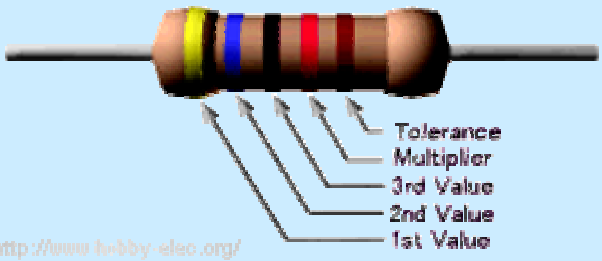
BỘ GIÁO DỤC VÀ ĐÀO TẠO

TRƯỜNG ĐẠI HỌC SƯ PHẠM KỸ THUẬT HƯNG YÊN

English
for Electrical and Electronic Engineering

TIẾNG ANH CHUYÊN NGÀNH ĐIỆN-ĐIỆN TỬ



8- 2006

SECTION OF FOREIGN LANGUAGE

CONTENT

Unit 1

CONDUCTORS, INSULATORS AND SEMICONDUCTORS

I. Reading and comprehension:

If we connect a battery across a body, there is a movement of free electrons towards the positive end. This movement of electrons is an electric current. All materials can be classified into three groups according to how readily they permit an electric current to flow. These are: conductors, insulators and semiconductors.

In the first category are substances which provide an easy path for an electric current. All metals are conductors, however some metals do not conduct well. Manganin, for example, is a poor conductor. Copper is a good conductor, therefore it is widely used for cables. A non-metal which conducts well is carbon. Salt water is an example of a liquid conductor.

A material which does not easily release electrons is called an insulator. Rubber, nylon, porcelain and air are all insulator. There are no perfect insulators. All insulators will allow some flows of electrons, however this can usually be ignored because the flow they permit is so small. (see Fig 1.1)

Fig.1.1:

Semiconductor are mid-way between conductors and insulators. Under certain conditions they allow a current to flow easily but under others they behave as insulators. Germanium and silicon are semiconductors. These are known as thermistors. The resistance of thermistors falls rapidly as their temperature rises. They are therefore used in temperature sensing devices.

Exercise 1: *Rephrasing*

Rewrite the following sentences, replacing the words in *italics* with expressions from the passage which have similar meanings:

1. The *flow* of free electrons is called an electric current.
2. Materials in the first *group* are called conductors.
3. *Materials* which provide a path for an electric current are conductors.
4. All insulators *permit* some flow of electrons.
5. Germanium sometimes *acts as* an insulator and sometimes as a conductor.

Exercise 2: *Contextual reference*

Which do the pronouns in italics in these sentences refer to?

1. All material can be classified into three groups according to how readily *they* permit an electric current to flow (line 3)

a) Three groups
b) All materials
c) Free electrons

2. Under certain conditions, they allow a current to flow easily but under others they behave as insulators (line 16)

a) Conductors.
b) Semiconductors
c) Insulators

3. These are known as thermistors. (line 18)

a) Metallic oxides.
b) Semiconductors.
c) Mixtures of certain metallic oxides.

4. They are therefore used in temperature-sensing devices.

a) Thermistors.
b) Semiconductors.
c) Metallic oxides.

Exercise 3: *Checking facts and ideas.*

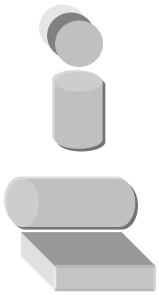
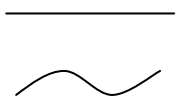
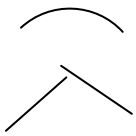
Describe if these statement are true or false. Quote from the passage to support your decision.

1. Electrons flow from positive to negative.
2. Copper provides an easy path for an electric current .

3. All metals are good conductors.
4. All good conductors are metals.
5. Air is not a perfect good insulator.
6. Rubber readily releases electrons.
7. The resistance of a thermistor is higher at low temperature than at high temperatures.

Exercise 4: *Describing shapes*

Study these nouns and adjective for describing the shapes of objects:

Shape	Noun	adjective	shape	noun	Adjective
2D			3 D		
	Circle Semi-circle Square Rectangle	Circular Semi-circular Square Rectangular		Sphere Cylinder Tube	Spherical Cylindrical Tubular Rectangular
Line		Straight curve	edges		Rounded pointed
					

When something has a regular geometric shape we can use one of the adjectives from the table to describe it:

Example:

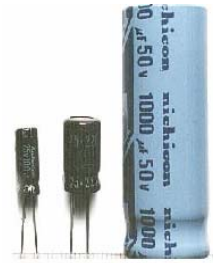
 A square wave

Now describe the shape of the following objects as completely as possible:

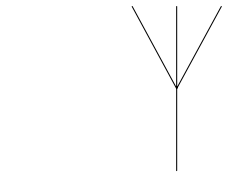
1. Ceramic capacitor

a) b) c)

2. Transformer laminations

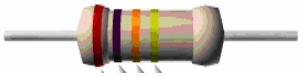


3. Electrolytic capacitor



4. Antenna

5. Magnet



6. Resistor

II. Use of English:

1. Relative clauses 1

Study these sentences:

1- Starter motor brushes are made of carbon

2- The carbon contains copper.

Both these sentences refer to carbon. We can link them by making sentence 2 a relative clauses.

1+2. Starter motor brushes are made of carbon WHICH CONTAINS COPPER.

The *relative clause* is capitals. Note that THE CARBON in sentence 2 becomes WHICH.

Study these other pairs of sentences and note hoe they are linked.

3- 33kV lines are fed to intermediate substations,

4- In the intermediate substations the voltage is stepped down to 11kV.

3 +4. 33 kV lines are fed to intermediate substations WHERE THE VOLTAGE IS STEPPED DOWN TO 11Kv.

Now link these sentences. Make the second sentence in each pair a relative clause.

1. The coil is connected in a series with a resistor.

The resistor has a value of 249 ohms.

2. The supply is fed to the distribution substation.
   The supply is reduced to 415 V in the distribution substation
3. Workers require a high degree of illumination.
   The workers assemble very small precision instrument.
4. Manganin is a metal.
   This metal has a relatively high resistance.
5. The signal passes to the detector.
   The signal is rectified by the detector.
6. A milliammeter is an instrument.
   The instrument is used fro measuring small current.
7. Workers require illumination of 300 lux.
   The workers assemble heavy machinery.
8. Armoured cables are used in places
   There is a risk of mechanical damage in these places.

2. Reason and result connectives 1

Study these sentences:

1. Copper is used for cables.
2. Copper is a good conductor.

Sentence 1 tells us what copper is used for. Sentence 2 tells us why it is used, sentence 2 provides a reason for sentence 1. we can link a statement and a reason using *because*.

1+2. Copper is used for cables BECAUSE it is a good conductor.

When the reason is a noun a noun phrase, we can use *because of* .

Note that a comma is used before *therefore*.

Now link these ideas using ***because*** *and* ***therefore*** *to make shorten two sentences.*

1. Soft iron is used in electromagnets.
   Soft iron can be magnetized easily
2. The voltage is 250 V and the current 5 A.

The resistance is 50 ohms

3. Pvc is used to cover cables.

   Pvc is a good insulator.

4. Transistors can be damaged by the heat.

   Care must be taken when soldering transistors.

5. Capacitance is usually measured in microfarads or pico-farads.

   The farad is too large a unit.

6. Output transistors are mounted on a heat sink.

   Output transistors generate heat

7. It is easy to control the speed of DC motors.

   DC motors are used when variable speeds are required.

8. A cathode ray tube screen glows when an electron beam strike it.

   The screen is coated with a phosphor.

