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Харківський державний політехнічний коледж

Іноземна мова за проф. спрямуванням

(назва навчальної дисципліни)

Методичний посібник
для самостійної роботи студентів

зі спеціальності 5.151 Автоматизація та комп'ютерно-інтегровані
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(шифр і назва спеціальності)

спеціалізації 5.151.2 Обслуговування пристроїв електрозв'язку
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Методичний посібник розглянутий та рекомендований цикловою комісією гуманітарних та соціально-економічних дисциплін для використання студентами при

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Протокол № _____ від “ _____ ” _____ 20 _____ р.

Голова циклової комісії _____ (Діброва Л.М.)
(підпис) прізвище та ініціали

Схвалено методичною радою Харківського державний політехнічний коледж

Протокол № _____ від “ _____ ” _____ 20 _____ р

Голова методичної ради _____ (В.О.Величко)
(Підпис) прізвище та ініціали

Structure

The structure of a material is usually determined by the arrangement of its internal components.

On an atomic level, structure includes the organization of atoms relative to one another.

Subatomic structure involves electrons within individual atoms and interactions with their nuclei. Some of the important properties of solid materials depend on geometrical atomic arrangements as well as on the interactions that exist among atoms or molecules.

Various types of primary and secondary interatomic bonds hold together the atoms composing a solid.

The next larger structural area is of nanoscopic scale which comprises molecules formed by the bonding of atoms, and particles or structures formed by atomic or molecular organisation, all within 1 nm – 100 nm dimensions. Beyond nano scale are structures called microscopic, meaning that they can directly be observed using some kind of microscope. Finally, structural elements that may be viewed with the naked eye are called macroscopic.

Work with a partner. Fill in the table with the different structural levels and their characteristics as described in the text.

structural	characteristics

Choose the correct terms for the following definitions.

A sufficiently stable, electrically neutral group of at least two units in a definite arrangement

held together by strong chemical bonds.

.....
The smallest particle characterizing an element

.....
A fundamental subatomic particle, carrying a negative electric charge.

.....
It makes up almost all the mass of an atom.

.....
A positively charged subatomic particle.

.....
An electrically neutral subatomic particle.

.....

General tools

section 2.1 Tools Needed

All employees of Talbot Electrical Services will bring their own **tool kits**. Tool kits need to contain the basic tools needed for electrical jobs. These basic tools are sold at most hardware stores.

Pliers are needed for pulling and cutting wires. Your kit needs to include **long nose pliers** and **end cutting pliers**. **Side cutters** and **diagonal cutters** are recommended.

You must have **wire strippers** in your kit. Make sure they are able to strip the most common wires. You will also need several types of **screwdrivers** on the job.

A **flashlight**, **measuring tape** and **utility knife** will round out your kit.

Reading

Read the page from the company manual. Then, mark the following statements as true (T) or false (F).

- 1 _ Employees can buy the tools at hardware stores.
- 2 _ Side cutters and diagonal cutters are needed in the tool kit.
- 3 _ Wire strippers are used for cutting and pulling wire.

Write a word that is similar in meaning to the underlined part.

1 Jack forgot his pliers that are only used for cutting wire at the job site.

_ a _ n _ c _ t _ r _

2 A small, battery operated light is good for seeing in dark spaces.

_ l _ h _ _ g _

3 Mary used a tool with a thin, sharp slanted blade to cut open the box.

_ t _ _ t _ _ _ f _

4 The electrician bought a tool used for pulling out staples for his kit.

_ n _ _ t _ _ _ p _ _ e _

Match the words (1-6) with the definitions

(A-F).

- 1 _ tool kit
- 2 _ side cutters
- 3 _ screwdriver
- 4 _ long nose pliers
- 5 _ measuring tape
- 6 _ wire stripper

A a tool with blades able to grip or cut wires B a tool used to tighten or loosen screws

C a tool for cutting, twisting or pulling wires

D a tool used to pull the covering off of wires

E a tool used for finding the length of an object

F a bag or box used to hold a set of tools

Specialized tools



Read the company webpage. Then, complete the table using information from the webpage.

Category	Tools
1 Specialized	
2 Power	
3 Electronic	

Zap Tools has the best selection and lowest prices on everything electricians need.

We carry specialized tools such as conduit benders, levels, fish tapes and stud punches. We also have the largest selection of lineman's pliers on the Internet. Be sure to check out our power tools too. We have saws and drills, including hammer drills. To go with the drills, we have specialized drill bits. We have the toughest brands of stepped drill bits and masonry drill bits. We also sell electronic equipment for electricians. We have multimeters, plug in analyzers and labeling machines.

Fill in the blanks with the words and phrases from the word bank.

fish tape hammer drill level multimeter labeling machine

- 1 We used a _____ to keep track of the wire connections.
- 2 The _____ showed the wire had a lot of voltage.
- 3 The wires were put behind the wall using a _____
- 4 Kate used a _____ to make sure the picture was straight.
- 5 The _____ broke through the concrete quickly.

Read the sentence pair. Choose where the words best fit the blanks.

1 lineman's pliers / stud punch

A Sam used a _____ on the wall.

B _____ are good for cutting wires.

2 stepped drill bit / masonry drill bit

A I need a _____ to drill through the metal.

B A _____ will make a hole in the concrete.

3 plug-in analyzer / conduit bender

A The _____ indicates there are some loose wires.

B Mark the conduit before you use the _____ on it.

What is electricity?

Electricity is the **flow of charge** around a circuit **carrying energy** from the battery (or power supply) to components such as lamps and motors.

Electric charges; Electrical conductivity

One fundamental property of electrical charge is its existence in two varieties that are named **positive** and **negative**. All charged particles can be divided into two classes, where all members of one class repel each other, while attracting members of the other class.

Electric current is caused by the motion of charge carriers. The electric current is a measure of the amount of charge passing any point of the wire per unit time.

According to their ability to conduct current, materials are divided into electrical **insulators** and electrical **conductors**. The electrical difference between a good insulator and a good conductor is huge, as both properties depend on the mobility of atomic particles; in the electric, the mobility of the charge carriers, electrons or ions.

In electrical conductivity some substances can change conductivity, depending on conditions such as their temperature. Materials called **semiconductors** have this property.

Metals are the best conductors. Their conductivity is caused by free electrons. Since they are not attached to any single atom, they are able to move through the whole crystal lattice.

