio	[ˈreɪdɪəʊ]
dielectric	[daɪɪˈlektrɪk]	condenser	[kənˈdensə]
battery	[ˈbætərɪ]	electrolytic	[ɪlektrəˈlɪtɪk]
electron	[ɪˈlektrɔn]	plastic	[ˈplæstɪk]

2. Read the following words and try to remember them

VOCABULARY

capacitance	[kəˈpæsɪtəns]	емкость, емкостное сопротивление
insulating	[ˈɪnsjʊleɪtɪŋ]	изоляционный
associated	[əˈsəʊʃɪeɪtɪd]	связанные
excess	[ɪkˈses]	избыток
discharge	[dɪsˈʧɑːʤ]	электрический разряд
jar	[ʤɑː]	банка
leakage	[ˈliːkɪʤ]	утечка
demand	[dɪˈmɑːnd]	требование, спрос, нужда
capacitor	[kəˈpæsɪtər]	конденсатор
tantalum	[ˈtæntələm]	танталовый
sliver mica	[ˈslɪvəˈmaɪkə]	слюдяной
frequency	[ˈfriːkwənsɪ]	частота
equipment	[ɪˈkwɪpmənt]	оборудование
retain	[rɪˈteɪn]	сохранять

wire	[ˈwaɪə]	провод
wireless	[ˈwaɪəlɪs]	беспроводной
inductance	[ɪnˈdʌktəns]	индуктивность
select	[sɪˈlekt]	выбирать

3. Read the text and answer the questions

1. What is a capacitor used for?
2. What are the basic components of a capacitor?
3. What is the function of insulators?
4. What does the capacity of a capacitor depend on?
5. What is an ideal capacitor characterized by?
6. What inventions enabled further development of capacitors?
7. What event created a demand for standard capacitors?
8. What is another word for a "capacitor"?

A CAPACITOR

Capacitance is one of the most important effects used in electronics. Along with this the associated components - capacitors are widely used, the second most widely used component.

Capacitance is the ability to store electric charge. In its simplest form a capacitor consists of two parallel plates or electrodes that are separated from each other by an insulating dielectric. It is found that when a battery or any other voltage source is connected to the two plates as shown a current flows for a short time as it charges up. One plate of the capacitor receives an excess of electrons, while the other has too few. In this way the capacitor plate or electrode with the excess of electrons becomes negatively charged, while the other capacitor electrode becomes positively charged.

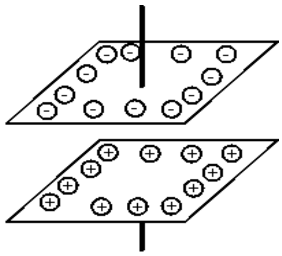

Figure 1

If the battery is removed the capacitor will retain its charge. However if a resistor is placed across the plates, a current will flow in the resistor until the capacitor becomes discharged.

In October 1745, Ewald Georg von Kleist of Pomerania in Germany found that charge could be stored by connecting a high voltage electrostatic generator by a wire to a volume of water in a glass jar. Von Kleist's hand and the water acted as conductors and the jar as a dielectric. The following year, the Dutch physicist Pieter van Musschenbroek invented a similar capacitor, which was named the Leyden jar, after the University of Leyden where he worked. Leyden jars were used until about 1900, when the invention of wireless (radio) created a demand for standard capacitors, and the steady move to higher frequencies required capacitors with lower inductance. Early capacitors were also known as condensers, a term that is still occasionally used today.

An ideal capacitor is characterized by constant value, capacitance, which is measured in farads. In practice, the dielectric between the plates passes a small amount of leakage current.

Electronic capacitors are one of the most widely used forms of electronics components. However, there are many different types of capacitors including electrolytic, ceramic, tantalum, plastic, sliver mica, and many more. Each capacitor or type has its own advantages and disadvantages and can be used in different applications. They are used in radio frequency’s equipment to select particular frequencies from a signal with many frequencies.

Typically, the different types of capacitor are named after the type of dielectric they contain. This gives a good indication of the general properties they will exhibit and for what circuit functions they can be used.

4. Match the words similar in meaning

1. capacitor	a. store
2. retain	b. connect
3. volume	c. get
4. associate	d. capacitance
5. receive	e. condenser
6. separated	f. require
7. excess	g. divided
8. demand	h. overage

5. Translate the following word combinations into Russian

1. the associated components
2. general properties
3. the charge storage capacity
4. higher frequencies
5. voltage electrostatic generator
6. volume of water in a glass jar
7. radio frequency's equipment
8. type of dielectric

6. Choose the correct variant

1. What is a capacitor used to?

a) To supply voltage.

b) To increase the voltage output.

c) To store energy.

2. What are the main parts of a capacitor?

a) Insulators only.

b) Metal plates only.

c) Metal plates and insulators between them.

3. What kind of charge can be on the capacitor plate?

a) Only positive.

b) Only negative.

c) Negative or positive.

4. What happens if you put a resistor in the place of the dielectric?

a) Current will flow in the resistor until the capacitor becomes discharged.

b) Current will flow in the resistor until the capacitor becomes charged.

c) Nothing will happen.

5. What is capacitance measured in?

a) Farads.

b) Coulomb.

c) Farad / meter.

6. What types of capacitors are usually used?

a) Paper capacitors.

b) Ceramic capacitors.

c) Electronic capacitors.

7. What happens if the battery is removed?

a) The capacitor is discharged.

b) Capacitors retain charge.

c) Nothing will happen.

8. How did Daniel Gralath increase the battery capacity?

a) He increased the volume of water in the jar.

b) He connected low-voltage electrostatic generator.

c) He combined several jars in parallel "battery".

9. Who invented the first capacitor?

a) Ewald Georg von Kleist of Pomerania.

b) The Dutch physicist Pieter van Musschenbroek.

c) Daniel Gralath.

7. Insert the necessary word in the gap

1) If the battery is … the capacitor will retain its charge.

2) Capacitance is the … to store electric charge.

3) Each capacitor or type has its own advantages and disadvantages can be used in different …

4) Leyden … were used until about 1900, when the invention of wireless (radio) created a demand for standard …, and the steady move to higher … required capacitors with lower inductance.

5) In this way the capacitor plate or electrode with the excess of electrons becomes … charged, while the other capacitor electrode becomes … charged.

8. Translate in writing three last paragraphs beginning with "An ideal capacitor …"

9. Give the summary of the text

UNIT 2. DEVELOPMENT OF ELECTRONICS

Text 1.

THE EVOLUTION OF ELECTRONIC TECHNOLOGY

1. Practice the pronunciation of the following words

transmission	[trænzˈmɪʃən]	consumption	[kənˈsʌmpʃən]
trajectory	[ˈtrædʒɪktərɪ]	reliable	[rɪˈlaɪəbl]
manipulation	[məˌnɪpjuˈleɪʃən]	manufacturing	[ˌmænjuˈfæktʃərɪŋ]
technology	[tekˈnɔlədʒɪ]	conductor	[kənˈdʌktə]

2. Read and think about the meaning of the following international words

Electronics; electron; physics; information; microelectronics; industrial; design; to calculate; trajectory; phenomena; nature; automatization; production; process; organism; vacuum tube; specialize; function; progress; radio; communication; technology; transistor; electrode; component; to realize; system; discrete; chip.

3. Read the following words and try to remember them

VOCABULARY

applied physics	[əˈplaɪd ˈfɪzɪks]	прикладная физика
generation	[ˌdʒenəˈreɪʃən]	создание, формирование, выработка
manipulation	[məˌnɪpjuˈleɪʃən]	управление; обработка; преобразование
reduced weight	[rɪˈdju:st weɪt]	уменьшенный вес
power consumption	[ˈpauəkənˈsʌmpʃən]	потребление электроэнергии
to carry out	[ˈkærɪ aut]	выполнять
to respond	[rɪsˈpɔnd]	отвечать; реагировать

integrated circuit (IC)	[ˈɪntɪɡreɪtɪdˈsə:kɪt]	интегральная схема
batch processing	[bætʃ prəusesɪŋ]	пакетная обработка
to assemble	[əˈsembl]	собирать; монтировать
to lower manufacturing	['ləuəˌmænjuˈfæktʃərɪŋ]	снизить производительность

4. Give the definition of the word 'electronics'. Can you imagine modern life without electronics? Read the text and answer the questions

1. Where are electronic devices used?
2. What was the beginning of electronics development?
3. What made the progress in radio communication technology possible?
4. What is the transistor?
5. When was the transistor invented?
6. What aim was realized with the invention of the transistor?
7. When were integrated circuits discovered?
8. What advantages did the transistors have over the vacuum tubes?

THE EVOLUTION OF ELECTRONIC TECHNOLOGY

Electronics is a field of engineering and applied physics dealing with the design and application of electronic circuits. The operation of circuits depends on the flow of electrons for generation, transmission, reception and storage of information.

Today it is difficult to imagine our life without electronics. It surrounds us everywhere. Electronic devices are widely used in scientific research and industrial designing, they control the work of plants and power stations, calculate the trajectories of spaceships and help the people discover new phenomena of nature. Automatization of production processes and studies on living organisms became possible due to electronics.

The invention of vacuum tubes at the beginning of the 20th century was the starting point of the rapid growth of modern electronics. Vacuum tubes assisted in manipulation of signals. The development of a large variety of tubes designed for specialized functions made possible the progress in radio communication technology before the World War II and in the creation of early computers during and shortly after the war.

The transistor invented by American scientists W.Shockly, J.Bardeen and W.Brattain in 1948 completely replaced the vacuum tube. The transistor, a small piece of a semiconductor with three electrodes, had great advantages over the best vacuum tubes. It provided the same functions as the vacuum tube but at reduced weight, cost, power consumption, and with high reliability. With the invention of the transistor all essential circuit functions could be carried out inside solid bodies. The aim of creating electronic circuits with entirely solid-state components had finally been realized. Early transistors could respond at a rate of a few million times a second. This was fast enough to serve in radio circuits, but far below the speed needed for high-speed computers or for microwave communication systems.

