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**ПРАКТИЧЕСКОЕ ПОСОБИЕ**

**ПО ИНОСТРАННОМУ ЯЗЫКУ В ПРОФЕССИОНАЛЬНОЙ ДЕЯТЕЛЬНОСТИ**

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SECTION I TOPICS

**The Electric Current**

When a conductor joins two points of different potential, electricity flows from one to the other along the conductors until the potentials are equal. This process is very rapid, and with good conductors is completed in a fraction of a second. While it lasts, an electric current is said to flow from one point to the other. By convention, the direction of the current is said to be that from the higher to the lower potential, i.e. the direction in which positive charges would travel, but actually, owing to their much greater mobility, it is the negative electrons which move, and it is their motion which constitutes the current.

**2. Translate. Переведите на русский язык:**

Conductor, potential, rapid, direction, positive, charge, mobility, motion, negative, current.

**3. Translate the sentences. . Переведите предложения:**

1) Electricity flows from one potential to the other until the potentials are equal.

2) An electric current flows from one point to the other.

3) The motion of the negative electrons constitutes the electric current.

**4. Find the correct answer in each case Выбрать правильный вариант слова:**

When a conductor joins two points of different potential... flows from one to the other.

a) process b) electricity c) motion

**5. Find the correct answer. Выбрать правильный вариант:**

This process is very ... and is completed in a fraction of a second.

a)large b)slow c) rapid

**6. Find the correct answer. Выбрать правильный вариант:**

The direction of the ... is that from the higher to the lower potential

a) current b) electricity c) charge

**7. Complete the sentence. Закончить предложение:**

The electric current passing through a wire ....

a) will cool that wire b) will heat that wire

**8**. **Complete the sentence. Закончить предложение**

By connecting wires to the top and bottom discs Volta ....

a) was able to get electric current

b) was able to heat a conductor

**9.** **Complete the sentence. Закончить предложение**

When an electric current flows along a conductor, ....

a) the latter becomes strong

b) the latter becomes heated

**10. Make the sentence. Составить предложение:**

from, to, along, flows, potential, the, conductor, electricity, one, other, the.

**11. Translate. Перевести на английский язык.**

1) Направление тока осуществляется от высшего к низшему потенциалу.

2) Электричество течет от одного потенциала к другому, пока потенциалы равны.

3) Именно движение отрицательных электронов образует электрический ток.

**Faraday's Experiment**

Faraday knew from his long study of electricity that magnetism should be able to produce a current, as well as vice versa. In spite of his various failures, the idea of producing a current directly by magnetic action remained firm in his thoughts. One of his friends said later how at this period of his long life Faraday used to carry about with him in his pocket a small rough model of electro-magnetic apparatus. This consisted simply of an inch-long straight iron core with some turns of copper wire wound round it. The basic idea he had in mind was this: if an electric current in a wire can produce a magnetic effect, why should not a magnet near a conducting wire produce an electric current?

**2. Перевести на русский язык:**

electricity, magnetism, various, directly, magnetic, action, really, successful, immediately, reaction.

3. **Перевести на русский язык:**

1) Faraday knew that magnetism should be able to produce a current.

2) He had produced electricity through magnetism which had never been done before.

3) Faraday used to carry about with him a model of electromagnetic apparatus.

4. **Выбрать правильный вариант:**

In spite of his various.... Faraday was sure that magnetism should be able to produce a current.

a) failures b) purposes c) magnets

5. **Выбрать правильный вариант:**

Anyone who has a coil of wire, a.... magnet and a sensitive current indicator may repeat Faraday's experiment.

a. ) big b) bar c) copper

6. **Выбрать правильный вариант:**

Amplifying the current, the scientist.... the necessary results

a) deflected b) got c) switched on

7. **Закончить предложение**

Faraday's basic idea was that a magnet near a conducting wire should be.....

a) on opposite sides of the ring b) able to produce an electric current

8. **Закончить предложение**

Faraday separated each turn.....

a) by string for insulation purposes b) fed from the battery

9. **Закончить предложение**

Faraday wound long coils of thin copper wire....,

a) he was disappointed b) on opposite sides of the ring

**10. Составить предложение:**

by, produce, wanted, electricity, Faraday, to, electromagnetism.

**11. Перевести на английский язык:**

1) Идея получения тока непосредственно действием магнита не оставляла его мыслей,

2) Обычно Фарадей носил в кармане маленькую модель электромагнитного прибора.

**12. Answer the questions. Ответить на вопросы:**

1) What was Faraday famous for?

2) What was his idea?

3) What can you say about a small model of electro-magnetic apparatus,

**The Discovery of Magnetic Induction.**

The discovery in 1820 that there was a close connection between electricity and magnetism was very exciting -until then, the two subjects had been considered as quite independent. The first discovery was that currents in wires make magnetic fields; then in the same year, it was found that wires carrying current in a magnetic field have forces on them. In 1840 Faraday discovered - electric effects exist only when there is something changing. If one of a pair of wires has a carrying current, a current is induced in the other, or if a magnet is moved near an electric circuit, there is a current. We say that currents are induced.