1 Use the information from the text to complete the following sentences.

1) Charged particles can be divided into two classes:

2) Regarding their conductivity, materials are divided into _____, _____ and _____.

3) _____ Semiconductors _____ are _____ materials _____ that _____.

4) High conductivity of metals is caused by _____.

5) _____ The _____ electric _____ current _____ is _____.

Conductors, semiconductors and insulators

Classifying materials

Materials can be placed into three groups according to their electrical **resistance**:

- conductors
- semiconductors
- insulators

Electrical conductor is any material that offers little resistance to the flow of an electric current. The difference between a conductor and an insulator, which is a poor conductor of electricity or heat, is one of degree rather than kind, because all substances conduct electricity to some extent. A good conductor of electricity, such as silver or copper, may have conductivity a billion or more times as great as the conductivity of a good insulator, such as glass or mica. A phenomenon known as *superconductivity* is observed when certain substances are cooled to a point near absolute zero, at which point their conductivity becomes almost infinite. In solid conductors the electric current is carried by the movement of electrons; in solutions and gases, the electric current is carried by ions.

2 Fill the gaps with words from the text above:

1. Property of any object or substance to resist or oppose the flow of an electrical current is called _____ 1.

2. Phenomenon displayed by certain substances that conduct electricity but demonstrate no resistance to the flow of an electric current is called _____

2.

3. _____ 3 is the lowest temperature theoretically possible, characterized by complete absence of heat (thermal energy).

4. _____ 4, in chemistry, are homogeneous (uniform) mixtures of two or more substances.

Semiconductors

Semiconductors may be either elements, namely Si (.....) and Ge (.....), or covalently bonded compounds. Si is used to create most semiconductors commercially.

A semiconductor is a solid material with electrical properties that are intermediate between the electrical conductors such as metals and metal alloys and insulators, namely ceramics and polymers. The electrical characteristics of these materials are extremely sensitive to temperature and *minute* concentrations of *impurity* atoms, called doping. Depending on the type of the impurity, the impurity atom either adds an electron or creates a hole, i.e. a site where one electron is missing.

Intrinsic Semiconductors

The electrical properties are inherent in the pure material, and electron and hole carrier concentration are equal. With rising temperatures, the intrinsic electron and hole concentration increases dramatically.

Extrinsic Semiconductors

An extrinsic semiconductor has been doped, giving it different electrical properties from the intrinsic one. The electron and hole carrier concentration at thermal equilibrium has been changed. For extrinsic semiconductors, with increasing impurity dopant content, the room temperature carrier concentration increases whereas carrier mobility diminishes.

**Write questions that elicit the answers contained in the sentences.
Different questions are possible.**

<i>Which element is most often used to create semiconductors commercially?</i>	Si is used to create most semiconductors commercially.
	Semiconductors have electrical properties that are intermediate between electrical conductors and insulators.
	The electrical characteristics of these materials are extremely sensitive to the presence of impurity atoms.
	The intrinsic electron and hole concentration increases dramatically with rising temperatures.
	Semiconductors are classified as either intrinsic or extrinsic on the basis of their electrical behavior

3 Fill the gaps in the following two paragraphs on semiconductors with the following

semiconductors – electrons – bond – valence – conduct – intrinsic – conductivity – increase – impurities.

Semiconductor is a solid or liquid material, able to _____ **1** electricity at room temperature more readily than an insulator, but less easily than a metal. Electrical _____ **2**, which is the ability to conduct electrical current under the application of a voltage, has one of the widest ranges of values of any physical property of matter. Such metals as copper, silver, and aluminum are excellent conductors, but such insulators as diamond and glass are very poor conductors. At low temperatures, pure semiconductors behave like insulators. Under higher temperatures or light or with the addition of _____ **3**, however, the conductivity of semiconductors can be increased dramatically, reaching levels that may approach those of metals. The physical properties of semiconductors are studied in solid-state physics.

The common _____ **4** include chemical elements and compounds such as silicon, germanium, selenium, gallium arsenide, zinc selenide, and lead telluride. The increase in conductivity with temperature, light, or impurities arises from an increase in the number of conduction _____ **5**, which are the carriers of the electrical current. In a pure, or _____ **6**, semiconductor such as silicon, the valence electrons, or outer electrons, of an atom are paired and shared between atoms to make a covalent _____ **7** that holds the crystal together. These _____ **8** electrons are not free to carry electrical current. To produce conduction electrons, temperature or light is used to excite the valence electrons out of their bonds, leaving them free to conduct current. Deficiencies, or “holes,” are left behind that contribute to the flow of electricity. (These holes are said to be carriers of positive electricity.) This is the physical origin of the _____ **9** in the electrical conductivity of semiconductors with temperature. The energy required to excite the electron and hole is called the energy gap.

Direct current and alternating current

AC generation and supply

Mains electricity is **generated** (produced) at sites called power stations, which use large generators. A generator converts mechanical energy to electrical energy.

Current from the generators leaves the power station and enters the **power grid** (or **grid**) – the network of **power lines** (cables) which transmit it around the country. At the point where it enters the grid, the electricity flows through **transformers** – specifically **step-up transformers**, which increase voltage and decrease amperage. This reduces the energy lost from the power lines over long distances, as **high-voltage (HV)** supplies flow more efficiently than **low-voltage (LV)** supplies. Before the supply is used by homes and other buildings, it passes through several **step-down transformers**, which reduce its voltage and increase its amperage.

The supply may be **stepped up** to over 400,000 volts at the point where it enters the large **transmission lines** (long-distance power lines) leaving the power

station. It is normally then **stepped down** in stages, first passing through a wider network of lower-voltage transmission lines, and finally through the small distribution lines which supply streets and houses – in many countries at around 230 volts.

1 Complete the text with the words from the box.

electricity – alternating – transport – plant – ferromagnetic – negative – voltage – transformer – changing – DC – sine

AC Versus DC

The turning point of the electric age came with the development of AC power systems. With **1.** _____ current, power plants could **2.** _____ electricity much further than before it. In 1895, G. Westinghouse opened the first major power plant at Niagara Falls using alternating current. While Edison's DC **3.** _____ could only transport electricity within one square mile of his Pearl Street Power Station, the Niagara Falls plant was able to transport **4.** _____ more than 200 miles.

Direct current, or **5.** _____, is simple: it's the type of electricity that batteries supply. In a DC circuit, electricity flows in one direction only – for example, from the positive terminal of a battery through a circuit to the **6.** _____ terminal. Alternating current, or AC, changes direction cyclically /'saɪklɪkli/, typically in the form of a **7.** _____ wave.