The progress in semiconductor technology led to the development of the integrated circuit (IC), which was discovered due to the efforts of John Kilby in 1958. There appeared a new field of science — integrated electronics. The essence of it is batch processing. Instead of making, testing and assembling discrete components on a chip one at a time, large groupings of these components together with their interconnections were made all at a time. IC greatly reduced the size of devices, lowered manufacturing costs and at the same time they provided high speed and increased reliability.

5. Match the words similar in meaning

1. invent	a. answer
2. operation	b. part
3. imagine	c. discover

4. component	d. pretend
5. respond	e. work
6. trajectory	f. keeping
7. storage	g. common
8. specialized	h. path

6. Match the words opposite in meaning

1. development	a. reject
2. solid-state	b. ancient
3. realize	c. decline
4. rapid	d. liquid
5. modern	e. slow
6. early	f. connected
7. increase	g. late
8. descrete	h. lower

7. Find the English equivalents to the following word combinations in the text

1. применение электронных схем
2. передача и прием информации
3. вычислять траекторию космических кораблей
4. способствовать управлению сигналами
5. полупроводниковый кристалл
6. потребление электроэнергии
7. высокая надежность
8. твердотельные компоненты
9. высокоскоростной компьютер
10. микроволновые системы связи
11. полупроводниковая технология
12. сборка дискретных компонентов на кристалле

8. Match English and Russian equivalents

1. scientific research	a. со скоростью
2. due to the efforts	b. твердое тело; кристалл
3. to replace vacuum tubes	c. полупроводниковый кристалл
4. a piece of semiconductor	d. увеличить надежность
5. solid body	e. благодаря усилиям
6. at a rate	f. научные исследования
7. to increase reliability	g. заменять электронные лампы

9. Insert the necessary word in the gap

1. Electronics is a science studying the use of …:

    a) computers; b) electronic circuits;

    c) radio signals; d) reception of information.

2. Transistors have many … over vacuum tubes.

    a) patterns; b) advantages;

    c) scales; d) forms.

3. They … very little power.

    a) consume; b) generate;

    c) embrace; d) convert.

4. The transistor consists of a small piece of a … with three electrodes.

    a) diode; b) anode;

    c) conductor; d) semiconductor.

5. … contributed greatly to the discovery of integrated circuits.

    a) W. Shockly; b) J. Kilby;

    c) W. Brattain; d) J. Bardeen.

10. Give the title to each paragraph of the text

11. Retell the text using the titles

12. Read the passage. Give the title to the text and translate it in writing

We can use a combination of n- and p-type crystals to carry out the functions of a triode tube. Such an arrangement is known as a transistor. It consists of a p-type crystal placed between two n-type crystals. If we apply to the middle and to the right crystal an electric voltage from a battery no current will flow through the system. Things will change, however, if a small electric voltage from the battery is applied to the central and to the left crystal. In this case current will start to flow through the n-p-junction on the left. However, many electrons entering into the p-type crystal will continue across it and enter the n-type crystal on the right, thus permitting a current from the battery to flow through the right n-p-junction. The situation is quite similar to that existing in a triode tube, and the crystal on the left plays the role of the filament, while the middle crystal and the crystal on the right play the role of grid and plate. The principal advantage of transistors over vacuum tubes lies in the fact that the controlled flow of electrons takes place entirely within solid material. Thus it is not necessary to use a large amount of power to keep a filament red-hot to eject electrons into space. This, in addition to their simplicity, reliability and small size, have taken rapidly causing transistors to take the place of the old-fashioned vacuum tubes in many fields of electronics.

n-p junction – n-p переход

grid - решетка, сетка

filament – нить накала

12. Develop the following statement using the phrases – <u>in my opinion, in fact, for instance, moreover, one advantage is …, another point is that …, finally, in conclusion:</u>

“Electronics has extended man’s intellectual power “.

Text 2

SEMICONDUCTORS

1. Practice the pronunciation of the following words

semiconductor	[ˌsemɪkən'dʌktə]	crystal	[ˈkrɪstəl]
thermal	['θɜːməl]	crystalline	['krɪstəlaɪn]
impurity	[ɪmˈpjʊərɪti]	lattice	[ˈlætɪs]
occur	[əˈkɜː]	spotless	[ˈspɒtləs]
acceptor	[əkˈseptə]	regularity	[ˈregjʊlərɪti]
carrier	['kærɪə]	agitation	[ˌæʤɪ'teɪʃən]
chemical	['kemɪkəl]		

2. Read the following words and try to remember them

VOCABULARY

spotless regularity	[ˈspɒtləs ˈregjʊlərɪtɪ]	безупречная правильность
give rise	[gɪv raɪz]	вызывать
crystal lattice	[ˈkrɪstəlˈlætɪs]	кристаллическая решётка
semiconductor	[ˌsemɪkən'dʌktə]	полупроводник
acceptor	[əkˈseptər]	акцептор (дырка)
silicon crystal	[ˈsɪlɪkən ˈkrɪstəl]	кристалл кремния
valence	[ˈveɪləns]	валентность
conductive	[kənˈdʌktɪv]	проводящий
arsenic	[ˈɑːsənɪk]	мышьяк
free electron	['friː ɪˈlektrɒn]	свободный электрон
electric carrier	[ɪˈlektrɪk ˈkæriə]	электрический носитель
electron bond	[ɪˈlektrɒn ˈ bɔnd]	электронная связь
boron	[ˈbɔːrən]	бор

3. Read the text about semiconductors and answer the questions below

SEMICONDUCTORS

Some materials cannot be classified as either insulators or good conductors as thermal agitation of the atoms can knock loose only a few electrons and permit the material be slightly conductive. Such materials are known as semiconductors. A small amount of the proper kind of impurity in the crystalline structure of a semiconductor may, however, make it enormously more conductive. A pure silicon crystal in which each atom of silicon has a chemical valence 4, is connected with four of its neighbors by four electron bonds. This situation arises when one atom of silicon is replaced by an atom of arsenic (As) which has a valence of 5. The impurities in the crystalline structure of a semiconductor make the semiconductor very conductive.

The four valence electrons of the As atom form connections (bonds) with the four neighboring Si atoms, while the fifth "black sheep" electron is left unemployed and free to travel from place to place. The impurity atoms that give rise to free electrons in this way are known as donors. A reverse situation occurs when the Si atom is replaced by a trivalent atom of boron (B). In this case there will be a vacant place, or an electron hole, that breaks up the spotless regularity of the silicon crystal lattice. The impurity atoms that give rise to such "holes" are known as acceptors. A hole formed near a foreign atom present in the lattice may be filled up by an electron originally belonging to one of the neighboring silicon atoms, but in filling this hole the electron will leave a hole at the place where it was originally located. If this hole is filled by another neighboring electron, a new hole will move one step farther out.

Semiconductors that contain donor atoms and free electrons are known as n-type semiconductors, while those with acceptor atoms and holes are called p-type semiconductors (n and p stand for a negative and positive charge of electric carriers). The electrical conductivity of n-type semiconductors is determined by the number of free electrons per unit valence and the ease with which they move through the crystal lattice, while in the case of p-type semiconductors it depends *on* the number and mobility of the holes.

1. What materials can be classified as semiconductors?
2. Under what conditions can a semiconductor become more conductive'?
3. What impurity atoms are known as donors (acceptors)?
4. What is the difference between n-type and p-type semiconductors?
5. What is their conductivity determined by?

4. Match the words similar in meaning

1. acceptors	a. flint
2. give rise	b. poison
3. silicon	c. engender
4. arsenic	d. additive
5. impurity	e. holes
6. occur	f. range
7. classify	g. perfect
8. spotless	h. take place

5. ***Match the words opposite in meaning***

1. n-type	a. insulative
2. conductive	b. doped
3. pure	c. disappear
4. occur	d. pacification
5. agitation	e. p-type
6. give rise	f. far
7. regularity	g. stop
8. neighboring	h. mess

6. Translate the following word combinations into Russian

1. thermal agitation
2. crystalline structure
3. pure silicon crystal
4. chemical valence
5. impurity atoms
6. free electrons
7. electron hole
8. depend on
9. be replaced by an atom of
10. be filled up by an electron

7. Find the English equivalents to the following word combinations in the text:

1. безупречная правильность
2. кристаллическая решётка
3. кристалл кремния
4. свободные электроны
5. электрические носители
6. тепловое возбуждение
7. электронно-дырочная
8. химическая валентность
9. чистый кристалл кремния
10. примесные атомы

8. Match the following terms with definitions and translate them

1. semiconductor	a. a quantum transition of an atom or molecule from a lower energy level to a higher.
2. thermal agitation	b. the material, which occupies an

	intermediate position between conductors and insulators.
3. acceptors	c. auxiliary geometric image introduced for the analysis of the structure of the crystal.
4. valence	d. in solid state physics an impurity in the crystal lattice, which gives the crystal a p-type conductivity type, in which the charge carriers are holes.
5. crystal lattice	e. the ability of atoms of chemical elements to form a certain number of chemical bonds with atoms of other elements.

9. Match English and Russian equivalents

1. slight conductivity	a. обратная ситуация
2. chemical valence	b. небольшая проводимость
3. electron bonds	c. черная овца
4. black sheep	d. химическая валентность
5. reverse situation	e. элекоронные связи

10. Insert the necessary word in the gap

1. Semiconductors have ... conductivity.

a) electron substituted c) electron hole

b) full d) incomplete

2. ... increases conductivity of the semiconductor.

a) Arsenic c) Thermal agitation

b) Impurity d) Chemical valence

3. An atom of silicon has a chemical valency...

a) 2 c) 7

b) 5 d) 4

4. Impurity atoms that generate "holes" are called...

a) holes c) impurities

b) acceptors d) valency

5. Semiconductors that contain ... and free electrons are known as n-type semiconductors.

a) donor atoms c) impurities

b) electron hole d) electron bonds

11. Give the title to each paragraph of the text

12. Retell the text using the titles

13. Translate the passage in writing

METALS USED AS CONDUCTORS

The use of electricity depends upon a means of conducting it from its source to the point where it is to be used. Copper has been used as a conductor since the beginning of the industry and no proper substitute has been found. Only one metal, silver, is more efficient, but it has too high cost to be extensively used. Aluminum, because of its lightness, is used in common practice for transmission where long spans are necessary. It has been compared to other metals, a conducting capacity of about 60 per cent of copper.