**2. Переведите слова и словосочетания:**

Discovery, magnetic induction, wires, magnetic fields, current, electric effects, induced, an electric circuit, connection, electricity and magnetism.

**3. Переведите предложения:**

1) Electricity and magnetism subjects had been considered as quite independent subjects.

2) If currents make magnetic fields, people suggested that magnets might also make electric fields.

4. **Выбрать правильный вариант:**

For the atom to be electrically neutral, the number of protons must be....... to that of electrons.

a) more b) equal c) less

5.**Выбрать правильный вариант:**

We know Isaac Newton to express the connection between........ and motion in the form of several laws.

a) electricity b) current c) force

6. **Выбрать правильный вариант:**

Before Faraday's discovery the only usable source of........ was the galvanic battery.

a) electricity b) magnetism c) conduction

**7. Закончить предложение:**

Artificial magnets may be made by placing.........

a) a magnet to be magnetised into a battery

b) a piece of iron or steel to be magnetised into a coil

8. **Закончить предложение:**

Faraday wanted to produce electricity by.........

a) Electromagnetism b) electric circuit

**9. Составить предложение:**

Was, carrying, a, have, them, discovery, that, current, magnetic, forces, the, wires, in, field, on.

**10. Составить предложение:**

A, electricity, and, had, as, was, between, magnetism, subjects, considered, independent, there, connection, and, these, been, quite.

**Generating an Electric Current**

Alessandro Volta, a professor of physics, established the true source of the electric current. He demonstrated that it could be produced by the action of dissimilar metals. In 1800 he developed the first electric battery, a device known as a voltaic pile. Although he tried a number of different materials he found that the best results were obtained when he used silver and zinc as the two metals. The pile consisted of a series of small disks of these and of cardboard, the latter having been soaked in a salt solution.

**2. Translate. Переведите слова и словосочетания:**

source, dissimilar, device, a voltaic pile, silver, zinc, cardboard, soaked, salt solution, series.

**3**.  **Translate. Переведите слова и словосочетания:**

1) The electric current could be produced by the action of dissimilar metals.

2) A voltaic pile consisted of a series of small disks and of cardboard.

4. **Find the correct answer** **Выбрать правильный вариант:**

Alessandro Volta established the true... of the electric current.

a) material b) source c) field

**5. Find the correct answer Выбрать правильный вариант:**

During his experiments Volta developed the first electric...

1. battery b) source c) device

6. **Find the correct answer** **Выбрать правильный вариант:**

By connecting... to the top and bottom discs Volta got electric current

a) discs b) wires c) bars

**7. Complete the sentence. Закончить предложение:**

An electric current is a flow of electrons along...

a) the particles were electrons

b) a metal wire or a conductor

**8. Complete the sentence. Закончить предложение:**

There are many measuring devices e. g....

a) galvanometers, voltmeters and others

b) slight changes every day

**9. Complete the sentence. Закончить предложение:**

The method of producing electricity directly from heat attracts...

1. problem of life

b) attention of scientists

**10. Составить предложение:**

that, current, produced, action, metals, demonstrated, the, could, by, of, Volta, electric, be, the, dissimilar

**Types of transformers**

There are different types of transformers. By the purpose they are classified into step-up transformers and step-down transformers. In a step-up transformer the output voltage is larger than the input voltage, because the number of turns on the secondary winding is greater than that of the primary. In a step down transformer the output voltage is less than input voltage as the number of turns on the secondary is fewer than that on the primary.

By the construction transformers are classified into core-type and shell type transformers. In the core-type transformers the primary and the secondary coils surround the core. In the shell type transformers the iron core surrounds the coils. Electrically they are equivalent. The difference is in the mechanical construction.

By the methods of cooling transformers are classified into air – cooled, oil – cooled and water – cooled transformers.

By the number of phases transformers are divided into single – phase and polyphase transformers.

Instrument transformers are of two types, current and potential.

A current transformer is an instrument transformer used for the transformation of a current at a high voltage into proportionate current at a low voltage.

Current transformers are used in conjunction with a.-c. meters or instruments where the current to be measured must be of low value. They are also used where high – voltage current has to be metered. A voltage transformer, which is also called a potential transformer, may be defined as an instrument transformer for the transformation of voltage from one value to another. This transformer is usually of a step – down type because it is used when a meter is installed for use on a high – voltage system.

Transformers operate equally well to increase the voltage and to reduce it.

The above process needs a negligible quantity of power.

Transformers are widely used in our everyday life. All radio – sets and all television sets are known to use two or more kinds of transformers. These are familiar examples showing that electronic equipment cannot do without transformers.

**2. Объясните значение интернационализмов:**

1) to classify; 2) method; 3) phase; 4) instrument; 5) system; 6) process; 7) radio; 8) television.

**3. Переведите на английский:**

1) цель; 2) повышающий / понижающий трансформатор; 3) выходящее / входящее напряжение; 4) число витков; 5) механическое устройство; 6) монофазные / полифазные трансформаторы; 7) высокое / низкое напряжение.