3. Mathematical symbols used in electrical engineering and electronics

Study the table of mathematical symbols used in electrical engineering and electronics in Appendix 1. Then write out the following expressions in full:

EXAMPLE:

$$I = \frac{E}{R}$$ (Read: *I is equal E over R)*

1. $P = I^2 \times R$
2. $\frac{1}{Rtot} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$
3. $B \alpha H$
4. $X_L = \sqrt{Z^2} - R^2$
5. Frequency ability ≈ 0.04 % / ^oC
6. $Z = \frac{100x10^4}{200x10^{-5}}$

III. Further reading:

Conductors, insulators, and electron flow

The electrons of different types of atoms have different degrees of freedom to move around. With some types of materials, such as metals, the outermost electrons in the atoms are so loosely bound that they chaotically move in the space between the atoms of that material by nothing more than the influence of room-temperature heat energy. Because these virtually unbound electrons are free to leave their respective atoms and float around in the space between adjacent atoms, they are often called *free electrons*.

In other types of materials such as glass, the atoms' electrons have very little freedom to move around. While external forces such as physical rubbing can force some of these electrons to leave their respective atoms and transfer to the atoms of another material, they do not move between atoms within that material very easily.

This relative mobility of electrons within a material is known as electric *conductivity*. Conductivity is determined by the types of atoms in a material (the number of protons in each atom's nucleus, determining its chemical identity) and how the atoms are linked together with one another. Materials with high electron mobility (many free electrons) are called *conductors*, while materials with low electron mobility (few or no free electrons) are called *insulators*.

Unit 2

CIRCUIT ELEMENTS

I. Reading and comprehension:

Current moves from a point of high potential energy to one of low potential. It can only do so if there is a path for it to follow. This path is called an electrical circuit. All circuits contain four elements: a source, a load, a transmission system and a control.

The source provides the electromotive force. This establishes the difference in potential which makes the current to flow possible. T he source can be any devices which supplies electrical energy. For example, it many be a generator or a battery.

The load converts the electrical energy from the source into some other form of energy. For instance, a lamp changes electrical energy into light and heat. The load can be any electrical device.

The transmission system conducts the current round the circuit. Any conductor can be part of a transmitting system. Most systems consist of wires. It is often possible, however, for the metal frame of a unit to be one section of its transmission system. For example, the metal chassis of many electric devices are used to conduct current. Similarly, the body of a car is part of its electrical transmission system.

The control regulates the current flow in the circuit. It may control the current by limiting it, as does a rheostat, or by interrupting it, as does a switch.

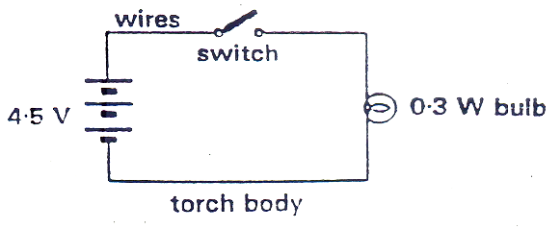
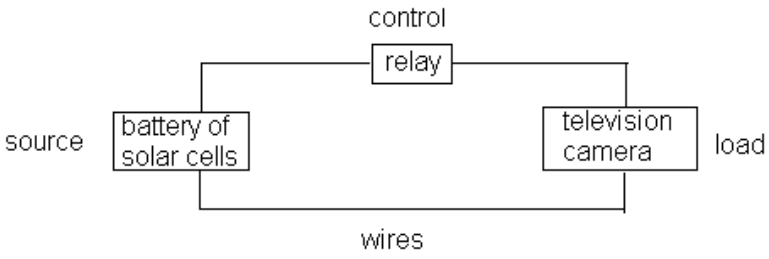


Figure 2.1

Study figure 2.1. In this simple flashlight circuit, the source comprises three 1.5V cells in series. The load is a 0.3 W bulb. Part of transmission system is the metal body of the flashlight, and the control is a sliding switch.



Transmission system

figure 2.2

Compare figure 2.2. The function of this circuit is to operate a television camera aboard a space satellite. Here the source is a battery of solar cells. A solar cell is an electric cell which converts sun light into energy. The load is the television camera. The transmission system is the connecting wires. The control is a relay actuated bys transmissions from ground control. Although the function of this circuit is much more complex than that of the flashlight, it too consists of the four basic elements.

EXERCISE 1: *Rephrasing*

Rewrite the following sentences, replacing the words in *italics* with expressions from the passage which has a similar meaning.

1. A lamp *converts* electrical energy into light.
2. The generator *provides* the circuit with electromotive force.
3. The metal *frame* of the oscilloscope is part of its transmission system.
4. The rheostat *controls* the current flow in the circuit.
5. A battery of a solar cells *supplies* power to the circuit.

EXERCISE 2: *Contextual reference*

What do the pronouns in *italics* in these sentences refer to?

1. Current moves from a point of high potential energy to *one* of low potential. (line 1)

   A- Current.

B- Energy

C- A point

2. For example, *it* may be a generator or a battery. (line 7)

   A- The source

   B- A device

   C- Electromotive force

3. It is often possible, however, for the metal frame of a unit to be one section of *its* transmission system. (line 13)

   A- The metal frame's

   B- The unit's

   C- The circuit's

4. Although the function of this circuit is much more complex than that of the flashlight, *it* too consists of the four elements. (line 27)

   A- This circuit

   B- The function

   C- The flashlight

EXERCISE 3: *Checking fact and ideas*

Decide if these statements are true (T) or false (F). Quote from the passage to support your decisions.

1. A difference in potential is required before current can flow in a circuit.
2. A generator is a source of electromotive force.
3. Loads converts systems must consist of wires.
4. A rheostat may be used as a control.
5. The load in the flashlight circuit is a solar cell.
6. Loads convert electrical energy into light and heat.
7. The source in the satellite circuit is a solar cell.
8. The current flow in the satellite circuit is regulated by a relay.
9. the flashlight circuit differs basically from the satellite circuit.

II. Use of language

1. Describing function

When we answer the question *what does it do?*. We describe the function of *It*.

Example:

What does a fuse do? It protect a circuit.

We can emphasize function by using this pattern:

The function of a fuse id to protect a circuit.

Now identify and explain the function of each component with help of this list.

a- adds capacitance to a circuit.

b- rectifies alternating currents.

c- adds resistance to a circuit.

d- measures very small currents.

e- breaks a circuit.

f- protect a circuit.

g- varies the current in a circuit.

h- transforms AC voltages.

i- receives RF signal

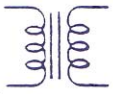
j- selects a frequency

1 

2. 

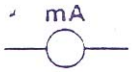
3 

4. 

5 

6. 

7 

8. 

9 

10. 

2. Describing purpose

When we answer the question *What is it for?,* we describe the purpose of *It*.

Example:

What is an ammeter for? It is for measuring current.

Other ways we can describe the purpose of an ammeter are:

1. It is used for measuring current.
2. It is used to measure current.
3. We measure current with an ammeter.
4. We measure current using an ammeter.

Now describe the purpose of these instruments and tools using any of the structures presented above.

1. a voltmeter.
2. a soldering iron.
3. a milli-ammeter
4. an oscilloscope.
5. a heat sink
6. wire-clippers.
7. a mega-ohmmeter
8. an ohmmeter
9. a signal generator.
10. a battery charger.

3. Relative clause 2: making definition

Study these two sentences:

The cables were undamaged.

The cables were armoured.