15. Write the summary of the following text

Semiconductors have had a monumental impact on our society. You find semiconductors at the heart of microprocessor chips as well as transistors. Anything that is computerized or uses waves depends on semiconductors.

Today, most semiconductor chips and transistors are created with silicon. You may have heard expressions like "Silicon Valley" and the "silicon economy," and that is why -- silicon is the heart of any electronic device.

Silicon is a very common element – for example, it is the main element in sand and quartz. If you look "silicon" up in the periodic table, you will find that it sits next to aluminum, below carbon and above germanium.

Carbon, silicon and germanium (germanium, like silicon, is also a semiconductor) have a unique property in their electron structure – each has four electrons in its outer orbital. This allows them to form nice crystals. The four electrons form perfect covalent bonds with four neighboring atoms, creating a **lattice**. In carbon, we know the crystalline form as diamond. In silicon, the crystalline form is a silvery, metallic-looking substance.

In a silicon lattice, all silicon atoms bond perfectly to four neighbors, leaving no free electrons to conduct electric current. This makes a silicon crystal an insulator rather than a conductor.

Metals tend to be good conductors of electricity because they usually have "free electrons" that can move easily between atoms, and electricity involves the flow of electrons. While silicon crystals look metallic, they are not, in fact, metals. All of the outer electrons in a silicon crystal are involved in perfect covalent bonds, so they cannot move around. A pure silicon crystal is nearly an insulator – very little electricity will flow through it. But you can change all this through a process called doping.

Adapted from http://electronics.howstuffworks.com

Text 3
SUPERCODUCTORS

1. Practice reading the following words with the help of given transcriptions

accelerator	[əkˈseləreɪtə]
occur	[əˈkɜː]
phenomenon	[fɪˈnɔmɪnən]
giant	[ˈʤaɪənt]
liquid	[ˈlɪkwɪd]

2. Read the following words and try to remember them

VOCABULARY

aptly	[ˈæptlɪ]	подходящим образом
alloy	[ˈælɔɪ]	сплав
liquefy	[ˈlɪkwɪfaɪ]	сжижать
magnetically levitated train	[mægˈnetɪklɪ [ˈlevɪteɪtɪd treɪn]	поезд на магнитной подушке
conceivable	[kənˈsiːvəbl]	возможный
stumble on	[stʌmbl]	натолкнуться на
breakthrough	[ˈbreɪkθruː]	достижение
coolant	[ˈkuːlənt]	хладагент
frigid	[ˈfrɪʤɪd]	холодный
immensely	[ɪˈmenslɪ]	очень
implication	[ɪmplɪˈkeɪʃn]	значение
superconductivity	[sjʊpəkɔndʌkˈtɪvɪtɪ]	сверхпроводимость

3. ***What do you know about the phenomenon and possible practical uses of superconductivity? Read the text and answer the questions below***

1. What is superconductivity?
2. What temperature is called “absolute zero”?
3. How many years ago was superconductivity discovered?
4. What conditions enable some metals to become superconductive?
5. Why hasn’t superconductivity become widely used in practice?
6. Why is liquid nitrogen more attractive as a coolant than liquid helium?
7. What fields of superconductor application could you name?

SUPERCODUCTORS

Superconductivity is aptly named. It involves a remarkable transition that occurs in many metals when they are cooled to temperatures within several degrees of absolute zero, or, 0 Kelvin. Absolute zero equivalent to -460°F or -273°C represents a total absence of heat; it is the coldest temperature conceivable. As the metals approach this frigid limit, they suddenly lose all their electrical resistance and become superconductors. This enables them to carry currents without the loss of any energy and in some cases to generate immensely powerful magnetic fields. Scientists have recognized that the implications of this phenomenon could be enormous, but reaching and maintaining the temperatures necessary for superconductivity in these metals is difficult and expensive.

From the time that a Dutch physicist Kamerlingh Onnes discovered superconductivity in 1911 until the recent rush of breakthroughs, there was only one way to produce the phenomenon: by bathing the appropriate metals — and later, certain metallic alloys – in liquid helium.

This exotic substance is produced by lowering the temperature of rare and costly helium gas to 4.2K (-452°F), at which point it liquefies. But the process is expensive and requires considerable energy. Furthermore, unless the liquid helium is tightly sealed in a heavily insulated container it quickly warms and vaporizes away. Thus, the practical use of superconductors has been limited to a few devices — an experimental Japanese magnetically levitated train, a few giant particle accelerators and medicine's magnetic resonance imaging machines that operate with intense magnetic fields.

But in the last few years physicists have stumbled on unusual cases of ceramic compounds that change everything. They also must be cooled to become superconductors but only to a temperature of 98 K (-283°F) and that suddenly brings superconductivity into the range of the practical: liquid helium can be replaced as a coolant by liquid nitrogen, which makes the transition from a gas at the easily produced temperature of 77 K (-320°F). Moreover, liquid nitrogen is cheaper than milk and so long-lasting that scientists carry it around in ordinary thermos bottles. Also, the ceramics may be able to generate even more intense magnetic fields than metallic superconductors.

Thus, if these new substances can be turned into practical devices technology will be transformed.

4. Match the words similar in meaning

1. remarkable	a. expensive
2. rare	b. demand
3. costly	c. intensely cold
4. frigid limit	d. seldom
5. require	e. outstanding
6. breakthrough	f. reach
7. approach	g. possible
8. conceivable	h. achievement

5. Match the words opposite in meaning

1. coldest	a. cheap
2. expensive	b. ordinary

3. liquid	c. high
4. exotic	d. hottest
5. low	e. solid
6. giant	f. weak
7. safe	g. tiny
8. intense	h. dangerous

6. Match the following terms with definitions and translate them into Russian

1. technology	a. a vacuum flask or bottle which can keep liquids at a desired temperature.
2. metal	b. physical matter; material
3. phenomenon	c. the study of or a collection of techniques
4. thermos	d. an observable fact or occurrence or a kind of observable fact or occurrence
5. substance	e. chemical elements or alloys, and the mines where their ores come from

7. Find the English equivalents to the following word combinations in the text

1. последствия этого явления
2. кроме того
3. производится путем понижения температуры
4. которые меняют все
5. дешевле, чем молоко
6. это дает им возможность проводить
7. самая низкая допустимая температура
8. технология будет изменена

8. Translate the following word combinations into Russian

1. to approach the frigid limit
2. recent rush of breakthroughs
3. magnetic resonance imaging machine
4. to generate intense magnetic field
5. reaching and maintaining the temperatures
6. the recent rush of breakthroughs
7. the implications of this phenomenon
8. giant particle accelerator

9. Complete the sentences using the text

1. Absolute zero equivalent…
2. There was only one way to produce the phenomenon...
3. The process is expensive and…
4. Liquid nitrogen is so long-lasting that…
5. Ceramics may be able to generate more intense magnetic fields than ...
6. Physicists have stumbled on unusual cases of ceramic compounds that …

10. Reorder the words to make a sentence

1. have, Scientists, years, recognized, for.
2. and, energy, expensive, The process, requires, is, considerable.
3. zero, heat, absence, Absolute, of, a total, represents.
4. cooled, superconductors, be, must, to, they, become, also.
5. aptly, is, superconductivity, named.

11. Translate into English

1. Значительный прогресс в понимании физической основы сверхпроводимости наступил (come) в 1940-х годах.

2. Он связан с работами хорошо известных учёных П.Л. Капицы и Л.Д. Ландау.

3. Они разработали теорию сверхтекучести (superfluidity) жидкого гелия, которая возникает при температурах около абсолютного нуля.

4. Они написали большое количество научных статей по сверхпроводимости и промежуточным (intermediate) состояниям в сверхпроводниках при низких температурах.

12. Give the summary of the text

13. Translate the text into Russian

In 1987, each new report of achieving superconductivity at a higher temperature was received with excitement by the physics community. By summer, claimed records were approaching room temperatures, but enthusiasm was cooling. In December, signs of superconductivity above the boiling point of water (373 K) were reported. However, most observers were skeptical, reflecting growing doubts that the existence of superconductivity above 100 K has been proved.

During the second half of the year, about 20 research groups reported evidence for superconductivity above 100 K. However, at the Boston meeting, Paul Chu, the researcher from the University of Houston, who made the first superconductor at 90 K, said higher-temperature observations were "unstable superconducting anomalies. He stressed that reports of high-temperature superconductivity should meet four criteria: zero resistance; demonstration of the Meissner effect (the exclusion of magnetic fields from a superconductor); stability; and reproducibility. Although he said that there was "no clear evidence to exclude" the possibility of superconductivity well above 100 K.