It is simple to change the voltage of AC using a **8.** _____. A basic transformer consists of a pair of coils, separated either by air or, more commonly, by some **9.** _____ material such as a bar of iron. As the AC voltage varies over time, it creates a **10.** _____ magnetic field around the coil it is connected to. This magnetic field induces *вызывать* an AC voltage in the other coil.

AC's biggest advantage is in power transmission. Since AC's voltage can be increased or decreased using transformers, it is possible to choose the most appropriate **11.** _____ for a given situation.

2 Choose the correct words from the brackets to complete the descriptions of different stages of AC generation and supply (a-f). Then, put the stages in the correct order.

a After the step-up transformer, the current enters a (distribution / transmission) line.

b Current is produced, by electromagnetic induction, in the (magnet field / coils) of a generator.

c The current goes from the last step-down transformer to a (distribution / transmission) line.

d The current leaves the power (grid / station) and enters the home.

e Amperage is reduced and voltage is increased by a (step-up / step-down) transformer.

f The current is stepped (up / down) from a higher voltage to a lower voltage, in stages.

1 Complete the extract about current and power calculations using the words in the box.

amps	components	conductor	circuit	current	ohms
resistance	supply		voltage	volts	wattage
			watts		

In electrical calculations, electromotive force is expressed by the letter E, resistance by the letter R, and current by the letter I (which comes from the word 'intensity').

According to Ohm's Law: $I = E/R$.

In other words, the (1) _____ flowing through a (2) _____, measured in (3) _____, equals the (4) _____ of the electrical (5) _____, measured in (6) _____, divided by the total (7) _____, measured in (8) _____. To work out the value of R, it is necessary to calculate the total resistance of all the (9) _____ and connecting lengths of (10) _____ that make up the circuit.

Once both the voltage and amperage are known, it is possible to work out the power, measured in (11) _____, that will be consumed. Power (P) can be calculated using the equation $P = EI$. Therefore (12) _____ equals voltage multiplied by amperage.

2 Read the text and label the picture with the name of each part.

An electric circuit or network is a pathway through which the electric current can flow. A simple circuit consists of a **power source**, two conducting wires, each one attached to a terminal of the source and a **device** through which electricity can flow. This device is called a **load** and it's attached to the wires. If all the parts are properly connected, the current flows and the lamp lights up. This kind of circuit is called 'closed'.

On the contrary, if the wires are disconnected the circuit is called 'open' or 'broken'. The circuit can be opened and closed by a device called a **switch**.

Loads can **turn** electrical energy **into** a more useful form. Some examples are:

- **light bulbs**, which change electrical energy into light energy;
- electric motors, which change electrical energy into mechanical energy;
- **speakers**, which change energy into sound.

The source provides the electrical energy used by the load. It can be a storage battery or a generator. The switch interrupts the current delivered to the load by the source and allows us to control the flow.

When an abnormally high amount of current passes through a network, you get a **short circuit**. This may occur when there is a drop in the **resistance** or a broken insulation. In order to **prevent** short circuits, it is best to use **fuses**, which **melt** when too much current flows through them, interrupting in this way the circuit.



3 Match the words with their definitions.

- | | |
|------------------|---|
| 1 load | a a device which interrupts the circuit |
| 2 switch | b a circuit in which wires are disconnected |
| 3 source | c a device which provides power |
| 4 fuse | d a complete circuit with no breaks at all |
| 5 closed circuit | e a device which consumes electric power |
| 6 broken circuit | f a protective device |

4 Read the text again and answer the following questions.

- | | |
|---|--|
| 1 What does a simple circuit consist of? | 5 What is the function of a switch? |
| 2 What happens to the lamp in a closed circuit? | 6 When does a short circuit occur? |
| 3 Can you name some examples of loads? | 7 What can we use to prevent short circuits? |
| 4 What is a generator? | 8 How does a fuse work? |

5 Complete the texts with the words in the box. Then listen and check.

<i>components</i>	current	turn on	branch	amount	positive
	appliances	continue	burns out	path	

The (1) *components* of a circuit can be wired in two different ways: series or parallel. If components are **arranged** one after another to form a single (2) _____ between the terminals and the components, the circuit is known as a **series circuit**. In this type of circuit, the (3) _____ flows from the negative terminal to the (4) _____ terminal, passing through all the other components of the circuit. This means that the (5) _____ of energy passing through all the components in the series is the same. The main disadvantage of a series circuit is that when a single component in the path (6) _____, the entire circuit stops operating (e.g. Christmas tree lights).

A **parallel circuit** consists of several paths connecting the different components. Each separate path is called a (7) _____ of the circuit. Current from the source divides and flows through the different **branches**.

Unlike series circuits, if one of the components in the parallel circuit **burns out**, the other paths (8) _____ to operate. Parallel circuits are commonly used to connect (9) _____ at home, so that each **socket** can function independently. For example, you don't have to (10) _____ the light in your room for the TV socket to work.

6 Read the text and find synonyms for the words below.

A fuse can be added to an electric circuit to protect it from the effects of **undue** power. This safety device, which is made of a heat-sensitive alloy, is connected in series with the circuit it has to protect. If an excessive amount of current flows through the circuit, the alloy will liquefy and open the circuit. A circuit breaker is fundamental in a house to protect circuits against overloading, overheating and short circuits. The advantage of a circuit breaker is that it can be reset after the overloading by replacing the fuse. A professional electrician should

always provide his customers with a map of the electric circuit in the house so that it will be easier to work on it in case of **faults**.

1 excessive: _____

4 loading up: _____

2 reacting to high temperatures: _____

5 adjusted: _____

3 to melt: _____

6 clients: _____

Circuits and components

Simple circuits

The circuit diagrams below show lamps connected in a **parallel circuit** and in a **series circuit**. The supply has **live** and **neutral** conductors. On an alternating current (AC) supply, the difference between live and neutral is that conductors on the neutral side of appliances are **earthed** – that is, connected to **earth** (the ground).