We can link in two ways using a relative clause:

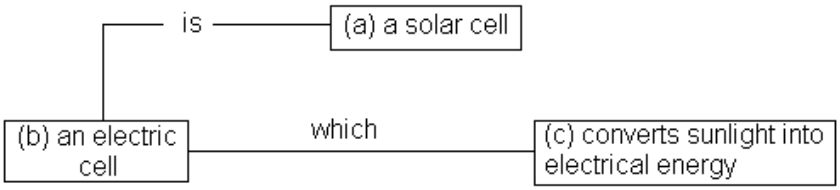
1. The cables WHICH WERE ARMOURED were undamaged
2. The cables, WHICH WERE ARMOURED, were undamaged.

Sentence 1 means that only armoured cables were undamaged. Other cables, for example PVC coated cables, were damaged. The relative clause is a

defining one. It defines the type of cable which were undamaged. It carries essential information.

Sentence 2 means that all the cables were undamaged and all the cables were armoured. The relative clause is a non-defining one. It adds extra information to the sentence still makes goof sense. It is separated from the rest of the sentence by commas.

One use of defining relative clauses is to make definition. Study this diagram.



We can make a definition of a solar cell by joining (a), (b) and (c).

A solar cell is an electric cell which converts sunlight into electrical energy.

Now make eight definitions using information in this table. You must decide the correct combinations of (A), (B) and (C).

(A)	(B)	(C)
A generator	a material	measures light
An insulator	an instrument	readily releases electrons
An alternating current	a current	flows first in one direction then in the other
A direct current	a device	
A resistor		does not readily release electrons.
A conductor		Impedes the flow of current in a circuit
A light meter		
An ammeter		Measures current
		Converts mechanical energy into electrical energy.
		Flows in one direction only

4. Terms used in electrical engineering and electronics

Study and write out the following expressions in full

1. $I = \frac{V}{R}$
2. B α H
3. $P = I^2 \times R = 40$ W.
4. $V = \frac{Q}{C} = \frac{1.6}{20} \frac{x}{x} \frac{10^{-3}}{10^{-6}} = 80$ V
5. $Z = \sqrt{R^2 + (X_L - X_C)^2} = 330\Omega$
6. $V = \frac{1}{\infty C}$
7. $f = \frac{1}{2\pi C X_C} = 79.5$ Hz
8. $y = \frac{1}{P}$
9. $F_r = \frac{1}{2\pi (LC)^4} = 8750$ Hz
10. $\frac{V}{Z} = I = VY$

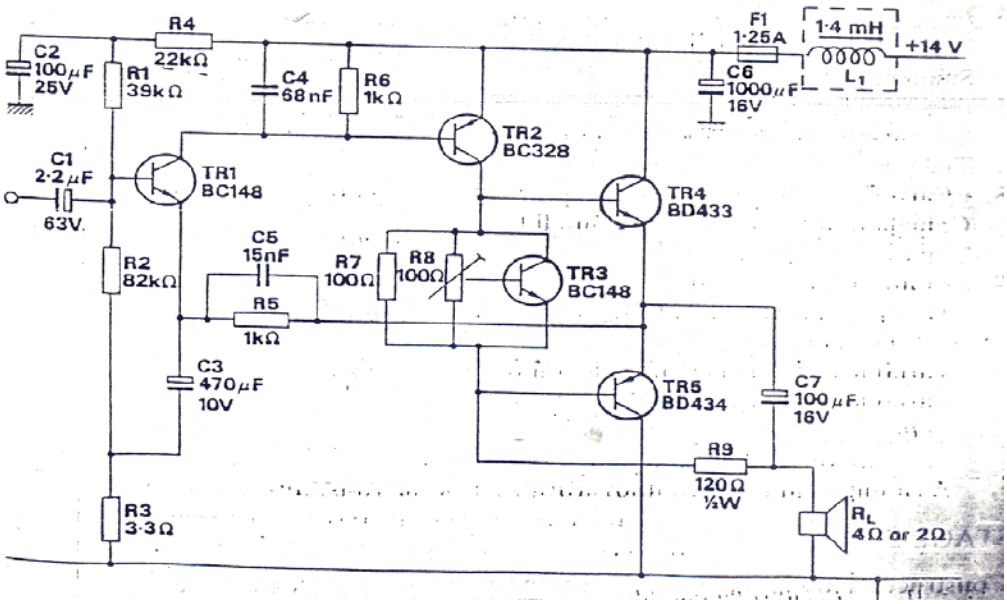
5. Describing component values

Study this table

Prefix	symbol	Multiple	example
giga	G	10^9	GHz gigahertz
mega	M	10^6	MΩ mega-ohms
kilo	k	10^3	kV kilovolts
deci	d	10^{-1}	dB decibels
milli	m	10^{-3}	mW milliwatts
micro	μ	10^{-6}	μA microamps
nano	n	10^{-9}	nF nanofarads
pico	p	10^{-12}	pF picofarads

Identify the following components in the circuit of the amplifier and wire out their value in full

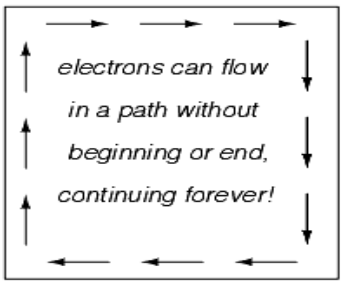
1. R 4
2. R 9
3. C 5
4. C 1
5. F 1
6. L_1
7. R_L
8. R 8

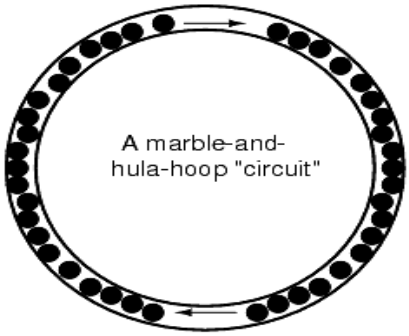


III. Further reading

Electric circuits

You might have been wondering how electrons can continuously flow in a uniform direction through wires without the benefit of these hypothetical electron Sources and Destinations. In order for the Source-and-Destination scheme to work, both would have to have an infinite capacity for electrons in order to sustain a continuous flow! Using the marble-and-tube analogy, the marble source and marble destination buckets would have to be infinitely large to contain enough marble capacity for a "flow" of marbles to be sustained.

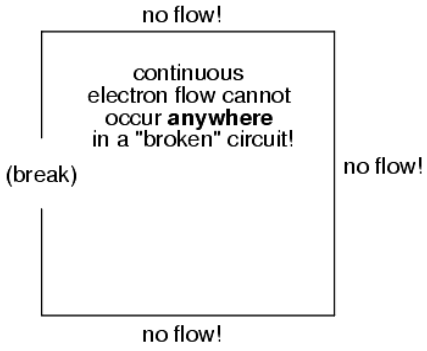




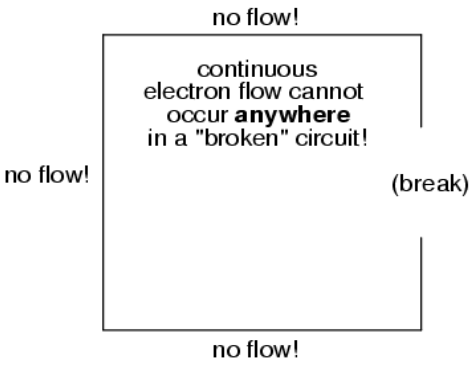
The answer to this paradox is found in the concept of a *circuit*: a never-ending looped pathway for electrons. If we take a wire, or many wires joined end-to-end, and loop it around so that it forms a continuous pathway, we have the means to support a uniform flow of electrons without having to resort to infinite Sources and Destinations:

Each electron advancing clockwise in this circuit pushes on the one in front of it, which pushes on the one in front of it, and so on, and so on, just like a hula-hoop filled with marbles. Now, we have the capability of supporting a continuous flow of electrons indefinitely without the need for infinite electron supplies and dumps. All we need to maintain this flow is a continuous means of motivation for those electrons, which we'll address in the next section of this chapter.