Text 4

ASIC

1. Practice reading the following words

circuit	[ˈsɜː.kɪt]	design	[dɪ'zaɪn]
analogue	[ˈænəlɒg]	product	['prɔdʌkt]
manufacturing	[ˌmænjuˈfæktʃərɪŋ]	logic	['lɔʤɪk]
functionality	[ˌfʌŋkʃənˈæləti]	virtually	['vɜːʧuəlɪ]
major	[ˈmeɪʤə]	area	['eərɪə]

2. Read the following words and try to remember them

VOCABULARY

integrate	[ˈɪntɪgreɪt]	интегрировать, объединять
indicate	[ˈɪndɪkeɪt]	указывать, показывать
undertake	[ʌndəˈteɪk]	предпринимать, совершать
tailor	[ˈteɪlə]	приспосабливать,
exact	[ɪgˈzækt]	точный, строгий
requirement	[rɪˈkwaɪəmənt]	требование, условие
virtually	['vɜːʧuəlɪ]	фактически
significantly	[sɪgˈnɪfɪkəntlɪ]	значительно
incorporate	[ɪnˈkɔːpərɪt]	включать, принимать
circuitry	[ˈsɜːkɪtrɪ]	схема, схемотехника
proposition	[prɔpəˈzɪʃn]	предложение
solution	[səˈluːʃn]	решение
assemble	[əˈsembl]	собирать
enable	[ɪˈneɪbl]	делать возможным
timescale	[ˈtaɪmskeɪl]	сроки, шкала времени
viable	[ˈvaɪəbl]	жизнеспособный
proprietary	[prəˈpraɪətərɪ]	запатентованный, фирменный

3. Read the text and answer the questions below

1. What do the letters in ASIC stand for?
2. What is ASIC?
3. Where are ASICs widely used?
4. What functions are incorporated in a mixed signal ASIC designs?
5. Why is a mixed signal ASIC design so attractive for many applications?
6. What are the advantages of ASICs?

ASIC *

Application Specific Integrated Circuits or ASICs are, as the name indicates, non-standard integrated circuits that have been designed for a specific use or application. Generally an ASIC design will be undertaken for a product that will have a large production run, and the ASIC may contain a very large part of the electronics needed on a single integrated circuit. As may be imagined, the cost of an ASIC design is high, and therefore they tend to be reserved for high volume products.

Despite the cost of an ASIC design, ASICs can be very cost effective for many applications where volumes are high. It is possible to tailor the ASIC design to meet the exact requirement for the product, and using an ASIC can mean that much of the overall design can be contained in one integrated circuit and the number of additional components can be significantly reduced. As a result, they are widely used in high volume products like cell phones or other similar applications, often for consumer products where volumes are higher, or for business products that are widely used.

The first ASICs traditionally addressed only logic functions. Now mixed signal ASIC designs can incorporate both analogue and logic functions. These mixed signal ASICs are particularly useful in being able to make a complete system on chip. Here a complete system or product is integrated onto a chip and virtually no other components are required. This makes a mixed signal ASIC design a very attractive proposition for many applications.

The beginnings of the ASIC can be traced back to the early 1980s. Around this time, ICs were beginning to make a major impact on the electronics industry. In view of the advantages that ICs provided, and the limited number that were available, some attempts were made to create logic chips that could be easily focused towards a specific application.

ASIC designs offer a very attractive solution for many high volume applications. They enable significant amounts of circuitry to be incorporated into a single chip. Had the circuits been assembled using proprietary chips, additional components, and board area, manufacturing costs would be more. With sufficient volume, custom chips, in the form of ASICs offer a very attractive proposition. In addition to the cost aspects, ASICs may also be used some times because they enable circuits to be made that might not be technically viable using other technologies. They may offer speed and performance that would not be possible if discrete components were used. When developing an ASIC, it is often necessary to employ another specialist company to provide the ASIC design service. By using their expertise the design can be undertaken more effectively – in terms of correct functionality, cost and timescale.

Adapted from www.radio-electronics.com

*ASIC (Application Specific Integrated Circuits) - интегральная схема специального назначения

4. Mark the following sentences True or False

1. The beginnings of the ASIC can be traced back to the early 1960s.
2. The first ASICs traditionally addressed both analogue and logic functions.
3. ASICs are non-standard integrated circuits that have been designed for a specific use or application.
4. As a result ASICs are widely used in high volume products like cell phones or other similar applications or for business products.

5. Match the words similar in meaning

1. circuit	a. buyer
2. consumer	b. try
3. incorporate	c. contain
4. attempt	d. propose
5. offer	e. scheme
6. exact	f. part
7. indicate	g. accurate
8. component	h. show

6. Match the words opposite in meaning

1. integrate	a. different
2. exact	b. separate
3. enable	c. unsuccessful
4. similar	d. disable
5. effective	e. inappropriate
6. mixed	f. end
7. beginning	g. wrong
8. correct	h. pure

7. Find the English equivalents to the following word combinations in the text

1. цифровые сигналы
2. интегральная схема
3. производственный цикл
4. потребительские продукты
5. ограниченное число
6. привлекательное предложение
7. производственные затраты
8. дополнительные компоненты

9. специальное назначение

10. точные требования

8. Match English and Russian equivalents

1. descrete components	a. технически возможный
2. a major impact	b. значительно снижать
3. significantly reduce	c. будет осуществляться
4. high volume applications	d. значительные суммы
5. significant amounts	e. существенное влияние
6. will be undertaken	f. широкое применение
7. proprietary chip	g. направлены на
8. technically viable	h. фирменная микросхема
9. focused towards	i. отдельные компоненты

9. Insert prepositions and translate the sentences

1. As may be imagined, the cost … an ASIC design is high, and therefore they tend … be reserved … high volume products.

2. In view … the advantages that ICs provided, and the limited number that were available, some attempts were made to create a logic chip that could be easily focused … a specific application.

3. As a result they are widely used in high volume products … cell phones or other similar applications, often … consumer products where volumes are higher, or … business products that are widely used.

4. It is possible to tailor the ASIC design to meet the exact requirement ... the product and using an ASIC can mean that much … the overall design can be contained in one integrated circuit and the number … additional components can be significantly reduced.

5. … using their expertise the design can be undertaken more effectively – in terms … correct functionality, cost and timescale.

10. Find out the key words to make up the outline of the text

11. Give the summary of the text

12. Render the text in English

ASIC (аббревиатура от англ. *application-specific integrated circuit*, «интегральная схема специального назначения») — интегральная схема, специализированная для решения конкретной задачи. В отличие от интегральных схем общего назначения, специализированные интегральные схемы применяются в конкретном устройстве и выполняют строго ограниченные функции, характерные только для данного устройства; вследствие этого выполнение функций происходит быстрее и, в конечном счёте, дешевле. Примером ASIC может являться микросхема, разработанная исключительно для управления мобильным телефоном, микросхемы аппаратного кодирования/декодирования аудио- и видео-сигналов (сигнальные процессоры).

Микросхема ASIC имеет узкий круг применения, обусловленный жёстко предопределённым набором её функций.

Современные ASIC часто содержат 32-битный процессор, блоки памяти (как ПЗУ, так и ОЗУ) и другие крупные блоки. Такие ASIC часто называют система на кристалле (англ. *System-on-a-Chip*).

UNIT 3. ELECTRONIC DEVICES

Text 1

TRANSFORMERS

1. Practice reading the following words

transformer	[trænsˈfɔːmə]	proportional	[prəˈpɔːʃənl]
electromagnet	[ɪˈlektrəʊˈmægnɪt]	generator	[ˈʤenəreɪtə]
transfer	[ˈtrænsfɜː]	minimize	[ˈmɪnɪmaɪz]
distance	[ˈdɪstəns]	cycle	['saɪkl]
corresponding	[kɔrɪsˈpɔndɪŋ]	experiments	[ɪksˈperɪmənt]
variation	[vɛərɪˈeɪʃn]	design	[dɪˈzaɪn]

2. Read the following words and try to remember them

VOCABULARY

coil	[kɔɪl]	катушка
wire	[ˈwaɪə]	провод
wrap	[ræp]	обертывать
iron core	[ˈaɪən kɔː]	железное ядро
field	[fiːld]	поле
close proximity	[kləʊs prɔkˈsɪmɪtɪ]	непосредственная близость
values	[ˈvæljuːz]	значения
device	[dɪˈvaɪs]	устройство
induce	[ɪnˈdjuːs]	вызвать
supply	[səˈplaɪ]	подача
magnetic flux	[mægˈnetɪk flʌks]	магнитный поток
frequency	[ˈfriːkwənsɪ]	частота
domestic power lines	[dəʊˈmestɪk ˈpaʊə laɪn]	внутренние линии электропередач

complete oscillation	[kəmˈpliːt ɔsɪˈleɪʃn]	полное колебание
number of turns	[ˈnʌmbər əv tɜːnz]	число витков
step-up transformer	[ˈstepʌp trænsˈfɔːmə]	повышающий трансформатор
step-down transformer	[ˈstep ˈdaʊn trænsˈfɔːmə]	понижающий трансформатор
electric power	[ɪˈlektrɪk ˈpaʊə]	электрическая мощность
high-voltage	[ˌhaɪˈvəʊltɪʤ]	высоковольтный
restriction	[rɪsˈtrɪkʃn]	ограничение
describe	[dɪsˈkraɪb]	описывать
power plant	[ˈpaʊə plɑːnt]	электростанция
transmission line	[trænzˈmɪʃn laɪn]	линия электропередачи
potential difference	[pəʊˈtenʃəl ˈdɪfrəns]	разность потенциалов
power-line pole	[ˈpaʊə-laɪn pəʊl]	полюс линии электропередачи
multiply	[ˈmʌltɪplaɪ]	умножить
inversely proportional	[ˈɪnˈvɜːslɪ prəˈpɔːʃənl]	обратно пропорциональный

4. Do you know anything about transformers? What are they designed for? Read the text to find more information about transformers

TRANSFORMERS

A coil of wire wrapped around an iron core makes an electromagnet, which intensifies the field generated by the motion of the current through the coiled wire. If we place two of these electromagnets next to one another in close proximity (but not touching), we have what is called a *transformer*. One reason that alternating current is widely used to transfer electrical energy over long distances is that voltage and current values may be readily and efficiently changed by the use of these devices.

In principle, the pair of coils in Figure 1 is a transformer. Any change in the current in the primary coil induces a current in the secondary coil. If an alternating current is supplied to the primary, there will be a corresponding variation of magnetic flux through the secondary. As a result, an alternating current of the same frequency will be induced in the secondary coil. In the United States the frequency used on domestic power lines is 60 cycles per second - that is, the current makes 60 complete oscillations per second, or 60 Hz.