**5.Переведите на русский слова и словосочетания из текста:**

1) core-type / shell-type transformers; 2) air-cooled / oil – cooled / water – cooled transformers; 3) current / potential transformers; 4) in conjunction with smth.; 5) to reduce; 6) electronic equipment.

**6. Дополните предложения с опорой на текст:**

1. By the purpose transformers are …

2. By the construction transformers are …

3. By the methods of cooling transformers are …

4. By the number of phases transformers are …

5. Transformers operate equally well…

6. Process of voltage changing needs…

7. Familiar examples of transformer applications are …

**7. Ответьте на вопросы:**

1. What voltage is larger in a step-up transformer and why? 2. What voltage is less in a step – down transformer and why? 3. What is the construction of a core – type transformer?4. What is the construction of a shell – type transformer? 5. What are the two types of instrument transformers? 6. What are current transformers used for? 7. What are potential transformers used for?

**The Tools You Need for Electrical Projects**

Electrical work will require a few tools to accomplish the job. This is a partial list of needed tools to take care of most electrical jobs. These tools are readily available at most building material outlet stores or electrical wholesale stores. If you are a serious electrician depending on your tools to get the job done, tool cost is not a problem. The descriptions below will help you in selecting the proper tools for the type of electrical projects you will encounter. The greatest electrical tools that can make your life easier doing electrical work!

A fish tape is used to pull stranded or solid wire through metal or PVC conduit. Cable lube is available to assist you in pulling the wires through the pipe.

A tape measure is used to measure heights for switches and outlets. You will also need it to center lighting fixture boxes.

A voltmeter is used to check voltages and verify that circuits are indeed “live”. There are many manufacturers of these testers with various options available. Choose the voltmeter that serves your needs.

A hammer is used to secure boxes equipped with nail-on brackets to studs in a home. You’ll also need it to drive straps when adding new wiring in a home.

Channel lock pliers are used to take knockouts out of the boxes, tighten down connectors in the boxes, and adjust expansion-type ceiling fan boxes.

Wire strippers are used to cut the insulation off of the wire. They are equipped with different sized cutting teeth for various sized wires. They also have a cutoff portion in order to cut the wire.

A voltage detector is used for a quick safety check to see if there is voltage or current flow present. Some of these devices are automatic and some must be turned on via a switch. Simply place the end of the tracer beside a wire, breaker or cord to see if it’s energized.

Cutting pliers, sometimes called side snips, are used to cut wire. They are specially designed with a cutting edge that goes down to the tip of the pliers. The advantage being that you can get into tight areas to trim wires. There are some that are equipped with live wire detection capabilities.

Flashlight. A light comes in handy in those places where lighting is limited. Never try to reach into a panel without proper lighting.

A knife is needed to cut the insulation off of wiring. You will also need to open boxes when doing the installation and this tool will come in handy.

A screwdriver has four blades used to install Phillips-head screws. The tip looks like a plus sign.

А screwdriver is used for straight slot screws. You will likely need more than one size for your project. If you have to choose just one, pick a medium blade. It will suit most projects.

Wire crimper. This tool strips the wire and also crimps lugs onto the wire.

**Напишите названия инструментов**

|  |  |  |
| --- | --- | --- |
| **1** |  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **2** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **3** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **4** | **https://images-na.ssl-images-amazon.com/images/I/41qM9ujhD%2BL._SL1001_.jpg** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **5** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **6** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **7** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **8** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **9** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **10** | **Stanley 10-099 6 in Classic 99Â® Retractable Utility Knife, 1-Pack** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **11** | **https://images-na.ssl-images-amazon.com/images/I/619isk3Yg7L._SL1069_.jpg** | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **12** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **13** |  | **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

**SECTION II READING**

**Text 1. Electromotive force**

When free electrons are dislodged from atoms, electrical energy is released.

Chemical reaction, friction heat and electromagnetic induction will cause electrons to move from one atom to another. Whenever energy in any form is released, a force called electromotive (e. m. f.) is developed. If the force exerts its effort always in one direction, it is called direct; and if the force changes its direction of exertion periodically, it is called alternating.

The chemical reaction in a dry cell, heat and friction are sources of a unidirectional force. Electromagnetic induction produces an alternating force. The direction of force depends on the direction in which the field is cut. Whenever an e. m. f. is developed, there is also a field of energy called an electrostatic field, which can be detected by an electroscope and measured by an electrometer.

**Text 2 Electromagnetic Induction**

An electromotive force is induced in the conductor when there is a change in the magnetic field surrounding a conductor. This induced electromotive force may be produced in several ways as follows:

a. A conductor may move in a stationary magnetic field of constant strength.

b. A stationary conductor may be exposed 'to a moving magnetic field of constant strength.

c. The strength of the field surrounding the conductor may change without any motion of conductor or magnetic circuit.

The electromotive force induced by motion of a conductor or a magnetic flux is the same when the conductor rotates and the flux is stationary or the flux rotates and the conductor is stationary. If both, conductor and flux, rotate in the same direction at the same speed, no electromotive force will be produced, if they rotate at the same speed but in opposite directions, the electromotive force induced would be twice as that which would be induced, if one of them was stationary. An electromotive force is not induced when a conductor is moved parallel to the lines of force, but only when it moves at an angle with these lines.