It must be realized that continuity is just as important in a circuit as it is in a straight piece of wire. Just as in the example with the straight piece of wire between the electron Source and Destination, any break in this circuit will prevent electrons from flowing through it:



An important principle to realize here is that *it doesn't matter where the break occurs*. Any discontinuity in the circuit will prevent electron flow throughout the entire circuit. Unless there is a continuous, unbroken loop of conductive material for electrons to flow through, a sustained flow simply cannot be maintained.



- **REVIEW:**
- A *circuit* is an unbroken loop of conductive material that allows electrons to flow through continuously without beginning or end.
- If a circuit is "broken," that means it's conductive elements no longer form a complete path, and continuous electron flow cannot occur in it.
- The location of a break in a circuit is irrelevant to its inability to sustain continuous electron flow. *Any* break, *anywhere* in a circuit prevents electron flow throughout the circuit.

Unit 3

THE DC MOTOR

I. Reading and comprehension:

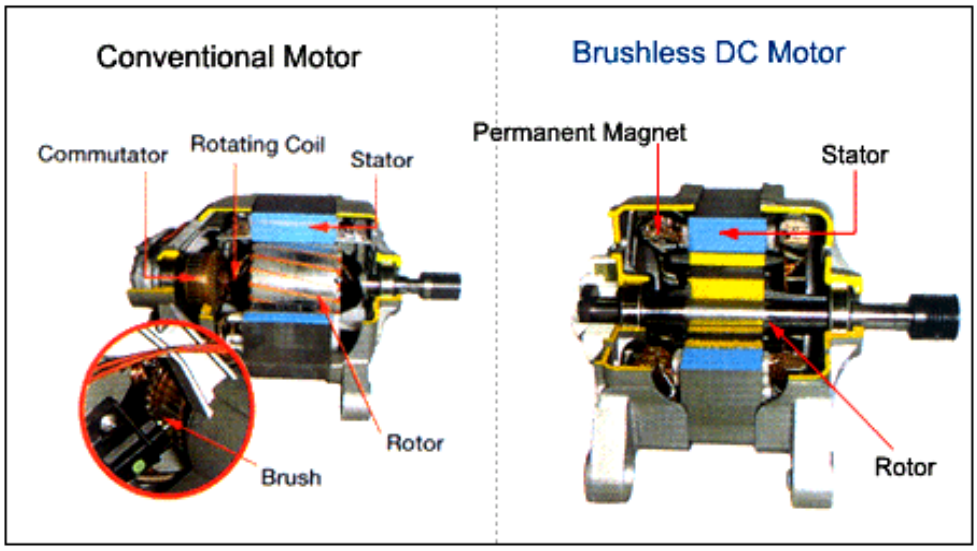


Figure 3.1

An electric motor is a machine for converting electrical energy into mechanical energy. Motors can be designed to run on direct (DC) or alternating current (DC). The motor shown in figure 3.1 is a DC motor. Its most important parts are the motor, the stator and the brush gear.

The motor is the moving part. It contains an armature, which is a set of wire loops wound on a steel core. When current is fed to the armature. These windings produce a magnetic field. The armature and core are mounted on a shaft which runs on bearings. It provides a means of transmitting power from the motor.

The motor also contains a commutator. This consists of a number of copper segments insulated from one other. The armature windings are connected to these segments. Carbon brushes are held in contact with the commutator by springs. These brushes allow current to pass to the armature windings. As rotor turns, the commutator acts as a switch making the current in the armature alternate.

The stator does not move. It consists of magnetic and electrical conductors. The magnetic circuit is made of the frame and the poles. Wound round the poles are the field coils. These form the stator's electrical circuit. When current is fed to them, a magnetic field is set up in the stator.

The motor operates on the principle then when a current-carrying conductor is placed in a magnetic field, a force is produced on the conductor. The interaction of the forces produced by the magnetic field of the rotor and the stator make the rotor spin.

EXERCISE 1: *meaning from context*

Select the word from the three alternatives given which is most similar to meaning to the word in *italics* as it is used in the passage:

1. Provides (line 8)

A- Produces

B- Supplies

C- Allows

2. segments (line 11)

A- sections

B- pieces

C- wires

3. alternate (line 15)

A- reverse

B- change

C- flow in one direction then in another

4. interaction (line 22)

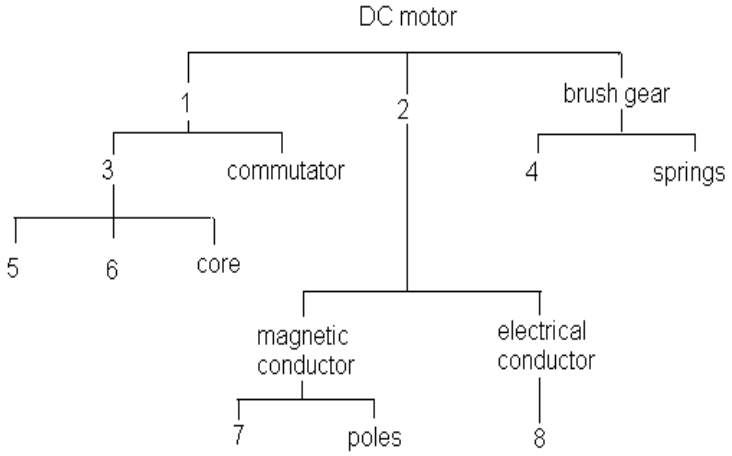
A- acting together

B- operation

C- result

EXERCISE 2: *Complete a diagram*

Complete the following diagram of the component of a DC motor using the information in the passage and figure 3.1



EXERCISE 3: *Describing positions*

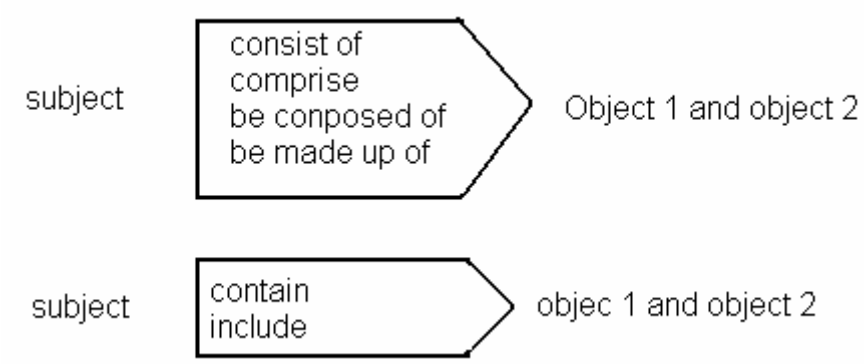
Describe the following components are located using the information in the passage and the figure 3.1