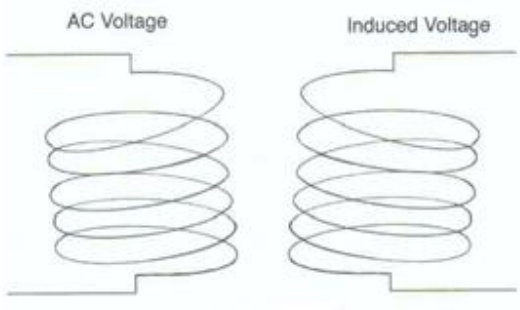

Figure 1

In iron-core transformers, the voltages in the two coils are proportional to the number of turns, or

$$V_s/V_p = n_s/n_p$$

where V_s = voltage in the secondary, V_p voltage in the primary, n_s = number of turns in secondary, and n_p = number of turns in primary. If there are more turns in the secondary than in the primary, the voltage of the secondary will be greater than the primary voltage, and the device is called a *step-up transformer;* conversely, if there are more turns in the primary than in the secondary, the device is a *step-down transformer.*

When electric power is to be used at a great distance from the generator, it is transmitted in the form of high-voltage AC, for the following reason: the heat loss in an electric power line is proportional to I^2R, so if the losses are to be minimized, the current should be as small as possible. If the power is a constant, this restriction means that the voltage must be high, since $P = IV$.

Transformers work only with alternating currents, as described in the experiments of Faraday and Lenz. In a power plant, the generator voltage may be as high as 10,000 V. A transformer steps this voltage up to perhaps 230,000 V and places this voltage on the transmission line. At the edge of a city, a step-down transformer may reduce the potential difference to about 2300 V, and small step- down transformers located on power-line poles throughout the city then reduce it to a safe value of about 110 V for use in homes.

There are no moving parts in a transformer, and when these devices are properly designed the energy losses may be as low as 2 percent. This means that, practically, the same amount of power is developed in each coil. As in the case of direct current, the power developed in either coil is equal to current multiplied by voltage, so that $I_pV_p = I_SV_S$, or $I_s/I_p = V_p/V_s$. Combining this equation with the preceding relation, we have

$$I_s/I_p = n_p/ n_s$$

so that the currents in the two coils are inversely proportional to the number of turns in each.

4. Answer the questions:

1. What is a transformer used for?
2. What does a transformer consist of?
3. What is the dependence between the primary and secondary coils?
4. What type of transformer is called a step-up transformer?
5. What type of transformer is called a step-down transformer?
6. What is the relation between the number of turns in the coils and the voltages?

5. Match the words similar in meaning

1. device	a. on the contrary
2. readily	b. quantity
3. conversely	c. inner
4. loss	d. attitude
5. part	e. easily
6. amount	f. waste
7. relation	g. unit
8. domestic	h. machine

6. Match the words opposite in meaning

1. intensify	a. dangerous
2. supply	b. directly
3. restrict	c. following
4. safe	d. primary
5. multiply	e. take away
6. preceding	f. expand
7. inversely	g. divide
8. secondary	h. weaken

7. Find the English equivalents to the following word combinations in the text.

1. в непосредственной близости
2. широко использовать для передачи электрической энергии
3. быстро и эффективно менять
4. представлять собой электромагнит
5. передавать в виде переменного тока высокого напряжения
6. по следующей причине
7. тепловая потеря
8. свести потери к минимуму
9. уменьшить разность потенциалов

10. нет движущихся частей
11. разрабатывать должным образом
12. объединить уравнение с

8. Match English and Russian equivalents current

1. generated by the motion of the current	a. может достигнуть
2. by the use of these devices	b. то же самое количество энергии
3. primary voltage	c. по всему городу
4. may be as high as	d. при помощи этих устройств
5. throughout the city	e. основное напряжение
6. the same amount of power	f. создаваемое движением тока

9. Complete the sentences using the correct variant

1. A transformer is used…

a) to store charge;

b) to prevent the change of energy;

c) to transfer energy;

d) to change the voltage and current value in a circuit.

2. Electric power is transferred at a high voltage and reduced to any value…

a) due to resistors;

b) due to capacitors;

c) due to transformers.

3. A transformer consists of …

a) cores only;

b) the primary and the secondary coils;

c) a core and the primary and the secondary coils.

4. A step-up transformer is used …

a) to step down or decrease the secondary voltage;

b) to step up or increase the primary voltage.

5. A step-down transformer is used …

a) to step down the secondary voltage;

b) to step down the primary voltage.

6. In a step-up transformer …

a) the number of turns of the secondary coil is greater than the number of turns of the primary;

b) the number of turns of the primary coil is greater than the number of turns of the secondary.

10. Complete the sentences using "while"

1. The **primary** winding **receives** energy …
2. In the **USA** the frequency used on domestic power lines is **60** Hz …
3. **A step-down** transformer **decreases** the primary voltage...
4. In a **step-up transformer** the number of turns of the **secondary** winding is greater than a number of turns of the **primary** winding …

11. Find out the key words to make up the outline of the text

12. Give the summary of the text

Text 2

ELECTRIC GENETATORS

1. Practice reading the following words

generator	['ʤenəreɪtə]	produce	[prə'djuːs]
function	['fʌŋkʃən]	motor	['məutə]
mechanical	[mɪ'kænɪkəl]	cycle	['saɪkl]
electromagnetic	[ɪlektrə(u)mæg'netɪk]	engine	['enʤɪn]
induction	[ɪn'dʌkʃən]	turbine	['tɜːbaɪn]

2. Read the following words and try to remember them

VOCABULARY

turn into	['tɜːn 'ɪntə]	превращать, преобразовывать
be designed to	[bɪ dɪ'zaɪnd tə]	предназначенный, сделанный (для чего-л.)
rotate	[rəu'teɪt]	вращать
means	[miːnz]	средство; способ, метод
adjustment	[ə'ʤʌstmənt]	регулировка, подгонка, наладка, настройка
either…or…	['aɪðə ɔː]	или … или,
force	[fɔːs]	сила
convert (smth. into smth.)	['kɔnvɜːt]	преобразовывать; превращать
slip ring	[slɪp rɪŋ]	токосъёмное контактное кольцо
brush	[brʌʃ]	щётка (часть электрической машины, служащая для передачи тока от неподвижных частей к вращающимся)
furnish	['fɜːnɪʃ]	снабжать, давать

electroplating	[ɪˌlektrə'pleɪtɪŋ]	гальванизация
charge	[ʧɑːʤ]	заряжать (аккумулятор)
storage	['stɔːrɪʤˌbætərɪ]	аккумуляторная батарея; аккумулятор
flow	[fləu]	течь

3. Do you know anything about generators? What are they designed for? Read the text to find more information about generators

ELECTRIC GENETATORS

Generators perform the reverse function of an electric motor, they continuously turn mechanical energy into direct or alternating current. They are designed to use electromagnetic induction to produce more than temporary, weak current.

The essential parts of a generator are the same as those of an electric motor: a coil or current-carrying wire, a magnetic field in which the coil can be rotated, and some means for connecting the coil to an outside circuit. In fact, with slight adjustments, the same device may be used as either a motor or a generator. If a current from some outside source is passed into the coil, it rotates and acts like a motor; that is, it converts electrical force into mechanical force. If the coil is mechanically turned, as by an engine or a water-driven turbine, an induced current results; that is, the machine converts mechanical energy into electrical energy.

If the coil of a standard motor is connected to an outside circuit by means of slip rings and brushes, the current furnished to this circuit will be *alternating current* (AC). The number of complete cycles equals the number of coil rotations per second. Thus, an alternating current is the kind that naturally results from the turning of a coil (electromagnet) in a fixed magnetic field. Alternating currents are well suited to many purposes such as heating and lighting.

Other uses of current, such as electroplating or the charging of storage batteries, require *direct current (DC)*, which always flows in one direction. AC generators must be modified to generate DC currents.

4. Answer the questions

1. What function do generators perform?

2. What are the essential parts of a generator?

3. What is an electric motor?

4. What does an alternating current result from?

5. What purposes are alternating currents well suited to?

6. What is direct current required for?

5. Match the words opposite in meaning

1. direct current	a. permanent
2. convert	b. stop
3. weak	c. accessory
4. connect	d. remain
5. temporary	e. strong
6. produce	f. alternating current
7. essential	g. disconnect
8. flow	h. consume

6. Match the words similar in meaning

1. perform	a. power
2. rotate	b. transform
3. act	c. provide
4. force	d. make
5. furnish	e. change
6. convert	f. spin (turn)
7. produce	g. operate
8. modify	h. do

7. *Translate the following word combinations into Russian*

1. to perform the function
2. to turn mechanical energy into current
3. magnetic field
4. either a motor or a generator
5. to convert electrical force into mechanical
6. to connect to an outside circuit
7. to suit to many purposes
8. to turn mechanically

8. *Find the English equivalents to the following word combinations*

1. вырабатывать ток
2. при помощи
3. провод по которому идет ток
4. выполнять функцию мотора
5. гидротурбина
6. индуцированный ток
7. возникать в результате
8. стационарное магнитное поле

9. *Match a line in A with a line in B*

1. motor	a. turns mechanical energy into electrical current
2. AC	b. amount of work an object can do
3. generator	c. converts electrical force into mechanical force
4. DC	d. results from the continued turning of a coil in a fixed magnetic field
5. mechanical energy	e. current in which the charge flows continually in one direction

6.electromagnetic induction	f. device for increasing electromagnetic force by means of a soft-iron core
7.electromagnet	g. combination of magnetic and electric forces, due to the motion of charged particles

10. *Suffixes are used to form different parts of speech. Use your dictionary to find the other parts of speech*

To generate – generator …

To induce, to rotate, to connect, to magnetize

11. *Match a line in A with a line in B*

A	**B**
1.This text is about …	a. an induced current results.
2. A generator is a device …	b. the turning of a coil (electromagnet) in a fixed magnetic field.
3. The essential parts of a generator are: …	c. to generate DC currents.
4. If the coil is mechanically turned …	d. electric generators.
5. A motor	e. which converts mechanical energy into electrical energy
6. An alternating current results from …	f. converts electrical force into mechanical force.
7. Direct current always flows …	g. a coil or current-carrying wire, a magnetic field in which the coil can be rotated, and some means for con-necting the coil to an outside circuit.
8. AC generators must be modified …	h. in one direction.