BrE: live; **AmE**: phase

BrE: earth, earthed; **AmE**: ground, grounded

Mains AC circuits and switchboards

Where an AC supply enters a building, it is connected to a **switchboard**. This has a number of switches to allow different circuits in the building to be **switched on** and **off**. Circuits include **power circuits**. These supply the **power sockets** (or **sockets**) for the **plugs** on appliances. Usually, a **circuit-breaker** is fitted to each circuit. This is a safety switch that switches off automatically if there is a problem. This may happen if a person touches a live conductor, or if there is a **short circuit**. A short circuit is when current flows directly from a live conductor to a neutral conductor – for example, due to damaged insulation. Circuit breakers also allow circuits to be switched off manually, to **isolate** them (switch them off safely) – for example, before maintenance work.

Note: The equipment in **switchboards** is often called **switchgear**.

Printed and integrated circuits

The circuits in electrical appliances are often **printed circuits**, on **printed circuit boards** (PCBs). These are **populated** with (fitted with) electrical components. Many appliances also contain small, complex **integrated circuits** – often called **microchips** (or **chips**) – made from silicon **wafers** (very thin pieces of silicon). They act as **semiconductors**, which can be positively charged at certain points on their surface and negatively charged at other points. This principle is used to make very small circuits.

Make word combinations with *circuit*. Then match the combinations with the descriptions (1-6) below.

a _____

a _____

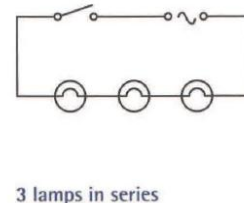
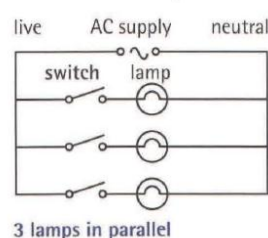
a _____

a _____

a _____

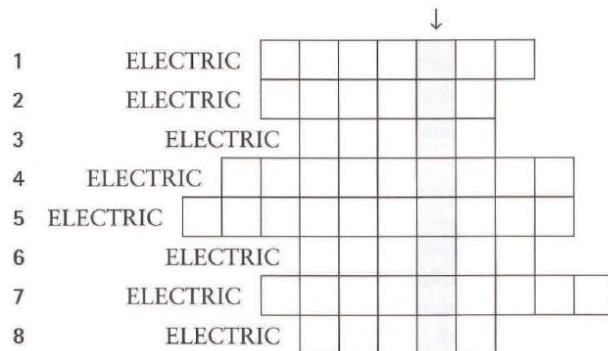
an _____

1 a circuit containing one or more sockets



- 2 a simple circuit where all the components are placed one after the other along the same conductor
- 3 a microchip – a very small, often complex circuit
- 4 what happens if live and neutral conductors touch while a current is flowing, and there is no component or appliance between them
- 5 a circuit which allows different components to be controlled independently by separate switches
- 6 a circuit that can be populated with a large number of components

Complete the word puzzle and find the word going down the page.



- 1 another term for amperage
- 2 provided by a battery, for example
- 3 measured as a wattage
- 4 allows current to flow through it
- 5 has very high electrical resistance
- 6 carried by moving electrons
- 7 another term for an electrical 'device'
- 8 the consequence of a person touching a live conductor

Integrated Circuits

Work with a partner. Fill the gaps in the text with words from the box in their correct form.

advancement; approach; consume; electronic; improvement; manufacture; miniaturize; perform

In electronics, an integrated circuit, also known as IC or microchip, is a electronic circuit consisting mainly of semiconductor devices as well as passive components.

These circuits are on the surface of a thin substrate of semiconductor material. ICs revolutionized the world of electronics and nowadays appear in almost all equipment. Integrated circuits were made possible by discoveries which showed that semiconductor devices could the functions of *vacuum*

tubes. Thanks to technological in semiconductor device fabrication in the mid 20th century, large numbers of tiny transistors could be integrated into a small chip.

This was an enormous over the *manual assembly* of circuits. The fact that reliable integrated circuits could be mass produced using a building-block

..... in circuit design resulted in the fast adoption of standardized ICs in place of designs using transistors. The cost of integrated circuits is low because of mass production and because much less material is used. Being small and close together, the components switch quickly

and less power than their discrete counterparts. In 2006, chip areas ranged from a few square millimeters to around 350 mm², with up to 1 million transistors per mm².

SAFETY ENGINEERING

Label the safety equipment with the words in the list.

hard hat lifeline overalls safety
boots harness gloves ear
protectors
eye protectors/goggles

Reading

Read the safety poster. Then, mark the following statements as true (T) or (F).

- 1 _ Safety glasses should be worn if needed.
- 2 _ Arc flash clothing helps if there is an explosion.
- 3 _ Hold a hot stick when working with dead wires.

Working with electrical wiring is often dangerous. The proper safety equipment can save your life. Remember these tips:

1 Always protect your head, eyes, hands and feet. Never work without wearing the following items:

- a A **hard hat**
- b A pair of **leather gloves**
- c **Steel toe boots**
- d **Safety glasses**

2 On the job, there is sometimes danger of **electric shock** or explosion. In these cases, dress properly. Wear the following:

- a An **arc shield**
- b **Arc flash clothing**
- c **Electrical hot gloves**

3 When working with live wires, be extra careful. Protect yourself from shocks. Use an **arc flash blanket** and stand on a **rubber mat**. Finally, hold onto a **hot stick**.

Choose the sentence that uses the underlined part correctly.

- 1 A James put on leather gloves before picking up the hammer.
B The electrician stood on the arc shield while working.
- 2 A Steel toe boots protect your feet if something falls on them.
B A hot stick is worn when working with electricity.
- 3 A Oliver held on to the electrical hot gloves while touching the wire.
B Marie put a hard hat on her head before entering the building.

Match the words (1-7) with the definitions (A-G).

- 1 _ arc shield 5 _ electrical hot gloves



2 _ rubber mat 6 _ arc flash blanket

3 _ hot stick 7 _ arc flash clothing

4 _ safety glasses

A clear glasses that are made of thick plastic

B a blanket used to protect from explosions or shock

C a fiberglass rod that protects from shocks

D gloves made of rubber that protect from shocks

E a mat made of rubber that electricians stand on

F pants, shirts, jackets, and shoes designed to protect from shocks or explosions

G a protective plastic shield for the eyes and face

Read the text about safety signs. Write these four headings in the correct places.

a Green and white squares or rectangles

b Black and yellow triangles

c Red and white circles

d Blue and white circles



Safety signs: colours and shapes

Safety signs are very important because the oil and gas industry has many hazards. (*Hazards* = possible dangers like electricity, chemicals, hot things, gas, machines, noise, falling objects, and slippery surfaces).