1. The armature windings
2. the core
3. the field coils
4. the poles.
5. commutator

II. Use of language:

1. Describing component part 1

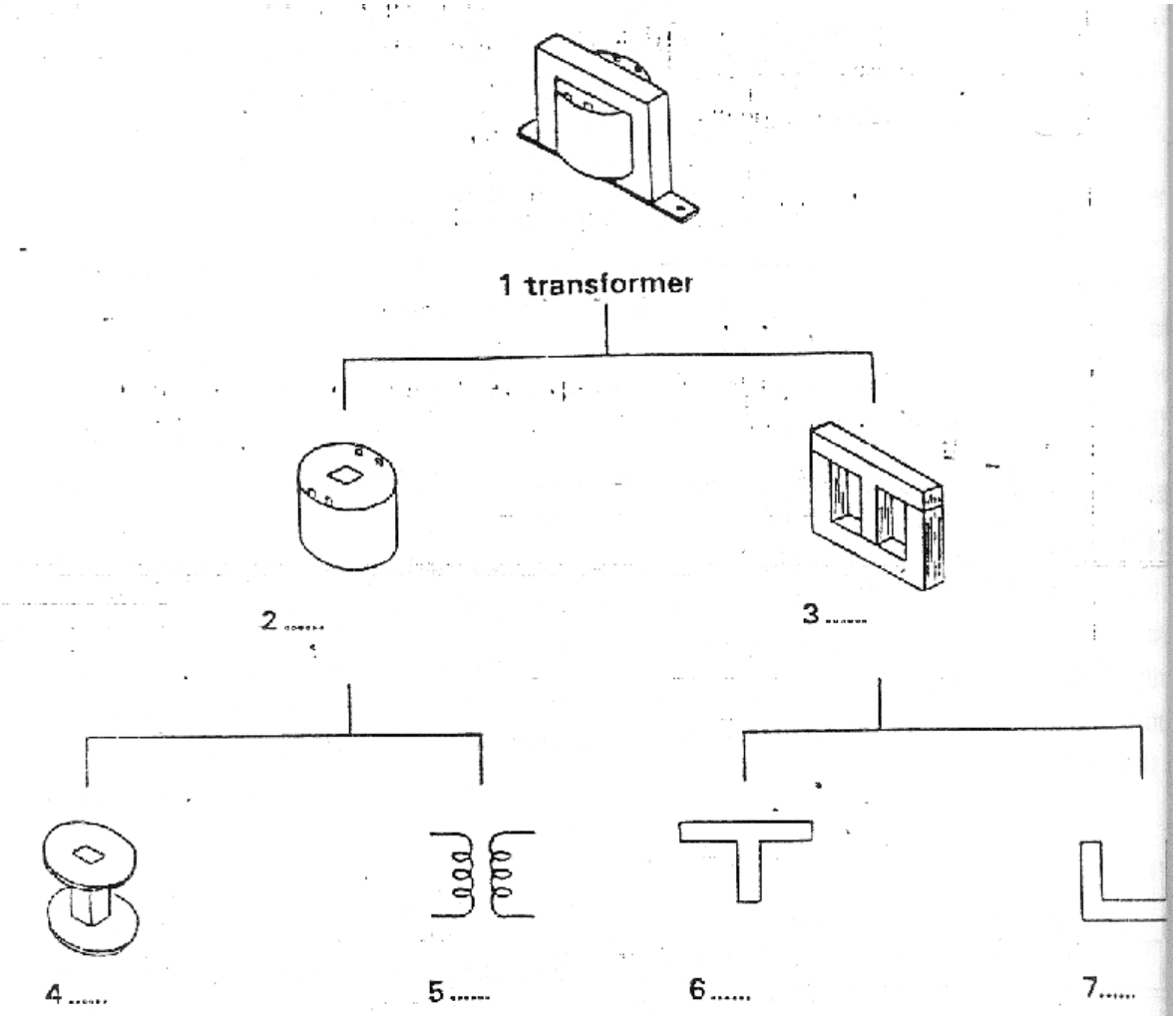
The following verbs can be used to break down a piece of equipment into its component part. Note how they are used:



Study this description of a simple transformer:

A simple transformer consist of two coils, primary and secondary, wound on a former which is mounted on a soft-iron core. The coils are made up of a number of laminations of turns of insulated wire. The core is composed of thin laminations. Either E-and I-or U- and T-shaped laminations are used. The former is mounted on the centre limb of the E or T.

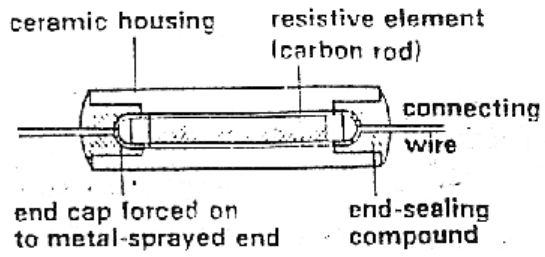
Now complete this diagram of the components of the transformer:

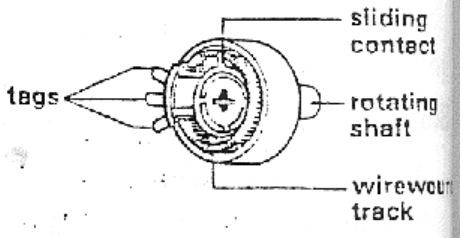


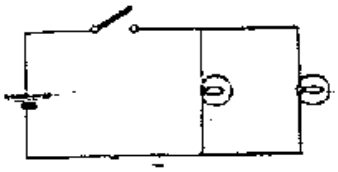
Now write your own description of a transformer using the diagram.

EXERCISE E *Describing component parts 2*

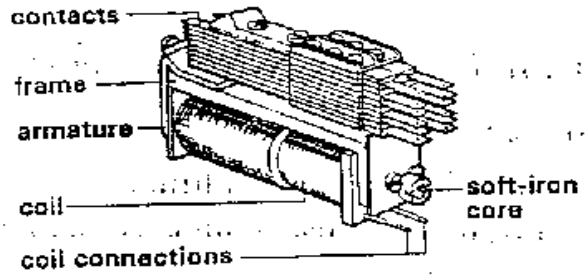
Break down each of these items into its components using the verbs you h
learned. Where possible, draw a diagram to illustrate the breakdown.



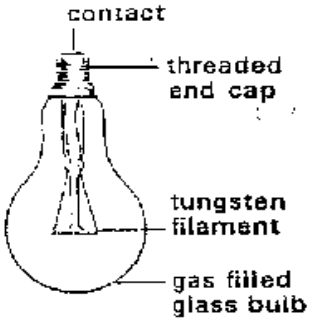




lamp circuit

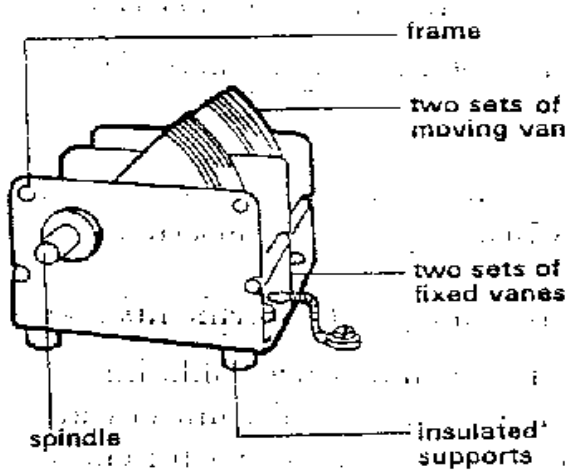


4. a relay

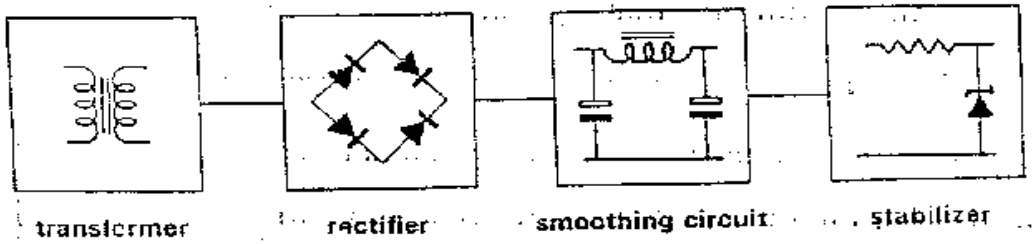


a filament bulb

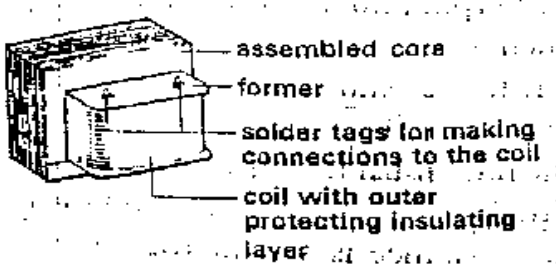
filament: dây tóc bđ



6. a variable capacitor



a power supply



2. Writing impersonal instructions

Study these instructions

1. Use a high-resistance voltmeter.
2. Do not insert a fuse in an earth conductor

In writing instructions are often made impersonal using *should*

Example:

1. a high-resistance voltmeter SHOULD be used.
2. a fuse SHOULD NOT be inserted in an earth conductor.