Any motion across the direction of the lines, however, will produce an electromotive force in the conductor. For this reason, the conductor is said to «cut» the lines of force. The actual electromotive force induced in the conductor depends upon the nature at which the flux is cut.

**Text 3 Electromotive force and resistance**

The electromotive force is the very force that moves the electrons from one point in an electric circuit towards another. In case this e. m. f. is direct, the current is direct. On the other hand, were the electromotive force alternating, the current would be alternating, too. The e. m. f. is measurable and it is the volt that is the unit used for measuring it. A current is unable to flow in a circuit consisting of metallic wires alone. A source of an e. m. f. should be provided as well. The source under consideration may be a cell or a battery, a generator, a thermocouple or a photocell, etc.

In addition to the electromotive force and the potential difference reference should be made to another important factor that greatly influences electrical flow, namely, resistance. All substances offer a certain amount of opposition, that is to say resistance, to the passage of current. This resistance may be high or low depending on the type of circuit and the material employed. Glass and rubber offer a very high resistance and, hence, they are considered as good insulators. All substances do allow the passage of some current provided the potential difference is high enough.

Certain factors can greatly influence the resistance of an electric circuit.

They are the size of the wire, its length, and type. In short, the thinner or longer the wire, the greater is the resistance offered.

**Text 4 Generators**

The powerful, highly efficient generators and alternators that are in use today operate on the same principle as the dynamo invented by the great English scientist Faraday in 1831. Dynamo-electric machines are used to supply light, heat and power on a large scale. These are the machines that produce more than 99.99 per cent of all the world's electric power.

There are two types of dynamos – the generator and the alternator. The former supplies d. c. which is similar to the current from a battery and the latter provides a. c. To generate electricity both of them must be continuously provided with energy from some outside source of mechanical energy such as steam engines, steam turbines or water turbines.

A generator is an electric machine, which converts mechanical energy into electric energy. There are direct-current (d. c.) generators and alternating current (a. c.) generators. Their construction is much alike. A d. c. generator consists of stationary and rotating elements. The stationary elements are: the yoke or the frame and the field structure. The yoke forms the closed circuit for the magnetic flux. The function of the magnetic structure is to produce the magnetic field.

The rotating elements are: true armature and the commutator. They are on the same shaft. The armature consists of the core and the winding. The winding is connected to the commutator. With the help of the brushes on the commutator that conduct the electric current to the line the winding is connected to the external circuit. The stationary element of an a. c. generator is called a stator. The rotating element is called a rotor. The essential difference between a d. c. generator and a. c. generator is that the former has a commutator by means of which the generated e. m. f. is made continuous, i. e. the commutator mechanically rectifies the alternating e. m. f. so that it is always of the same polarity.

D. c. generators are used for electrolytic processes such as electroplating. Large d. c. generators are employed in such manufacturing processes as steel making. The d. c. generator of small capacities is used for various special purposes such as arc welding, automobile generators, train lighting systems, etc. It also finds rather extensive use in connection with communication systems.

**Text 5 Main structural elements of a D. C. machine**

A direct-current machine consists of two main parts, a stationary part, usually called the stator, designed mainly for producing a magnetic flux, and a rotating part, called the armature or the rotor. The stationary and rotating parts should be separated from each other by an air-gap. The stationary part of a d. c. machine consists of main poles, designed to create the main magnetic flux; commutating poles interposed between the main poles; and a frame. It should be noted here that sparkles operation of the machine would be impossible without the commutating poles. Thus, they should ensure sparkles operation of the brushes at the commutator.

The main pole consists of a laminated core the end of which facing the armature carries a pole shoe and a field coil through which direct current passes. The armature is a cylindrical body rotating in the space between the poles and comprising a slotted armature core, a winding inserted in the armature slots, a commutator, and a brush gear.

The frame is the stationary part of the machine to which are fixed the main and commutating poles and by means of which the machine is bolted to its bedplate. The ring shaped portion which serves as the path for the main and commutating pole fluxes is called the yoke. End-shields or frame-heads which carry the bearings are also attached to the frame. Of these main structural elements of the machine the yoke, the pole cores, the armature core and the air-gap between the armature core and the pole core are known to form the magnetic circuit while the pole coils, the armature windings, the commutator and brushes should form the electric circuit of the machine.

**Text 6 Electricians - What They Do**

Electricians install and maintain all of the electrical and power systems for our homes, businesses, and factories. They install and maintain the wiring and control equipment through which electricity flows. They also install and maintain electrical equipment and machines in factories and a wide range of other businesses.

Electricians generally focus on either construction or maintenance, although many do both. Electricians specializing in construction primarily install wiring systems into factories, businesses, and new homes. Electricians specializing in maintenance fix and upgrade existing electrical systems and repair electrical equipment. All electricians including emergency electricians in Sydney must follow State and local building codes and the National Electrical Code when performing their work.