There are four main kinds of safety sign:

1 _____

These signs warn us about hazards. The signs give warnings like *Danger! Overhead crane* or *High voltage*.

2 _____

These signs usually have a red band across them. They tell us we must not do things. For example *Do not smoke here* or *Do not switch off this machine*.

3 _____

These signs tell us 'You must wear or do the thing in the picture'. For example *Wear goggles* or *Read the instructions before you use the machine*.

4 _____

These signs give information about safety. For example, they tell us *This way to the emergency exit* or *Lifejackets are here*.

Electrical safety

Reading

Read the safety pamphlet. Then, mark the following statements as true (T) or false (F).

- 1 _ Static electricity is not dangerous.
- 2 _ Lockout/tagout procedures cause electrocution.
- 3 _ Electric shocks can paralyze muscles.

Vocabulary

Read the sentence pair. Choose where the words best fit the blanks.

1 burn / live wire

- A** Touching a _____ is very dangerous.
- B** A serious should be seen by a doctor.

2 de-energize / electrocution

- A** Electricians sockets before they work on them.
- B** can be prevented by following safety rules.

3 risk / static electricity

- A** often builds up on door knobs.
- B** There is always a of getting hurt at work.

Match the words (1-4) with the definitions (A-D).

- 1 _ shock 3 _ lockout/tagout procedure
- 2 _ paralyze 4 _ hazard

- A** something that is not safe
- B** to make the muscles stop moving
- C** to pass electricity through the body
- D** a rule to lock energy sources and label electrical equipment when it's being repaired

Types of wires

Reading

Read the excerpt from a magazine article. Then, choose the correct answers.

- 1 What is the main idea of the article?
 - A** Wiring in older houses is dangerous.
 - B** Metal-clad cable is not recommended in homes.
 - C** Several types of wires and cables can be found in buildings.
 - D** Indoor and outdoor wires vary from each other.
- 2 Which of the following is NOT true according to the article?
 - A** Armored cable is a newer kind of wire.
 - B** NM cable is found in newer buildings.
 - C** Wires are unsafe in old buildings
 - D** SE cable is not used underground.
- 3 When do older wires need to be replaced?
 - A** when they are found in older homes
 - B** when NM cable is available for use
 - C** when bare wires or conductors are seen
 - D** when they are used for service entrances

There are many different types of electrical wire and cable. **Knob and tube (K&T) wiring** is one of the oldest types of wiring. Older types of cable are **armored**

cable (AC) and **metal-clad (MC) cable**. Both of these are **insulated** by steel. These were **replaced** in newer construction by **nonmetallic (NM) sheath cable**. However, replacement is not required if the wire or cable **jacket** is still good. Check them to make sure there is no bare **conductor** or wire showing.

Underground feeder (UF) cable and **service entrance (SE) cable** are used outdoors. However, SE cable is only approved for above-ground use.

Match the words (1-6) with the definitions

(A-F).

1 _ SE cable

2 _ knob and tube

3 _ armored cable

4 _ NM sheath cable

5 _ UF cable

6 _ metal-clad cable

A a cable with an insulating material like thermoplastic

B wires that run through porcelain covers found in old homes

C wires for above ground use encased in a PVC jacket

D wires in steel insulation with a grounding wire

E wires for underground, wet areas in a thermoplastic jacket

F wires encased in spiraled steel or aluminum

Match the words (1-6) with the definitions (A-F).

1 _ SE cable

2 _ knob and tube

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Optical Fibers versus Copper Cables

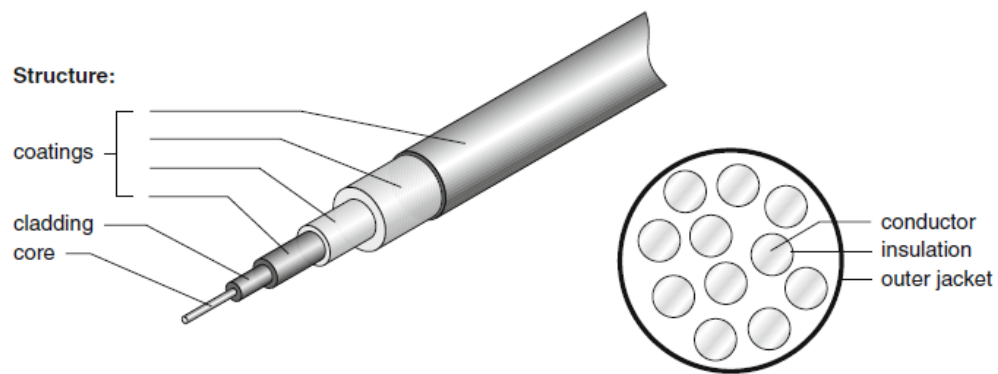


Figure 10: Optical fiber

Optical fibers, used in modern optical communication systems are an example for the application of an advanced ceramic material. They are made of extremely high-purity silica, which must be free of even extremely small levels of impurities and other defects that would absorb, scatter or weaken a light beam. Sophisticated processing has been developed to produce fibers that meet the rigorous restrictions required for this application, but such processing is costly.

Optical fibers started to replace some uses of copper cables in the 1970s, e.g. in telecommunications and cable TV. In these applications they are the preferred material, because the fibers carry signals more efficiently than copper cable and with a much higher bandwidth, which means that they can carry more channels of information over longer distances. For optical fibers, the longer transmission distances require fewer expensive repeaters. Also, copper cable uses more electrical power to transport the signals. In addition, optical fiber cables are much lighter and thinner (about 120 micrometers in diameter) than copper cables with the same bandwidth so that they take up less space in underground cabling *ducts*. It is difficult to steal information from optical fibers and they resist electromagnetic interference, e.g. from radio signals or lightning. Optical fibers don't *ignite* so they can be used safely in *flammable* atmospheres, e.g. in petrochemical plants.

Due to their required properties, optical fibers are more expensive per meter than copper. In addition, they can't be *spliced* as easily as copper cable, thus special training is required to handle the expensive splicing and measurement equipment.

Compare glass fibers to copper cables, listing the pros and cons of each material.

[illegible]

Panels

Reading

Read the magazine article on service panels. Then, mark the following statements as true (T) or false (F).

- 1 _ The main switch must be switched manually.
- 2 _ Two neutral bus bars are better than one.
- 3 _ An electrical system with higher capacity carries increased risk of overcurrent.