We emphasize an instruction by using *must*

Example:

1. a high-resitance voltmeter MUST be used
2. a fuse MUST NOT be inserted in an earth conductor

III. Further reading:

DC motors

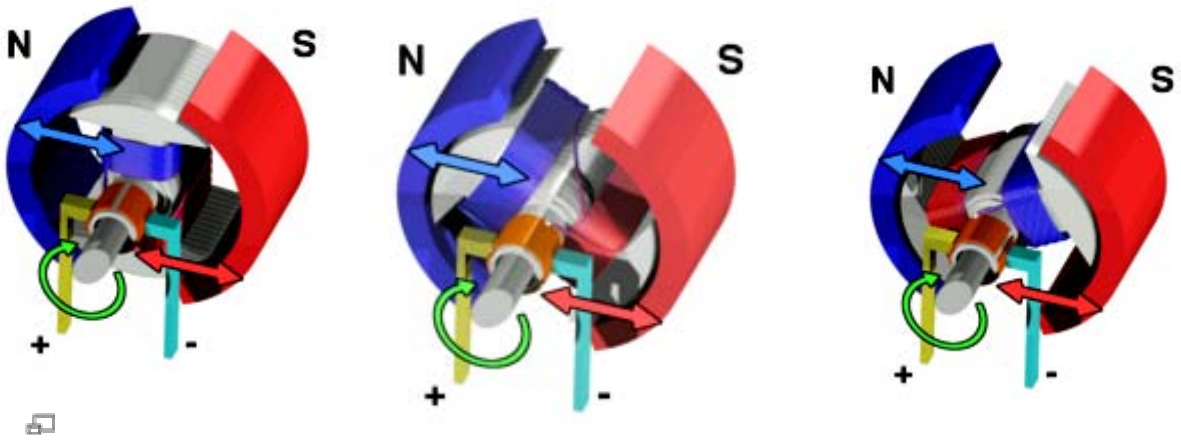


Figure 3.2

A simple DC electric motor. When the coil is powered, a magnetic field is generated around the armature. The left side of the armature is pushed away from the left magnet and drawn toward the right, causing rotation.
The armature continues to rotate.

When the armature becomes horizontally aligned, the commutator reverses the direction of current through the coil, reversing the magnetic field. The process then repeats.

One of the first electromagnetic rotary motors, if not the first, was invented by Michael Faraday in 1821, and consisted of a free-hanging wire dipping into a pool of mercury. A permanent magnet was placed in the middle of the pool. When a current was passed through the wire, the wire rotated around the magnet, showing that the current gave rise to a circular magnetic field around the wire. This motor is often demonstrated in school physics classes, but brine is sometimes used in place of the toxic mercury.

The modern DC motor was invented by accident in 1873, when Zénobe Gramme connected a spinning dynamo to a second similar unit, driving it as a motor.

The classic DC motor has a rotating armature in the form of an electromagnet with two poles. A rotary switch called a commutator reverses the direction of the electric current twice every cycle, to flow through the armature so that the poles of the electromagnet push and pull against the permanent magnets on the outside of the motor. As the poles of the armature electromagnet pass the poles of the permanent magnets, the commutator reverses the polarity of the armature electromagnet. During that instant of switching polarity, inertia keeps the classical motor going in the proper direction. (See the diagrams to the right.)

DC motor speed generally depends on a combination of the voltage and current flowing in the motor coils and the motor load or braking torque. The speed of the motor is proportional to the voltage, and the torque is proportional to the current. The speed is typically controlled by altering the voltage or current flow by using taps in the motor windings or by having a variable voltage supply.

As this type of motor can develop quite high torque at low speed it is often used in traction applications such as locomotives.

However, there are a number of limitations in the classic design, many due to the need for brushes to rub against the commutator. The rubbing creates friction, and the higher the speed, the harder the brushes have to press to maintain good contact. Not only does this friction make the motor noisy, but it also creates an upper limit on the speed and causes the brushes eventually to wear out and to require replacement. The imperfect electric contact also causes electrical noise in the attached circuit. These problems vanish when you turn the motor inside out, putting the permanent magnets on the inside and the coils on the outside thus designing out the need for brushes in a brushless design. However such designs need electronic circuits to control the switching of the electromagnets (the function that is performed in conventional motors by the commutator).

Wound field DC motor

The permanent magnets on the outside (stator) of a DC motor may be replaced by electromagnets. By varying the field current it is possible to alter the speed/torque ratio of the motor. Typically the field winding will be placed in series (series wound) with the armature winding to get a high torque low speed motor, in parallel (shunt wound) with the armature to get a high speed low torque motor, or to have a winding partly in parallel, and partly in series (compound wound) to get the best of both worlds. Further reductions in field current are possible to gain even higher speed but correspondingly lower torque. This technique is ideal for electric traction and many similar applications where its use can eliminate the requirement for a mechanically variable transmission

Unit 4

ELECTRICAL IGNITION

I. Reading and comprehension

Read the text and label the drawings with instructions a, b, c, d, or e:

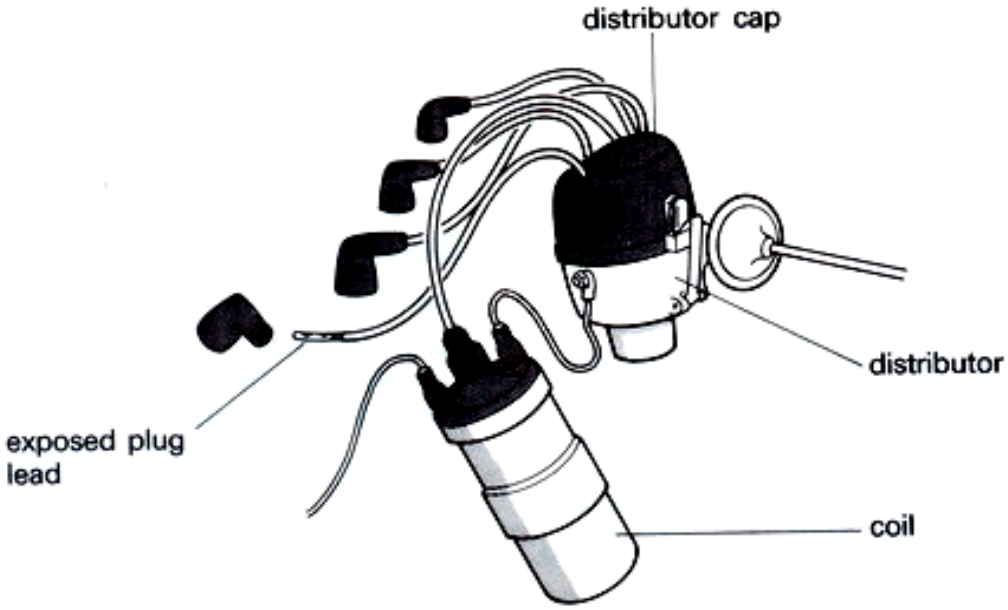
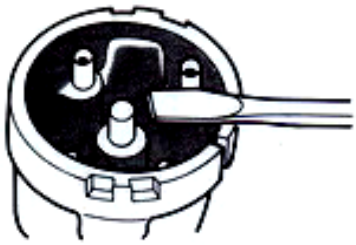
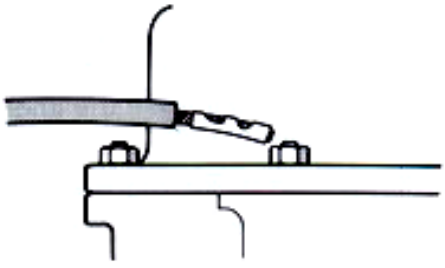