Electricians usually start their work by reading blueprints - technical diagrams that show the locations of circuits, outlets, load centers, panel boards, and other equipment. After determining where all the wires and components will go, electricians install and connect the wires to circuit breakers, transformers, outlets, or other components and systems.

When installing wiring, electricians use handtools such as conduit benders, screwdrivers, pliers, knives, hacksaws, and wire strippers, as well as power tools such as drills and saws. Later, they use ammeters, ohmmeters, voltmeters, harmonics testers, and other equipment to test connections and ensure the compatibility and safety of components.

Maintenance electricians repair or replace electric and electronic equipment when it breaks. They make needed repairs as quickly as possible in order to minimize inconvenience. They may replace items such as circuit breakers, fuses, switches, electrical and electronic components, or wire.

Electricians also periodically inspect all equipment to ensure that it is operating properly and to correct problems before breakdowns occur.

Maintenance work varies greatly, depending on where an electrician works. Electricians who focus on residential work perform a wide variety of electrical work for homeowners. They may rewire a home and replace an old fuse box with a new circuit breaker box to accommodate additional appliances, or they may install new lighting and other electric household items, such as ceiling fans. These electricians also might do some construction and installation work.

Electricians in large factories usually do maintenance work that is more complex. These kinds of electricians may repair motors, transformers, generators, and electronic controllers on machine tools and industrial robots. They also advise management as to whether the continued operation of certain equipment could be hazardous. When working with complex electronic devices, they may consult with engineers, engineering technicians, line installers and repairers, or industrial machinery mechanics and maintenance workers.

**Text 7 Wire and connection symbols**

|  |  |
| --- | --- |
| Wire and connection symbols | |
| Wire.Connects components and passes current easily from one part of a circuit to another. | wire symbol |
| Wires joined. A 'blob' should be drawn where wires are connected (joined), but it is sometimes omitted. Wires connected at 'crossroads' should be staggered slightly to form two T-junctions, as shown on the right. |  |
| Wires not joined. In complex diagrams it is often necessary to draw wires crossing even though they are not connected. The simple crossing on the left is correct but may be misread as a join where the 'blob' has been forgotten. The bridge symbol on the right leaves no doubt! |  |
| Power supply symbols | |
| Cell. Supplies electrical energy. The larger line is positive (+). A single cell is often called a battery, but strictly speaking a battery is two or more cells joined together. | cell symbol |
| Battery. Supplies electrical energy. A battery is more than one cell. The larger line is positive (+). | battery symbol |
| Solar Cell. Converts light to electrical energy.  The larger line is positive (+). | solar cell symbol |
| Supplies electrical energy. DC = Direct Current, always flowing in one direction. | DC power supply symbol |
| Supplies electrical energy. AC = Alternating Current, continually changing direction. | AC power supply symbol |
| Fuse. A safety device which will 'blow' (melt) if the current flowing through it exceeds a specified value. | fuse symbol |
| Transformer. Two coils of wire linked by an iron core. Transformers are used to step up (increase) and step down (decrease) AC voltages. Energy is transferred between the coils by the magnetic field in the core, there is no electrical connection between the coils. | transformer symbol |
| Earth (Ground). A connection to earth. For some electronic circuits this symbol is used for the 0V (zero volts) of the power supply, but for mains electricity and some radio circuits it really means the earth. It is also known as ground. | earth symbol |
| Output device symbols | |
| Lamp (lighting). A transducer which converts electrical energy to light. This symbol is used for a lamp providing illumination, for example a car headlamp or torch bulb. | lamp (lighting) symbol |
| A transducer which converts electrical energy to light. This symbol is used for a lamp which is an indicator, for example a warning light on a car dashboard. | lamp (indicator) symbol |
| Resistor symbols | |
| A resistor restricts the flow of charge. Uses include limiting the current passing through an LED, and slowly charging a capacitor in a timing circuit. | resistor symbol |
| A rheostat has 2 contacts and is usually used to control current. Uses include controlling lamp brightness or motor speed and changing the rate of flow of charge into a capacitor in a timing circuit. | rheostat symbol |
| A potentiometer has 3 contacts and is usually used to control voltage. It can be used like this as a transducer converting position (angle of the control spindle) to an electrical signal. | potentiometer symbol |
| Capacitor symbols | |
| A capacitor stores electric charge. It can be used with a resistor in a timing circuit, for smoothing a supply (it provides a reservoir of charge) and can be used as a filter (blocking DC signals but passing AC signals). Unpolarised capacitors usually have small values, less than 1µF. | capacitor symbol |
| A capacitor stores electric charge. Polarised capacitors must be connected the correct way round. They usually have larger values, 1µF and greater. See above for uses. | polarised capacitor symbol |
| A variable capacitor is used in a radio tuner. | variable capacitor symbol |
| This type of variable capacitor is designed to be set when a circuit is made and then left without further adjustment. | trimmer capacitor symbol |
| Diode symbols | |
| A device which allows current to flow in only one direction. | diode symbol |
| A transducer which converts electrical energy to light. Usually abbreviated to LED. | LED symbol |
| Transistor symbols | |
| A transistor amplifies current and can be used with other components to make an amplifier or switching circuit. This symbol is for a bipolar junction transistor (BJT), the type you are most likely to use at first. | NPN transistor symbol |
| A transistor amplifies current and can be used with other components to make an amplifier or switching circuit. This symbol is for a bipolar junction transistor (BJT), the type you are most likely to use at first. | PNP transistor symbol |
| Audio and Radio symbols | |
| Microphone  A transducer which converts sound to electrical energy. | microphone symbol |
| Loudspeaker  A transducer which converts electrical energy to sound. | loudspeaker symbol |
| Meters and Oscilloscope | |
| Voltmeter. Measures voltage. The proper name for voltage is 'potential difference' but voltage is more widely used. | voltmeter symbol |
| Ammeter. Measures current. | ammeter symbol |
| Galvanometer  A very sensitive meter used to measure tiny currents, usually 1mA or less. | galvanometer symbol |
| Ohmmeter  Measures resistance. Most multimeters have an ohmmeter setting. | ohmmeter symbol |
| Oscilloscope  An oscilloscope is used to display the 'shape' of electrical signals - showing how they vary with time. It can be used to measure voltage and time periods. | oscilloscope symbol |