GET POWERED!

Today's increased use of high-powered appliances and **gadgets** means you can't risk installing a substandard electrical system.

Before starting installation, you should understand electrical safety **functions**. The **main service panel** is what **safeguards** your system from dangerous malfunctions. This panel houses the **main switch**, where you can **manually** stop the flow of electricity.

More importantly, it **cuts off** power to all **branch circuits** automatically when it detects hazardous power levels.

When choosing electrical components, parts with high **capacity** are nearly always better. If you can install a circuit with higher amperage, or two **hot bus** bars instead of one, then go ahead. Having higher capacity than you need poses no dangers. If the capacity is too low, however, you risk **overcurrent**, which can lead to fire or electric shock. You should also make sure your **neutral bus** can safely **accommodate** the spent current as it returns to the seNice entrance conductor.

Match the words (1-5) with the definitions (A-E).

- 1 _ cut off
2 _function
4 _ manually
5 _ overcurrent
3 _ main service panel
A controlled by a person directly
B a part that controls power distribution
C a purpose or intended use
D an excessive surge of power

E to stop something abruptly

Subpanels

Reading

Read the DIY web article on subpanels. Then, mark the following statements as true (T) or false (F).

- 1 _ A subpanel and main panel require similar safety measures.
- 2 _ All of a subpanel's conductors should be bonded together.
- 3 _ A subpanel must have its own main breaker.

www.do-it-yourself .corn

Home Installations > Electrical > Subpanel Overview You should install a **subpanel** when you need electricity in a shed or other **remote** unit away from the electrical meter. While these panels are **secondary**, they require the same **safety precautions** as a main panel.

Neutral Ground

The subpanel needs the same basic **components** as a main panel, but is wired a little differently. Do not **bond** the **neutral return conductor** to the **grounding conductor**. This ensures that spent currents traveling back to the panel do not get carried through the grounding conductor and cause a **short circuit**. Also to avoid **malfunctions**, the **hot conductor** must be **continuous**. point

When all the conductors are properly wired, you will install a **feeder cable** to bring electricity from the main panel. You can also install a dedicated main breaker for the subpanel. This isn't necessary though, since its overcurrent protection is in the main panel.

Match the words (1-5) with the definitions (A-E).

- 1 _ bond
 - 2 _ subpanel
 - 3 _ neutral return conductor
 - 4 _ feeder cable
 - 5 _ grounding
- A a wire that carries spent electrical current
B a secondary panel that delivers electricity to a particular area
C a wire that delivers electricity to a panel
D a wire that maintains connection with the earth
E to fasten two parts together

Fill in the blanks with the correct words and phrases from the word bank.
short circuit remote hot conductor secondary continuous

- 1 The light receives electricity from the ____ _
- 2 The conductors must have ____ connections to maintain electrical flow.
- 3 A ____ panel is called a subpanel.
- 4 A disrupted electrical connection causes a ____ _
- 5 Jim installed a subpanel in the ____ shed behind the house.

Fuses and circuit breakers

Reading

Read the manufacturer's guide on fuses and circuit breakers. Then, complete the table using information from the guide.

Part	When to replace or not to replace
Fuse	
Circuit Breaker	

Electrical Supply

Electrical **overload** can result from various factors, such as a short circuit from a **ground fault**. Your **fuses or circuit breakers** protect your system from these excessive currents. If you need a new fuse or circuit breaker for your ZYX panel, use our handy replacement guide.

Fuses

ZYX no longer makes panels with fuses, but we carry replacement fuses for our older models. If your fuse is encased in a tube with metal end caps, check out our **cartridge fuses**. If you can unscrew the fuse from its socket, you need a **plug fuse**. **All blown fuses** must be replaced since they cannot be reused.

Circuit Breakers

Newer ZYX panels have circuit breakers instead of fuses. Unlike fuses, circuit breakers do not need **replacement** every time they are **tripped**. But broken ! or worn out breakers occasionally require replacement.

Our breaker diagrams will help you determine if you \ need a single pole or double pole breaker.

Write a word that is similar in meaning to the underlined part.

- 1 An electrical surge might tripped the circuit breaker. _ r i _
- 2 Make sure to get a new type of fuse that screws into a socket. _ I _ g _ e
- 3 After the power went out, I discovered a fuse with a melted metal strip.
b _ w _ f _ _
- 4 A breaker connected to two hot bus bars supplies 240-volt power to a circuit.
_ ou _ e _ ol _ b _ ak _

Read the sentence pair. Choose where the words best fit the blanks.

1 circuit breaker / cartridge fuse

- A** A is usually made out of glass and metal.
B You don't need to replace a _____ every time there is a power surge.

2 ground fault / single pole breaker

- A** The can only handle 120-volts.
B The short circuit was caused by a **3 overload / fuse**
A The power went out because of an electrical _____
B You need to replace the _____ as soon as it is blown.

Receptacle boxes

Reading

f) Read the textbook excerpt about receptacle boxes. Then, choose the correct answers.

- 1 What is the main idea of the excerpt?
A to explain the different kinds of receptacle boxes
B to discuss why volume is important

C to compare handy boxes and outlet boxes

D to describe how to install a receptacle box

2 What can you infer about installing receptacle boxes outdoors?

A They are too shallow to comfortably hold a lot of wires.

B They are more difficult to install than indoor installations.

C They can be unsafe if they aren't protected from the weather.

D They work best when used for temporary purposes.

3 Why do electricians use handy boxes?

A to mount a temporary installation

B to make sure outdoor wires are protected

C to keep wires from getting overcrowded

D to mount a permanent installation

Receptacle boxes are containers that hold electric wire connections. They vary in shape, size, material make-up, and function. Box choices include **outlet boxes**, **pancake boxes**, **cut-in boxes**, and others. Electricians choose boxes based on the installation they are doing.

For example, some electricians use **handy boxes** for temporary installations. But handy boxes are unreliable for longterm usage. **Integral nail boxes**, or something similar, work better for

permanent installations.

Size and material also influence which receptacle box electricians use. The box needs to have the right **volume** to be safe. A **shallow** box can overcrowd the wires. **Overcrowded** wires can easily **short** out. The box needs to be **deep** enough to comfortably hold all the wires.

The box's material make-up also affects its safety. For example, an outside box must be **weatherproof**. An electrician must always check this when **mounting** a box outside.

Match the words (1-6) with the definitions (A-F).