12. Retell the text

Text 3

OPERATIONAL AMPLIFIER (OP AMP)

1. Practice the pronunciation of the following words

workhorse	[ˈwɜːk hɔːs]	enable	[ɪˈneɪbl]
widely	[ˈwaɪdlɪ]	symbol	[ˈsɪmbəl]
quantity	[ˈkwɒntɪtɪ]	consist	[kənˈsɪst]
cent	[sent]	quantity	['kwɔntətɪ]
version	['vɜːʃn]	virtual	['vɜːʧuəl]
parameter	[pə'ræmɪtə]	configuration	[kənˌfɪgju'reɪʃn]
triangle	['traɪæŋgl]	phase	[feɪz]
diagram	['daɪəgræm]	value	['væljuː]

2. Read the following words and try to remember them

VOCABULARY

operational amplifier	[ɒpərˈeɪʃənəl ˈæmplɪfaɪə]	операционный усилитель
differential amplifier	[ˌdɪfə'renʃəl ˈæmplɪfaɪə]	дифференциальный усилитель
designate	['dezɪgneɪt]	обозначать
scene	[siːn]	область, сфера
performance	[pəˈfɔːməns]	производительность
gain	[geɪn]	усиление, коэффициент усиления
rail	[reɪl]	1) канал 2) шина
feedback	[ˈfiːd.bæk]	обратная связь
oscillator	[ˈɔsɪleɪtə]	осциллятор
impedance	[ɪmˈpiːdəns]	сопротивление

3. Read the text and answer the following questions

1. Why are operational amplifiers known as the workhorses?
2. What is an operational amplifier?
3. What is a combination of parameters that are of great use?
4. What is the circuit symbol for an operational amplifier?
5. What does + and – inputs mean?

OPERATIONAL AMPLIFIER (OP AMP)

Operational amplifiers are one of the workhorses of the analogue electronics scene. Op-amps, as they are also known are widely available in the form of integrated circuits, many costing only a few cents or a few pence for the standard versions. High performance op amp integrated circuits still offer excellent value for money, but obviously cost a little more. In view of their ease of use and low cost, these integrated circuits are used in vast quantities enabling high performance electronics circuits to be developed and designed with a minimum of electronics components.

Operational amplifiers, op amps are virtually the ideal amplifier. They provide a combination of parameters that are of great use: Very high gain, Very high input impedance, Very low output impedance. The operational amplifier is what is known as a differential amplifier. The differential amplifier has two inputs and this enables it to be used in a wide number of circuit configurations. The circuit symbol for an operational amplifier consists simply of a triangle. The two inputs are designated by "+" and "-" symbols, and the output of the operational amplifier is at the opposite end of the triangle. Inputs from the "+" input appear at the output in the same phase, whereas signals present at the "-" input appear at the output inverted or 180 degrees out of phase. This gives rise to the names for the inputs. The "+" input is known as the non-inverting input, while the "-" input is the inverting input of the operational amplifier. As the output from the amplifier is dependent upon the difference in voltage between the two inputs, it is known as a differential amplifier. Often the power supply rails for the operational amplifier are not shown in circuit diagrams and there is no connection for a ground line. The power rails for the operational amplifier are assumed to be connected. The power for the operational amplifier is generally supplied as a positive rail and also a negative rail. Often voltages of +15V and -15 V are used, although this will vary according to the application and the actual chip used.

Adapted from www.radio electronics.com

3. Match the words opposite in meaning

1.	obvious	a. non-inverting
2.	excellent	b. decrease
3.	great	c. inferior
4.	inverting	d. negative
5.	positive	e. puzzling
6.	gain	f. little
7.	amplify	g. break
8.	connection	h. reduce

4. Translate the following word combinations into Russian

1. a combination of parameters
2. to offer excellent value for money
3. the opposite end of the triangle
4. to be dependent upon the difference in voltage
5. to vary according to the application
6. to give rise to

5. Find the English equivalents to the following word combinations in the text

1. идеальный усилитель
2. интегральные и дифференциальные схемы
3. в области электроники
4. инвертирующий вход

5. зависеть от разницы напряжения
6. иметь большое применение
7. с той же фазой
8. линия заземления

6. Complete the sentences using the text and translate them into Russian

1) In view of their ease of use…
2) They provide a combination…
3) The circuit symbol for an…
4) The two inputs are…
5) The "+" input is known as…
6) The power for the operational…

7. Match the sentence halves

1. Op-amps, as they are also known are…	a. is what is known as a differential amplifier.
2. The operational amplifier…	b. and the output of the operational amplifier is at the opposite end of the triangle.
3. The power rails for…	c. very high gain, very high input impedance, very low output impedance.
4. The two inputs are designated by "+" and "-" symbols…	d. although this will vary according to the application and the actual chip used.
5. They provide a combination of parameters that are of great use:..	e. widely available in the form of integrated circuits.
6. Often voltages of +15V and -15 V are used,…	f. the operational amplifier are assumed to be connected.

8. Reorder the words to make a sentence

1. a) a little more, b) op amp integrated circuits, c)but obviously cost, d) High performance, e) still offer excellent value for money.
2. a) two inputs, b) The differential amplifier has, c) in a wide number of circuit configurations, d) and this enables it to be used.
3. a) while the "-" input is the inverting, b) as the non-inverting input, c) input of the operational amplifier, d) The "+" input is known.
4. a) rails for the operational amplifier, b) Often the power supply, c) connection for a ground line, d) circuit diagrams and there is no, e) are not shown in.
5. a) the ideal amplifier, b) op amps are virtually, c) Operational amplifiers.

9. Insert the suitable words and translate the sentence

1. Op-amps, as they are also known are … in the form of …
2. Operational amplifiers, op amps are virtually...
3. The circuit ... operational amplifier consists simply of a triangle.
4. Operational amplifiers are one ... of the analogue electronics scene.
5. As the output from the amplifier is … the difference in voltage between the two inputs, it is known as …

10. Give the summary of the text

11. Translate the passage in writing

Operational amplifiers or op amps can be used in a wide variety of different analogue circuits. The basic op amp integrated circuit makes them an almost ideal circuit building block, which can be used to provide exceedingly high levels of performance. Typically an operational amplifier circuit requires a few external components to make a high performance analogue circuit. It is the high gain of the basic amplifier combined with the use of feedback (most often negative feedback) that enables the final circuits to provide such a high level of performance.

Text 4

THE OSCILLOSCOPE

1. Practice reading the following words

equipment	[ɪˈkwɪpmənt]	specification	[ˌspesɪfɪˈkeɪʃən]
require	[rɪˈkwaɪə]	particular	[pəˈtɪkjulə]
environment	[ɪnˈvaɪərənmənt]	essential	[ɪˈsenʃəl]
dimension	[daɪ'menʃn]	laboratory	[lə'bɔrətərɪ]
measurement	['meʒəmənt]	technology	[tek'nɔləʤɪ]
voltage	['vəultɪʤ]	circuit	['sɜːkɪt]
detail	['diːteɪl]	view	[vjuː]
cathode	['kæθəud]	tube	[t(j)uːb]

2. Read the following words and try to remember them

VOCABULARY

two dimensional format	[tuː dɪˈmɛnʃənl ˈfɔːmæt]	двумерный формат
accommodate	[əˈkɔmədeɪt]	согласовывать
single pulse	[ˈsɪŋgl pʌls]	одиночный импульс
crude figure	[kruːdˈfɪgə]	необработанная диаграмма
high performance	[haɪ pə´fɔːməns]	высокопроизводительный
oscilloscope	[ə´sɪləskəʊp]	осциллограф
software	[´sɒftweə]	программное обеспечение
wide range	[waɪd ´reɪndʒ]	широкий диапазон
radar system	[´reɪdɑː 'sɪstəm]	радиолокационная система
dual beam	[ˈdjuːəl biːm]	двухлучевой
triggered sweep	[ˈtrɪgəd swiːp]	импульсная развёртка
digitizer	[ˈdɪʤɪtaɪzər]	цифровой преобразователь

3. Read the text and answer the questions below

1) What is the oscilloscope?

2) Who invented the cathode-ray tube?

3) Where is the oscilloscope used?

4) What is the advantage of the triggered sweep oscilloscope?

5) Who invented the Digital Storage Oscilloscope?

THE OSCILLOSCOPE

The oscilloscope or scope must be one of the most widely used and famous test instruments. The oscilloscope is a type of test equipment that allows signal voltages to be displayed on a screen in a two dimensional format. In this way it is possible to see waveforms on the screen and understand how a circuit is performing. In view of this, the scope is able to provide a far greater level of the detail than simpler items of test equipment.

In view of its usefulness the oscilloscope is an essential item in any electronics laboratory and many other environments. Often several scopes may be required in a lab with wide ranging specifications to accommodate the wide range of measurements and applications that they may need to fulfil.

In 1897 Karl Ferdinand Braun invents the Cathode Ray Tube (CRT)* and uses it to display crude figures on the screen controlled by voltages on the plates of the tube.

In late 1930 the British company A. C. Cossor invents a dual beam oscilloscope which is widely used during WW2 for servicing electronics equipment and in particular the radar systems that were used.