**SECTION III CHECKING UNDERSTANDING**

|  |  |
| --- | --- |
| **Electric Current:**  The flow of electric charges. | **http://www.techfak.uni-kiel.de/matwis/amat/semi_en/kap_2/illustr/drift_velocity.gif** |
| **Electric Current, I**  **I = q**  **t**  **Rate**  Unit: Coulomb / sec = Ampere (A)  Andre Ampere (1775-1836) | **http://www.techfak.uni-kiel.de/matwis/amat/semi_en/kap_2/illustr/drift_velocity.gif** |
| **Series circuit**  All in a row  1 path for electricity  1 light goes out and the circuit is broken |  |
| **Parallel circuit**  Many paths for electricity  1 light goes out and the others stay on |  |
| **Conventional current**  has the direction that the (+) charges would have in the circuit |  |
| **Fuse**  a small piece of metal that melts if the current becomes too high |  |
| **Circuit Breaker**  contains a small piece of metal that bends when it gets hot bending causes a switch to flip and opens the circuit |  |
| **Ammeter**  Measures electric current. |  |
| **Measuring current**  Electric current is measured in amps (A) using an ammeter connected in series in the circuit. |  |
| Must be placed in series | **http://www.physics.udel.edu/~watson/scen103/99s/images/ammeter-circ.gif** |
| **Resistance**  Resistance of an object to the flow of electrical current.  Resistance equals the ratio of voltage to current. | **R= V / I**  **Unit: Ohm (Ω)** |
| **Ohm’s Law** | **I = V / R**  **I=** Current (Amperes) (amps)  **V=** Voltage (Volts)  **R=** Resistance (ohms) |
| **Ohmic Resistor**  A device that obeys Ohm’s Law, who’s resistance does not depend on the voltage. |  |
| **Voltmeter**  Measures the voltage between two points in an electric circuit. |  |
| **measuring voltage**  The ‘electrical push’ which the cell gives to the current is called the voltage. It is measured in volts (V) on a voltmeter |  |
| A voltmeter is connected in parallel. |  |

**Test 1**

**1. A current is said to exist whenever \_\_\_\_\_.**

a. a wire is charged

b. a battery is present

c. electric charges are unbalanced

d. electric charges move in a loop

**2. Current has a direction. By convention, current is in the direction that \_\_\_.**

a. + charges move

b. - electrons move

c. + electrons move

**3. The drift velocity of mobile charge carriers in electric circuits is \_\_\_\_.**

a. very fast; less than but very close to the speed of light

b. fast; faster than the fastest car but nowhere near the speed of light

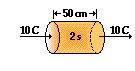
c. slow; slower than Michael Jackson runs the 220-meters

d. very slow; slower than a snail

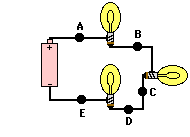
**4. If an electric circuit could be compared to a water circuit at a water park, then the current would be analogous to the \_\_\_\_.**

**Choices:**

|  |  |
| --- | --- |
| A. water pressure | B. gallons of water flowing down slide per minute |
| C. water | D. bottom of the slide |
| E. water pump | F. top of the slide |

**5. The diagram at the right depicts a conducting wire. Two cross-sectional areas are located 50 cm apart. Every 2.0 seconds, 10 C of charge flow through each of these areas. The current in this wire is \_\_\_\_ A.**

a. 0.10 b. 0.25 c. 0.50 d. 1.0 e. 5.0 f. 20 g. 10 h. 40 i. none of these

**** **6. Use the diagram at the right to complete the following statements:**

a. A current of one ampere is a flow of charge at the rate of \_\_\_\_\_\_\_ coulomb per second.

b. When a charge of 8 C flows past any point along a circuit in 2 seconds, the current is \_\_\_\_\_\_\_\_ A.

c. If 5 C of charge flow past point A (diagram at right) in 10 seconds, then the current is \_\_\_\_\_\_\_\_\_ A.

d. If the current at point D is 2.0 A, then \_\_\_\_\_\_\_ C of charge flow past point D in 10 seconds.

e. If 12 C of charge flow past point A in 3 seconds, then 8 C of charge will flow past point E in \_\_\_\_\_\_\_\_ seconds.

f. True or False:

The current at point E is considerably less than the current at point A since charge is being used up in the light bulbs.