1 _ pancake box

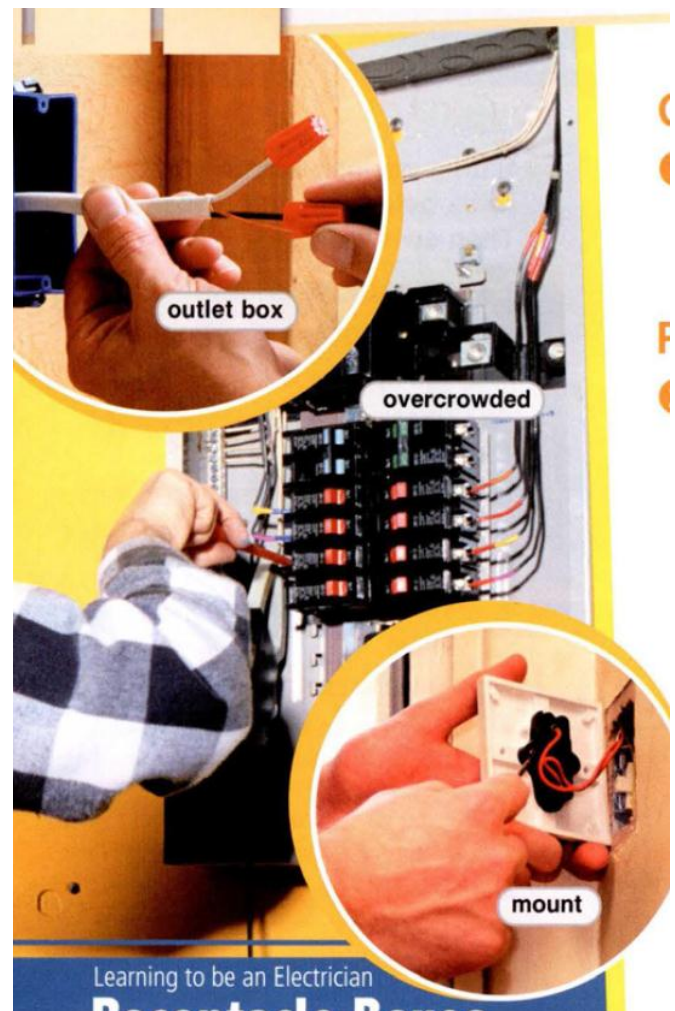
2 _ handy box

3 _ deep

4 _ overcrowded

5 _ volume

6 _ integral nail box



- A** a receptacle box that already has nail holes drilled into it
- B** describing the space from the front of something to the back of it
- C** a metal box sometimes used as a substitute receptacle box
- D** containing too many items
- E** a thin, round receptacle box
- F** the amount of space inside something measured in cubic units

Read the sentence pair. Choose where the words best fit the blanks.

1 short / mount

- A** If there is a _____, someone could be shocked.
- B** She needed tools to the receptacle box.

2 cut-in box / weatherproof box

- A** A protects wires from rain and heat.
- B** A was used in the wall in the hallway.

3 outlet box / shallow

- A** They wanted another _____ installed in their home.
- B** If a receptacle box is too _____, it can be unsafe.

Receptacles

Reading

Read the web forum about a problem with a receptacle. Then, choose the correct answers.

1 What is the main point in the web forum?

- A** suggesting ways to avoid dead outlets
- B** describing different types of receptacles
- C** giving instructions for installing a plug
- D** explaining the functions of plugs and outlets

2 Which is NOT a recommendation made on the web page?

- A** Use outlet caps for unused outlets.
- B** Avoid using immediate turn plugs.
- C** Install an outlet with a grounding slot.
- D** Check for tripped circuit breakers.

3 Which part was not properly connected?

- A** immediate turn plug **C** grounding pin
- B** grounding slot **D** cheater plug

HomeHelp Forums

0: I have a dead **outlet** in my kitchen. The problem started when I **hooked up** my washing machine. The **plug** has a **grounding pin**, but the outlet does not have a **grounding slot**. I also wanted to plug in a lamp, but the outlet is only a **single outlet**. I used a **cheater plug** to make a **duplex outlet** that takes a grounding pin. What went wrong?

A: Check your service panel for tripped breakers. The problem was likely caused by a short circuit. Since the grounding pin was only connected to the cheater plug, you had limited protection against electrical surges. Consider having an electrician install an outlet with a grounding slot.

If the washing machine has an **immediate turn plug**, ensure the new outlet is not installed upside down. In general, always make sure outlets maintain proper

polarity. A problem with the **narrow slot** might prevent electricity from getting through to a device. A problem with the **wide slot** could cause the device not to work. **Outlet caps** keep outlets clean when not in use.

Match the words (1-6) with the definitions

(A-F).

1 _ plug

2 _ narrow slot

3 _ single outlet

4 _ grounding pin

5 _ grounding slot

6 _ immediate turn plug

A a prong on some plugs that prevents surges

B a part that provides a hot current to a plug

C a part with two or more prongs

D a plug with a cord that lies against a wall

E one plug receptacle

F a receptacle that receives a grounding pin

Fill in the blanks with the correct words and phrases from the word bank.

duplex outlet

wide slot

outlet

cheater plug

outlet cap

polarity

1 You need a(n) _____ to use a three-pronged plug with a two-slot outlet.

2 Without a(n) _____ dirt might get into the outlet slots.

3 I need a(n) _____ to hook up both the toaster and the coffee maker.

4 The is connected to a neutral wire.

5 Hot and neutral slots are both needed to maintain

6 The surge occurred when one _____ received an excessive electrical load.

Switch boxes

Reading

Read the DIY webpage on switch boxes. Then, mark the following statements as

true (T) or false (F).

1 _ A room with a light and a ceiling fan most likely needs a single gang box.

2 _ A grounding screw ensures the wall cavity is sealed.

3 _ A coverplate should be flush with the wall as a safety measure.

Home Installations > Electrical > Switch Boxes

Different switch box sizes serve different purposes. For a typical room with one light, a **single gang box** will do. This is the easiest box to install in a narrow space beside a door. To **control** two switches from the same place, use a **two gang box**. A room with a light and a ceiling fan might require two switches. For more switches, **three gang boxes** and **four gang boxes** are available. But make sure you

have enough room for larger boxes before attempting installation. Large boxes may also require additional **brackets** to ensure they are mounted securely.