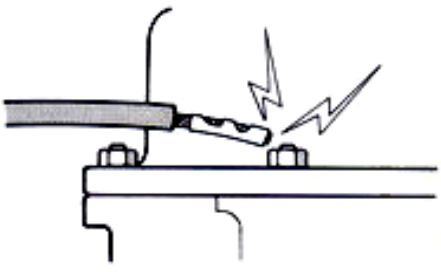
Figure 14.1 The ignition system

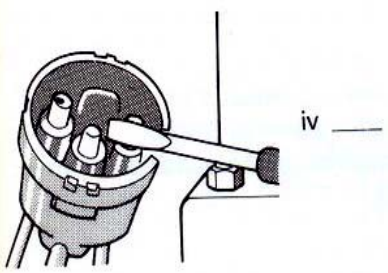
The coil produces high-tension electrical power. The distributor transmits this power to the spark plugs.
To check the ignition system follow these steps:

1 Remove the cap from one of the plug leads.
2 Hold the exposed end close to a good earth, e.g. an engine bolt.
3 Switch on the ignition.
4 Turn the engine.
5 Check for a spark as follows:
   a. If there is a spark between the plug lead and the earth, there is no fault.
   b. If there is no spark, check the electrical circuit in the distributor.
   c. To check the distributor, use an insulated screwdriver. Hold it against a good earth conductor and close to the distributor brush.
   d. If there is a spark, the fault is in the distributor. Check its condition.
   e. If there is no spark, check the coil.

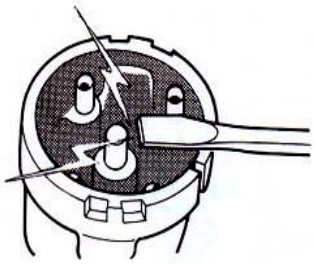








iv ____



v ____

Practice 1

Complete Table 14.1:

Observation	Action
No spark between the plug lead and the earth	Check ____
____ between ____ and ____	Check the condition of the distributor
Spark between ____ and ____	No action
____ between ____	Check the coil

Table 14.1

Practice 2

Complete the instructions on the next page with a, b, c, d and e:

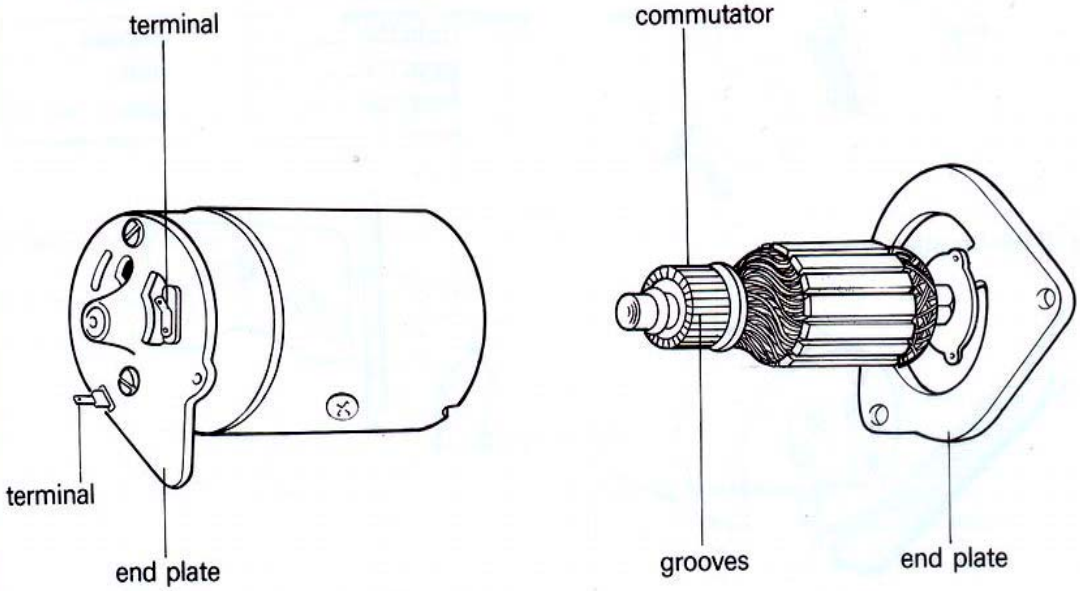
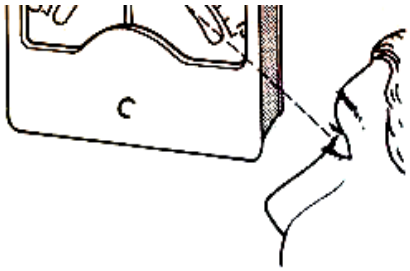
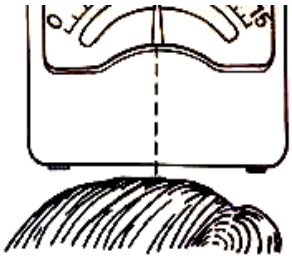


Figure 14.2 Repairing a generator





_ _, the reading _ _ _ _.

_ _ _ _ the front, _ _ _ _.

Development

Use Figs. 14.4 and 14.5 to complete the text:

Voltage is stepped up or stepped down by means of a transformer. This apparatus is shown in Fig. 14.4.

If a current is passed through the primary winding, a current is induced in the secondary winding. This is known as mutual induction. The strength of the induced current in the secondary winding depends on the number of turns on the secondary winding.