In 1946 the triggered sweep oscilloscope was invented by Howard Vollum and Jack Murdock. This made the oscilloscope much easier to perform as waveforms were able to be displayed in a far more steady manner. Howard Vollum and Jack Murdock went on to found the Tektronix company that produced some of the highest performance oscilloscopes of the day.

In 1963 Tektronix introduced the Direct View Bistable Storage Tube (DVBST). This allowed single pulse waveforms to be displayed rather than just repeating waveforms.

The Digital Storage Oscilloscope (DSO)** was invented by Walter LeCroy after producing high-speed digitizers for the research centre CERN*** in Switzerland. Walter later founded the LeCroy Corporation.

Oscilloscopes have been in use within the electronics industry for many years. Even with many new developments occurring and a shift to greater levels of software within products there is no lessening of the importance of oscilloscopes. As the technology develops, the production process used within scopes has enabled them to provide higher levels of performance and to provide new and useful functions. With the continuing movement of technology, oscilloscope technology will also move forwards.

Adapted from www.radio-electronics.com

Cathode Ray Tube (CRT)* - Электронно-лучевая трубка

Digital Storage Oscilloscope (DSO)** - Цифровой запоминающий осциллограф

the European Organization for Nuclear Research (CERN)*** - Европейский совет по ядерным исследованиям (Аббревиатура CERN произошла от фр. Conseil Européen pour la Recherche Nucléaire)

4. Match the words similar in meaning

1. development	a. easy
2. importance	b. evolution
3. introduce	c. broadly
4. simple	d. significance
5. widely	e. present
6. several	f. use

7. screen — g. some
8. application — h. display

5. Match the words opposite in meaning

1. enable	a. insignificant
2. movement	b. old
3. new	c. narrow
4. wide	d. disable
5. great	e. halt
6. single	f. slow
7. high-speed	g. increase
8. lessening	h. multiple

6. Translate the following word combinations into Russian

1. to provide a far greater level of detail
2. to accommodate the wide range of measurements
3. a research center
4. to display on the screen
5. electronics industry
6. essential item
7. to be widely used
8. rather than

7. Find the English equivalents to the following word combinations in the text

1. высокоскоростной цифровой преобразователь
2. электронно-лучевая трубка
3. хороший уровень детализации
4. двигаться вперёд
5. электронное оборудование

6. диагностический прибор

7. уровень качества продукции

8. Complete the sentences using the text and translate them into Russian

1. The oscilloscope is a type of test … signal voltages to be displayed on a screen in a two dimensional format.

2. … his the scope is able to provide a far greater level of detail than simpler items of test equipment.

3. This made the oscilloscope much easier to perform as waveforms were able to be displayed in a … .

4. Oscilloscopes have been in use … industry for many years.

5. … single pulse waveforms to be displayed rather than just repeating waveforms.

9. Reorder the words to make a sentence

1. famous, test instruments, or scope must be, The oscilloscope, one of the most, widely used and

2. later founded, Walter, the LeCroy Corporation

3. In view, of its usefulness, in any electronics laboratory, is an essential item, and many other environments, the oscilloscope

4. in use within, the electronics industry, have been, for many years, Oscilloscopes

10. Complete the text with one word and translate it into Russian

1. A conventional digital oscilloscope is known as a … storage oscilloscope (DSO).

2. Its display typically relies … a raster-type screen rather … the luminous phosphor found in an older analog oscilloscope.

3. Digital storage oscilloscopes (DSOs) allow you … capture and view events that may happen only once – known *as* transients.

4. Because the waveform information exists … digital form as a series of stored binary values, it can be analyzed, archived, printed, and otherwise processed, within the … itself or by an external computer.
5. The waveform need … be continuous; it can … displayed even when the signal disappears.
6. Unlike analog oscilloscopes, digital storage oscilloscopes provide permanent signal … and extensive waveform processing.
7. However, DSOs typically have … realtime intensity grading; therefore, they … express varying levels of intensity in the live signal.

11. Write the summary of the text

12. Render the following text

The Types of Oscilloscopes Electronic equipment can be classified into two categories: analog and digital. Analog equipment works with continuously variable voltages, while digital equipment works with discrete binary numbers that represent voltage samples. A conventional phonograph is an analog device, while a compact disc player is a digital device. Oscilloscopes can be classified similarly – as analog and digital types. In contrast to an analog oscilloscope, a digital oscilloscope uses an analog-to-digital converter (ADC) to convert the measured voltage into digital information. It acquires the waveform as a series of samples, and stores these samples until it accumulates enough samples to describe a waveform. The digital oscilloscope then reassembles the waveform for display on the screen. Digital oscilloscopes can be classified into digital storage oscilloscopes (DSOs), digital phosphor oscilloscopes (DPOs), mixed signal oscilloscopes (MSOs), and digital sampling oscilloscopes. The digital approach means that the oscilloscope can display any frequency within its range with stability, brightness, and clarity. For repetitive signals, the bandwidth of the digital oscilloscope is a function of the analog bandwidth of the front-end components of the oscilloscope, commonly referred to as the – 3 dB point. For single-shot and transient events, such as pulses and steps, the bandwidth can be limited by the oscilloscope's sample rate. Please refer to the Sample Rate section under Performance Terms and Considerations for a more detailed discussion.

Adapted from www.ab4oj.com

12. Render in English

Осциллографы – незаменимый инструмент для тех, кто проектирует, производит или ремонтирует электронное оборудование. В современном быстро изменяющемся мире специалистам необходимо иметь самое лучшее оборудование для быстрого и точного решения своих насущных, связанных с измерениями задач. Будучи "глазами" инженеров в мир электроники, осциллографы являются ключевым инструментарием при изучении внутренних процессов в электронных схемах. Применение осциллографов не ограничивается лишь миром электроники. При использовании соответствующего преобразователя осциллографы способны контролировать любые природные явления. Преобразователь – это устройство, генерирующее электрические сигналы в ответ на какое-либо физическое воздействие, такое как звук, механический удар, давление, свет или тепло. Например, микрофон представляет собой преобразователь звука в электрический сигнал. Осциллографы используют все: от физиков-ядерщиков до мастеров, ремонтирующих простейшую бытовую электронику. Инженеры по обслуживанию автомобилей используют осциллографы для измерений вибраций двигателей. Врачи – для измерений волн, генерируемых человеческим мозгом. Возможности прибора под названием осциллограф бесконечны.

Электрический колебательный процесс изначально фиксировался вручную на бумаге. Первые попытки автоматизировать запись были предприняты Жюлем Франсуа Жубером в 1880 году, который предложил пошаговый полуавтоматический метод регистрации сигнала. Развитием метода Жубера стал полностью автоматический ондограф Госпиталье. В 1885 году русский физик Роберт Колли создал осциллометр, а в 1893 году французский физик Андре Блондель изобрел магнитоэлектрический осциллоскоп с бифилярным подвесом.

Подвижные регистрирующие части первых осциллографов обладали большой инерцией и не позволяли фиксировать быстротечные процессы. Этот недостаток был устранён в 1897 году Уильямом Дадделлом, который создал светолучевой осциллограф, использовав в качестве измерительного элемента небольшое лёгкое зеркальце. Запись производилась на светочувствительную пластину. Вершиной развития этого метода стали в середине XX века многоканальные ленточные осциллографы.

Практически одновременно с Дадделлом Карл использовал для отображения сигнала изобретённый им кинескоп. В 1899 году устройство было доработано Йонатаном Зеннеком, получившим горизонтальную развертку, что сделало его похожим на современные осциллографы. Кинескоп Брауна в 1930-е годы заменил кинескоп Зворыкина, что сделало устройства на его основе более надёжными.

В конце XX века на смену аналоговым устройствам пришли цифровые. Благодаря развитию электроники и появлению быстрых аналого-цифровых преобразователей, к 1980-м годам они заняли доминирующую позицию среди осциллографов.

Adapted from http://lib.chipdip.ru

APPENDICES

Appendix 1

1. Как составить аннотацию к тексту на русском языке

При написании аннотации используйте следующие клише:

Статья (текст) посвящена проблеме/вопросу … В начале статьи

- речь идет о …

- дается определение …

- обосновывается значимость …

- привлекается внимание …

Далее

- описывается …

- рассказывается…

- рассматривается …

- излагается …

В частности

- отмечается, например, …

- подробно излагается …

- описывается схема …

- указывается …

- доказывается мысль …

Наконец

- рассказывается…

В заключение

- приводятся примеры

Подытоживая сказанное, следует отметить …

Как мне кажется, статья может представлять интерес для …

Думается, статья может оказаться полезной для …

2. Как составить аннотацию к тексту на английском языке

Для составления аннотации используйте следующие клише:

The text/article under review … (gives us a sort of information about …).