**7.Which of the following lists include only conductors of electricity?**

a. iron, wood and paper

b. nichrome, plastic and paper

c. mercury, copper and carbon

d. wood, plastic and paper.

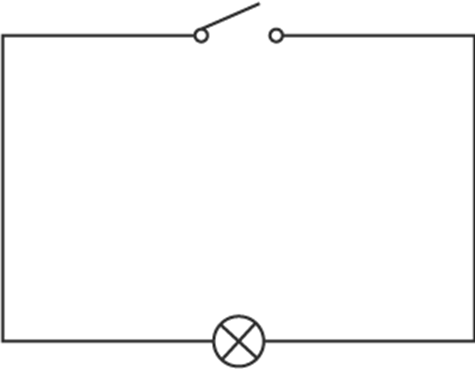
**8. Use the words from here (torch, battery, connecting wire, variable resistor, switch, globe) to label the diagram below.**

A is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ B is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

C is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ D is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Test 2 Electric current and potential difference**

**1.What needs to be done to this circuit so that the lamp lights up?**



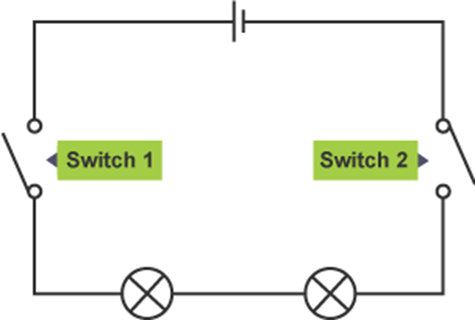
1. Close the switch
2. Add another lamp
3. Add a cell and close the switch

**2.What component does this circuit symbol represent?**



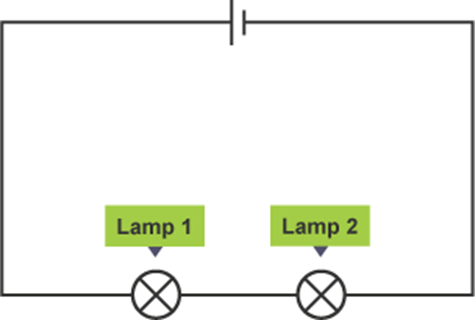
1. Cell
2. Voltmeter
3. Resistor

**3.Which switch or switches must be closed to make the lamps light?**



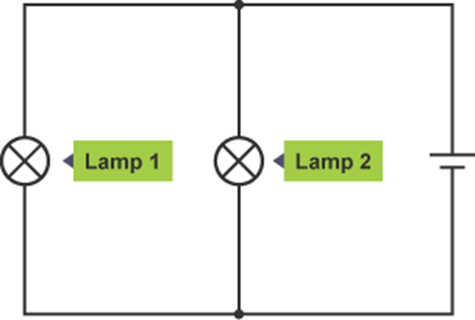
1. Only switch 1
2. Only switch 2
3. Switches 1 and 2

**4.If lamp 1 is unscrewed from its holder, what will happen to lamp 2?**



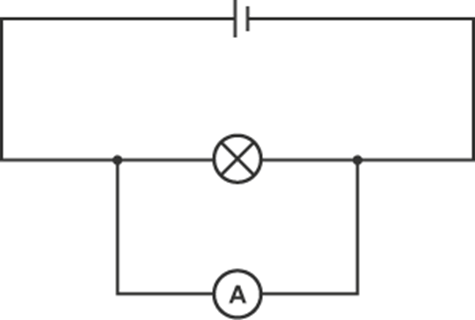
1. It will get brighter
2. It will go out
3. It will stay the same brightness

**5.If lamp 1 is unscrewed from its holder, what will happen to lamp 2?**



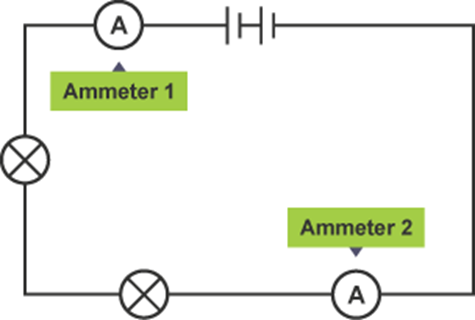
1. It will stay lit
2. It will go out
3. It will get dimmer

**6.What is wrong with this circuit diagram?**



1. There is only one cell
2. The ammeter should be connected in series
3. A ammeter should be connected in parallel

**7.Which ammeter will have the biggest reading?**



1. Ammeter 1
2. Ammeter 2
3. They will read the same

**8.Which statement about electric current is correct?**

1. It always flows clockwise
2. It gets used up as it goes around the circuit
3. It does not get used up as it goes around the circuit