Your box should be positioned so that the **coverplate is flush** with the wall. If this is not possible, use a **box extender** to seal the **wall cavity**. This safety measure prevents flammable materials from coming in contact with the electricity.

We recommend using plastic boxes to reduce the risk of electrical malfunction. But if you must use a metal box, always ground it with a metal **grounding screw**.

Match the words (1-5) with the definitions (A-E).

- | | |
|--------------------|---------------------|
| 1 _ flush | 4 _ bracket |
| 2 _ control | 5 _ single gang box |
| 3 _ three gang box | |

A a box that provides power to one switch

B to have power over something

C an attachment that secures to a wall

D having a surface level with another surface

E a box that provides power to three switches

Read the sentence pair. Choose where the words best fit the blanks.

1 coverplate / wall cavity

A The electrician installed a box inside the

B A properly fitted ____ _ ____ _
prevents fire from breaching a wall.

2 four gang box / two gang box

A A can accommodate several appliances or fixtures.

B For a room with a light and a ceiling fan, a ____ _ ____ _ is appropriate.

3 box extender / grounding screw

A Use a if the switch is not flush with the wall.

B Use a ____ _ ____ _ if the switch box is made out of metal.

Types of switches

Read the web forum on switches. Then, choose the correct answers.

1 What is the purpose of the web page?

A to suggest different types of switches

B to explain why to use one particular switch

C to compare three- and four-way switches

D to describe installation methods for several switches

2 Which of the following is NOT suggested by members of the forum?

A toggle switch

B double pole switch

C dimmer switch

D four-way switch

3 What advice does ElectricalGuy give?

A use a dimmer switch to control brightness

B avoid an open circuit whenever possible

C install a commercial grade switch

D get a switch that controls multiple locations

NewGuy: I'm wiring my own switches for the first time. I know about **single pole switches**. I know about **three-way switches** and **four-way switches** too, but each location only needs one switch. Does anyone have any other suggestions?

HandyGal: You could also use a **toggle switch**.

ElectricalGuy: You could use a **timer switch** if you need lights to go on and off at certain times. Or maybe a **dimmer switch** would suit your needs if you need varying levels of brightness.

WiredUp: It depends on the type of building you're wiring. A **residential grade switch** is good for a home. Use a **commercial grade switch** for bigger buildings.

ElectricalGuy: I installed a **keyed switch** for extra security. It was easier than I thought it would be.

HandyGal: I tried installing a **pilot light switch** last month. I had trouble with an **open circuit** though.

HandyGal: A **double pole switch** is an option for higher-voltage fixtures.

Match the words (1-8) with the definitions (A-H).

1 _ timer switch

2 _ toggle switch

3 _ four-way switch

4 _ pilot light switch

5 _ three-way switch

6 _ single pole switch

7 _ double pole switch

8 _ residential grade switch

A a switch used mostly in homes

B a switch that controls two circuits

C a switch that allows control at two locations

D a switch that controls one circuit

E a switch with a light that indicates it is on

F a switch that goes on and off at certain times

G a switch with an up-and-down lever

H a switch that allows control at more than two Locations

Read the sentence pair. Choose where the words best fit the blanks.

1 open circuit / commercial grade switch

A All the wires must be properly connected to avoid a(n) _ _ _ _ _

B We installed a new _ _ _ _ _ on the factory's main floor.

2 dimmer switch / keyed switch

A A _ _ _ _ _ is useful in areas that need extra security.

B I want to turn down the brightness, but we don't have a _ _ _ _ _

Grounding systems

Read the advertisement for earth grounding systems.

Then, mark the following statements as true (T) or false (F).

1 _ The company charges a fee for estimates.

2 _ A grounding system protects homes from lightning strikes.

3 _ Surge arresters are used to complete a grounding system.

Wilton Electrical Manufacturers specializes in protecting your property from lightning strikes. We have a wide range of products that keep you and your possessions safe. We also offer free

installation of our **earth grounding systems**. Our professional electricians are experts at **grounding** electrical systems.

A grounding system protects your home from **fault currents**, **stray voltage** and **ground faults**. Currently, we are running a special on our grounding system packages. Each package includes **equipment grounding conductors**, **ground rods**, and **grounding electrode conductors**. Additional equipment such as **surge arresters** and **clamps** are also included.

Call us at 1-800-345-7298 today to schedule a free **estimate**. One of our electricians will come out to your property. He or she will determine what size kit you need. The electrician will also explain how a grounding system works. If you have any questions, he or she will answer them.

Match the words (1-6) with the definitions (A-G).

1 _ fault current 4 _ grounding electrode

2 _ ground rod conductor 5 _ ground fault conductor

3 _ equipment grounding 6 _ grounding

A the flow of electricity in a ground line

B an irregular electrical current

C connects part of a system of electricity to other conductors

D a conductor joining a piece of metal to a grounding electrode conductor

E a pole that is put in the earth so electricity flows into it

F linking a circuit to the earth

G the flow of electricity in a ground line

Fill in the blanks with the correct words and phrases from the word bank.

Clamp estimate earth grounding system stray voltage surge arrester

1 Coming into contact with _____ could cause serious injury.

2 Businesses use a(n) _____ to measure the electrical capability of the ground against conductors.

3 A(n) _____ protects electrical systems from lightning strikes.

4 The electrician wrote a(n) _____ for the customer.

5 He used a(n) _____ to put the wires together.

BIBLIOGRAPHY

1. Полякова Т.Ю. Английский язык для инженеров / Т.Ю. Полякова, Е.В. Синявская и др. – 4-е изд., перераб. и доп. – М.: Высшая школа, 1998.
 2. Курбасова И.А. Учебник для технических вузов (транспорт, строительство, связь) / И.А. Курбасова и др. - М.: Высш.шк., 1988.
- Допоміжна
1. Блудова Т.П. Английский язык. Тестовые задания для студентов-заочников железнодорожных вузов.- ИрГУПС, Иркутск, 2002.
 2. Казарина И.Н. Методические указания по чтению железнодорожных текстов на английском языке для студентов 2 курса электромеханического факультета / И.Н. Казарина. – Иркутск: ИрИИТ, 1999.
 3. Клементьева Т.Б. English. Active Grammar/ Т.Б.Клементьева.– М.: Олимп. Хатбер, 1997.
 4. Шляхова В.А. Английский язык. Контрольные задания для студентов технических специальностей/ В.А. Шляхова, Т.Д. Любимова. - М.: Высшая школа, 2000