The article deals with the problem …

The subject of the text is …

At the beginning (of the text) the author describes … (dwells on …; explains…; touches upon …; analyses …; comments …; characterizes …)

The article begins with the description of …, a review of …, the analyses of …

The article opens with …

Then (after that, further on, next) the author passes on to…, gives a detailed (thorough) analysis (description), goes on to say that …

To finish with, the author describes …

At the end of the article the author draws the conclusion that …; the author sums it all up (by saying …)

In conclusion the author …

Appendix 2
Numbers

numbers	25 – twenty-five
	514 – five hundred and fourteen
	7,938 – seven thousand nine hundred and thirty-three
	2,045,238 – two million forty-five thousand two hundred and thirty eight
fractions and decimals	½ kilometer – half a kilometer
	1/3 ton – one third of a ton
	0.2 – point two
	6.145 – six point one four five

Appendix 3

Reading basic formulae

sign	noun	verb
+	addition	add
–	subtraction	subtract
×	multiplication	multiply
÷	division	divide

ABC are *capital letters; def* are *small letters*

$a+b=c$	*a* plus *b* equals *c*
$a-b=c$	*a* minus *b* equals *c*
$a \times b=e$	*a* times *b* eaquals *e* or, *a* multiplied by *b* equals *e*
$\frac{a}{b}=f$	*a* over *b* equals *f*
a^2	*a* square or, *a* to second power
a^3	*a* cubed or, *a* to the third power
$\frac{V}{I}=\mathrm{R}$	**V** over **I** equals **R** (all capital letters)
$\mathrm{F}=\frac{mv^2}{r}$	capital **F** equals small **m** small **v** squared all over small **r**

Appendix 4

The names for the Greek letters

alpha	['ælfə]	nu	['njuː]
beta	['biːtə]	xi	['saɪ]
gamma	['gæmə]	omicron	[əu'maɪkrən]
delta	['deltə]	pi	[paɪ]
epsilon	[epsɪlɔn]	rho	[rəu]
zeta	['ziːtə]	sigma	['sɪgmə]
eta	['iːtə]	tau	[tɔː]
theta	[θiːtə]	upsilon	['ʌpsɪlɔn]
iota	[aɪ'əutə]	phi	[faɪ]
kappa	['kæpə]	chi	[kaɪ]
lambda	['læmdə]	psi	[psaɪ]
mu	['mjuː]	omega	['əumɪgə]

GLOSSARY

absolute zero

Temperature at which gases cease to exert pressure;

0 K, or -273°C

acceleration

Rate of change of velocity, or the change in velocity divided by the time it takes for the change to occur

alternating current (AC)

Type of current that naturally results from the continued turning of a coil (e.g., an electromagnet) in a fixed magnetic field; the type of current in your house

alloy

Solid mixture containing two or more metals, or a metal and other elements

amplifier

An electronic device used to increase the strength of the signal fed into it

ammeter

Instrument for measuring the flow of electricity

ampere (amp)

Rate of flow equal to one coulomb of electric charge per second

amplitude

"Height" of a wave, measured as a displacement from a zero level

atom

Once thought to be the smallest component of matter; now thought to be simply the smallest unit of an element

cathode ray tube (CRT)

A vacuum tube containing one or more electron guns, and a phosphorescent screen used to view images

capacitance

Rating, stated in ohms, of the ability of a nonconductor (dielectric) to store charge when there is a difference in potential between its opposite surfaces

Celsius scale

System of temperature measurement in which the ice point is designated as 0° and the steam point as 100°; formerly called *centigrade* system

charge

Property of matter that is a measure of its excess or deficit of electrons

chemical potential energy

Energy stored in chemical bonds

compound

Substance that is the combination of two or more elements

conduction

Transfer of molecular motion through a substance by collisions; one way in which heat passes from one material to another

conductor

Material that allows electric charge to pass freely, with little resistance

coulomb

SI unit of electric charge; equal to the quantity of electricity moved by a current of 1 A in 1 s

degree

Unit for measuring temperature on various scales

direct current (DC)

Type of current in which the charge flows continually in one direction; the type of current in handheld electronics

electric circuit

Complete path of an electric current, including a source of potential difference and usually including various components (e.g., resistors, diodes)

electric current

Charge in motion

electric field

Space in the vicinity of a charged object in which its force or some part of it is exerted

electric force

Attractive or repulsive force between two charged objects (the Coulomb force)

electric resistance

Opposition of a conductor to the passage of electric V current

electricity

Electric current or power; the study of charges in motion

electromagnet

Device for increasing electromagnetic force by means of a soft-iron core

electromagnetic force

Combination of magnetic and electric forces, due to the motion of charged particles

electromagnetic induction

Production of electric current by means of a coil and a magnet

electromagnetic waves

Any waves that result from the motion of charged particles

electromotive force (emf)

A potential difference that causes electric charges to flow

electron

Smallest indivisible particle with negative charge

electrostatic induction

Production of an electric charge in a neutral body by bringing it near a charged one

electrostatics

Study of charges that are not in motion

element

Chemical that cannot be further broken down into component chemicals

emission lines

Bright spectral lines emitted by excited atoms with or without a continuous spectrum as a result of electronic transitions

energy

Ability to do work

field lines

Lines indicating the direction of a force field

force

Push or pull exerted on or by an object

free fall

State of an object under the influence of a gravitational force with no counteracting force

frequency

Number of vibrations per second of a wave; the reciprocal of period

fundamental units

Units of measurement that are the basis of our measurement of the universe; the meter (length) and second (time) are examples of fundamental units

galvanometer

Coil of wire that is free to rotate in a magnetic field; can be used to measure voltage or current

generator

Device used to convert mechanical energy into electrical current

gravitational potential energy

Energy associated with position in a gravitational field, or the amount of work an object can perform by returning to its original position

gravity

Attractive force between objects with mass; the curvature of space-time induced by the presence of mass

grounding

Loss of charge that occurs when a charged object is connected to a very large body with an almost infinite capacity to provide or absorb electrons

heat

Thermal energy that can be transferred between two bodies at different temperatures

hertz (Hz)

Unit of frequency; 1 Hz equals 1 cycle per second

integrated circuit (IC), (chip)

A small electronic device made out of a semiconductor material

insulator

Nonconductor; material that impedes passage of electric charge

kelvin

Temperature increment of the Kelvin, or absolute, scale of temperature; formerly called degree Kelvin

Kelvin scale

Temperature scale based on absolute zero (-273°C), also called *absolute scale*

kinetic energy (KE)

Energy of a moving body

liquid

State of matter in which the matter has no shape of its own but takes the shape of its container

magnetic field

Region around a magnet in which its effects are exerted

magnetic induction

Temporary transference of magnetism from a permanent magnet to another material

magnetic poles

The two ends of a magnet, north and south

magnetism

Ability to attract iron and certain other metals with a similar molecular structure

mass

Amount of matter an object or substance contains

matter

In classical physics, anything that takes up space; in modern physics, matter and energy are interchangeable

mechanical energy

Amount of work an object (body) can do

meter

Fundamental unit of length, about 39.37 in.

metric system

System of measurement in which all fundamental units are multiples of 10

molecule

Stable combination of two or more atoms

oscillate

Move back and forth about a center; vibrate

oscilloscope

electronic test instrument that allows observation of constantly varying signal voltages on a screen in a two dimensional format

parallel circuit

Connection of electrical components in such a way that current can branch in multiple directions, one through each component in parallel

period

Time required to complete one cycle of a wave; the reciprocal of frequency.

physics

Study of matter, energy, and the laws governing their interactions

potential difference

Difference in electric charge between two objects; a charge will tend to move from the area of higher potential to the area of lower potential

power

Rate of doing work

pressure

Amount of force exerted by an object on the area of the surface on which it acts

resistance

Capacity of an object or material to impede motion; also, the capacity of a material to impede the motion of charge

resonance

Process by which sound vibrations build up

scalar

Measured quantity that has size but no direction; mass is a scalar quantity

second

Basic unit of time in both the English and the metric systems

semiconductor

Solid-state device having medium resistivity used to transmit and amplify electronic signals

series circuit

Connection of electrical components in such a way that the same current flows through each component

solenoid

Coil of wire that can carry current; used in transformers

solid

State of matter that has a definite shape and volume

speed

Rate at which something moves

static electricity

Electric charge resting on an object

superconductor

Substance that at low temperature has almost no resistance to the passage of current

temperature

Degree of hotness or coldness of an object or an environment; a measure of the average velocity of particles in a substance

time

Continuum along which events move from the past through the present and into the future; not an absolute according to special relativity

transformer

Device that changes voltage and current values in AC circuits

transistor

Devices that switch electric currents on and off or amplify electric currents

vacuum

Space devoid of matter

vector

Measured quantity that has both a magnitude and a direction; weight, for example, is a vector quantity

velocity

Speed measured in a particular direction (a vector quantity)

volt

Measure of potential difference equal to 1 J/C

voltmeter

Instrument for measuring voltage that passes current through a rectangular coil having a high resistance

watt

Measurement of power; working rate of 1 J/s

weight

The pull of Earth's gravity on an object

work

Transfer of energy to an object by the application of a force over some distance

Abbreviations

Список сокращений и условных обозначений

A

A – ampere – ампер

AC – alternating current – переменный ток

As – arsenic – мышьяк

ASIC – Application Specific Integrated Circuit – интегральная схема специального назначения

B

B – boron – бор

C

C – coulomb - кулон

c – cycle – цикл

CERN - the European Organization for Nuclear Research - Европейский совет по ядерным исследованиям

CRT – Cathode Ray Tube – электронно-лучевая трубка (ЭЛТ)

D

DC – direct current – постоянный ток

DSO – Digital Storage Oscilloscope – цифровой запоминающий осциллограф

E

E – electric field – электрическое поле

emf – electromotive force – электродвижущая сила (ЭДС)

F

F – coloumb force – кулоновская сила

G

GPE – gravitational potential energy – гравитационная потенциальная энергия

H

Hz – Hertz – Герц (Гц)

I

I – current – ток

IC - integrated circuit – интегральная схема

J

J – Joule – Джоуль (Дж)

K

K – Kelvin – Кельвин

N

N – Newton – Ньютон (Н)

n – number – число, количество

n – negative charge – отрицательный заряд

O

Op Amp – Operational Amplifier – операционный усилитель

P

P – power – мощность

p – positive charge – положительный заряд

Q

q – charge - заряд

R

R – resistance - сопротивление

S

s – second – секунда (с)

SI – System of International Units – Международная система единиц (СИ)

Si - silicon – кремний

V

V – voltage – напряжение, вольт

Ω

Ω – omega (Ohm) – омега (Ом)

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Учебное издание

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RADIOPHYSICS AND ELECTRONICS

Дизайн обложки

Подписано в печать
Бумага офсетная. Печать цифровая.
Формат 60x84 1/16. Гарнитура «Times New Roman». Усл. печ. л. .
Тираж экз. Заказ

Отпечатано с готового оригинал-макета
в типографии Издательства Казанского университета

420008, г. Казань, ул. Профессора Нужина, 1/37
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