**9.What is the definition of current?**

1. The flow of charge
2. A measure of the difference in energy
3. How difficult it is for electrons to flow

**10.Which term is used instead of voltage?**

1. Resistance
2. Potential difference
3. Current

**Test 3**

**1. D-cell battery is a source of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .**

1. electricity
2. force
3. magnetism
4. fuel

**2.What is a pathway for the flow of electricity?**

1. circuit
2. wire
3. tunnel

**3.What provides the energy to light a light bulb?**

1. energy field
2. magnetic field
3. circuit board
4. electricity source

**4.A battery refers to more than one \_\_\_\_\_\_\_\_\_\_.**

1. cell
2. energy
3. force
4. circuit

**5.In a simple series circuit, why does the bulb light when you close the switch?**

1. the switch produces electricity
2. closing the switch completes the circuit
3. closing the switch breaks the circuit

**6.If there is a 1.5V battery and a bulb on a simple series circuit and the battery is changed to a 3V, what happens to the bulb?**

1. it gets dimmer
2. it gets brighter
3. it gets overheated
4. nothing happens

**7.What do the long straight lines represent in a circuit diagram?**

1. motors
2. wires
3. batteries

**8.When charge builds up on your body after rubbing your feet on the carpet, what happens?**

1. static electricity
2. shock waves
3. magnetic field

**9.When you rub a balloon on a wool sweater or your hair, it gets an excess of \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ which causes it to stick to the wall.**

1. positive charge
2. negative charge

**SECTION IV VOCABULARY**

electronic circuits …………..электронные схемы

inductor ……………………индукционная катушка

capacitor ……………………конденсатор

electron tube ……………….электронная лампа

transistor ……………………транзистор

radio receiver………………. радиоприемник

radio transmitter …………….радиопередатчик

fixed resistor ………………..постоянное сопротивление

adjustable (variable) resistor ..переменное сопротивление

potentiometer ………………потенциометр

to handle the current ……….пропускать ток

to compute the current ……..рассчитать силу тока

inductance coil ……………..катушка самоиндукции

inductive reactance …………реактивное сопротивление

high-frequency circuit ………высокочастотная цепь

bond......................связывать, скреплять

bound.....................сглаживать, ограничивать

charge....................1 n. нагрузка, заряд; 2 v. заряжать

circuit...................схема, контур

closed circuit замкнутая цепь, замкнутый контур

equivalent circuit эквивалентная схема

linear circuit линейная схема

clockwise.................по часовой стрелке

counter clockwise против часовой стрелки

coil......................катушка, виток, обмотка

conductance...............активная проводимость

conjugate.................соединять

conjugated................сопряженный, соединенный

consume...................потреблять, расходовать

convey....................передавать, сообщать

current...................ток

curve.....................кривая, дуга

data......................данные

datum.....................данное, характеристика

denominator...............знаменатель

denote....................обозначать, указывать на (что-либо)

derive....................получать, извлекать

die out...................затухать (о сигнале)

direct current(DC)........постоянный ток

vary directly as изменяться прямо пропорционально

displacement..............смещение,перемещение

dissipated................рассеянный

distortion................искажение

drop......................перепад

earthed...................заземлено, заземленный

dead earth………… полное заземление

efficiency................КПД, эффективность

efficiency coefficient коэффициент полезного действия

emitter...................источник, генератор

expansion.................расширение

factor of safety ………….запас прочности

flow......................течение, поток

magnetic flux магнитный поток

frequency.................частота

fulfillment...............исполнение

furnace...................печь

gain......................усиление

grounded..................заземлено, заземленный

impedance.................полное сопротивление

incandescent lamp………… лампа накаливания

instant...................мгновенный

insulator.................изолятор

junction..................соединение, переход

lead......................1 n. свинец; 2 adj. свинцовый

linear....................линейный

linear circuit ………..линейная схема

load......................нагрузка

loop......................контур, цепь

lumped circuit ……….схема с сосредоточенными параметрами

lumped inductance ……………сосредоточенная индуктивность

lumped resistance …………….сосредоточенное сопротивление

notably...................исключительно, особенно

obtain....................получать

ohm(Ω)....................мера измерения сопротивления(ом)

oscillation...............колебание, вибрация

oscillation frequency ………………….частота колебаний

pairwise..................попарная

partial solution частное решение

permittivity..............диэлектрическая проницаемость, удельная емкость

polyphase.................многофазная

polyphase system многофазная система

qualitative...............качественный

quantity..................величина, параметр, количество

in direct ratio…….. прямо пропорционально, обратно пропорционально

reactance.................реактивное сопротивление

capacitance reactance ………….емкостное сопротивление

reduce....................понижать, уменьшать

relative..................относительный

reveal....................выявлять, показывать

short circuit.............короткое замыкание

Siemence(S)...............мера измерения электропроводности(сименс)

sought-for parameters ……………..искомые параметры

specific resistanse …………….удельное сопротивление

switch....................переключатель, переключать

load-sharing switch ………..переключатель распределения нагрузки

transient.................временный, переходный

triple....................1 n. тройной 2 v. утраивать

turn down диапазон изменения (параметра)

turn off выключать

turn on включать, включить

aerial wire антенна