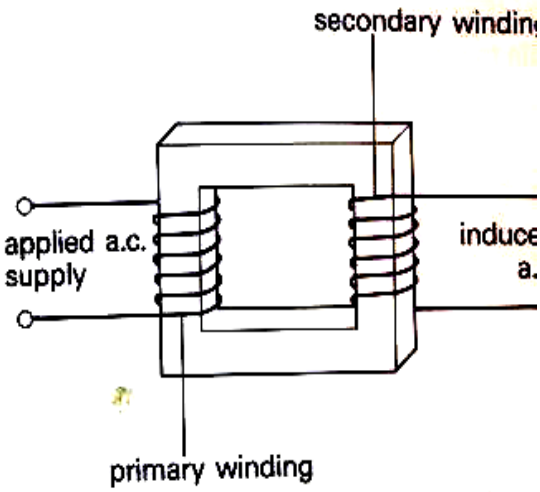


Figure 14.4 Transformer principle

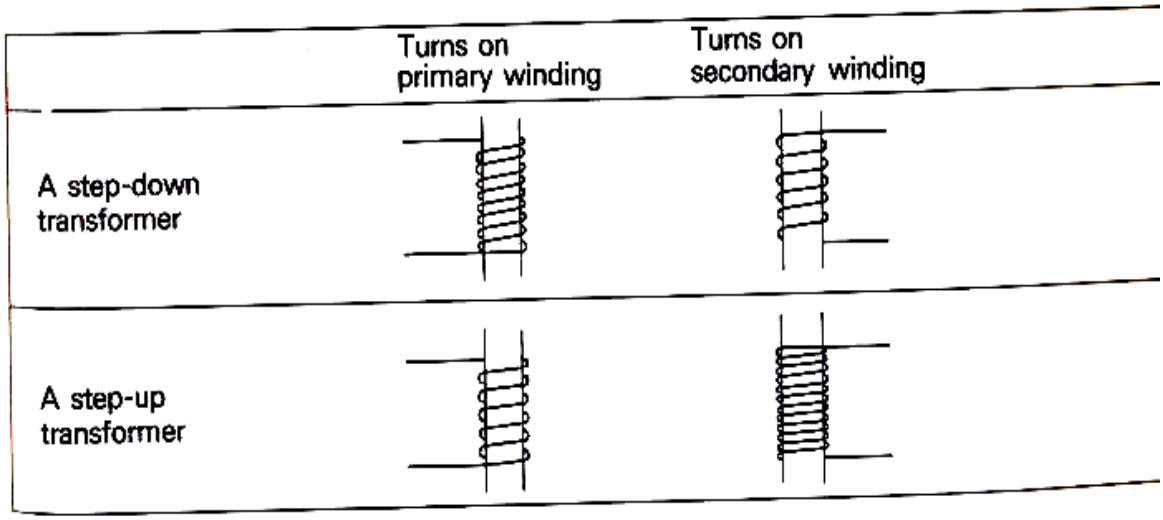


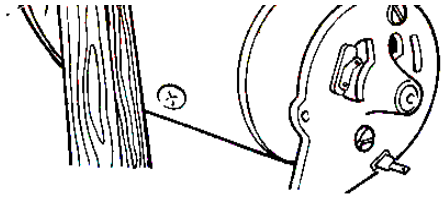
Figure 14.5

A step-down transformer

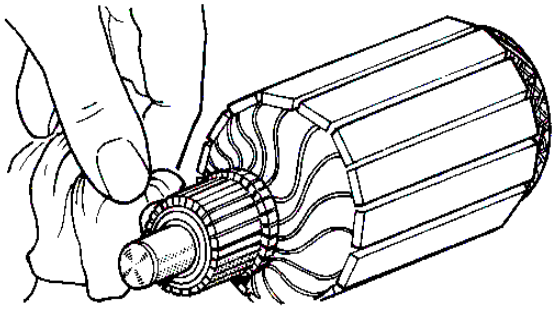
If the number of turns on the primary winding is more than the number of turns on _ _ _ _, the induced voltage will be less than _ _ _ _ voltage.

A step-up transformer

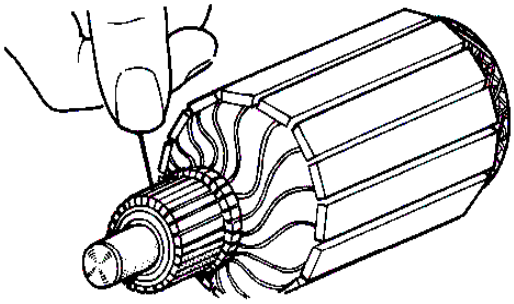
If the number of turns on _ _ _ _ is more than _ _ _ _



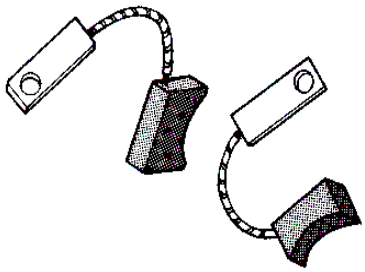
1 If the end plate does not come off, ____.



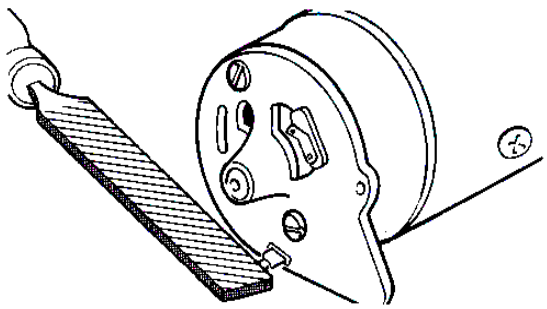
2 ____, clean it with a petrol-moistened cloth.



3 ____, clean them with a pin.



4 If the brushes are worn, ____.



5 ____, use a small file to clean them.

d. tap it with a piece of wood.
e. If the grooves on the commutator are clogged

Practice 3

Use the diagrams to complete the text and the table:

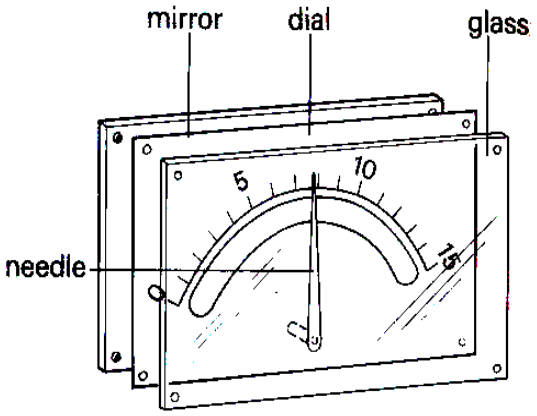
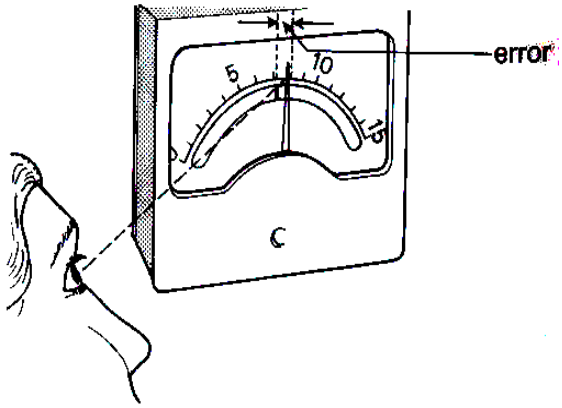


Figure 14.3 The main parts of a dial

Some measuring instruments are fitted with dials. To prevent incorrect readings, always read the dial correctly. Read the dial from directly in front so that the reflection is behind the needle. If the dial is not viewed from the front the reading will be incorrect.

viewing position	reading
from the ____	correct
from the ____	high
from the ____	low



If the instrument is viewed from the left, the reading will be ____ .

II. Further reading:

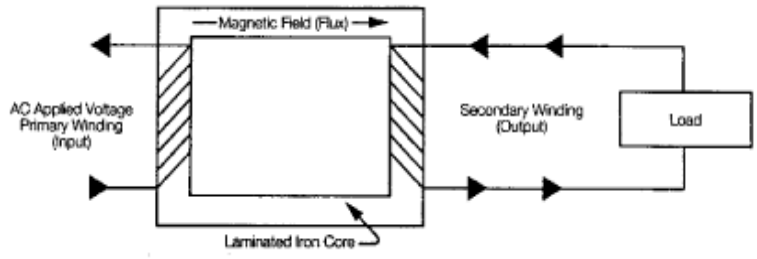
Voltage Transformers

A Transformer does not generate electrical power, it transfers electrical power. A transformer is a voltage changer. Most transformers are designed to either step voltage up or to step it down, although some are used only to isolate one voltage from another. The transformer works on the principle that energy can be efficiently transferred by magnetic induction from one winding to another winding by a varying magnetic field produced by alternating current . An electrical voltage is induced when there is a relative motion between a wire and a magnetic field. Alternating current (AC) provides the motion required by changing direction which creates a collapsing and expanding magnetic field.

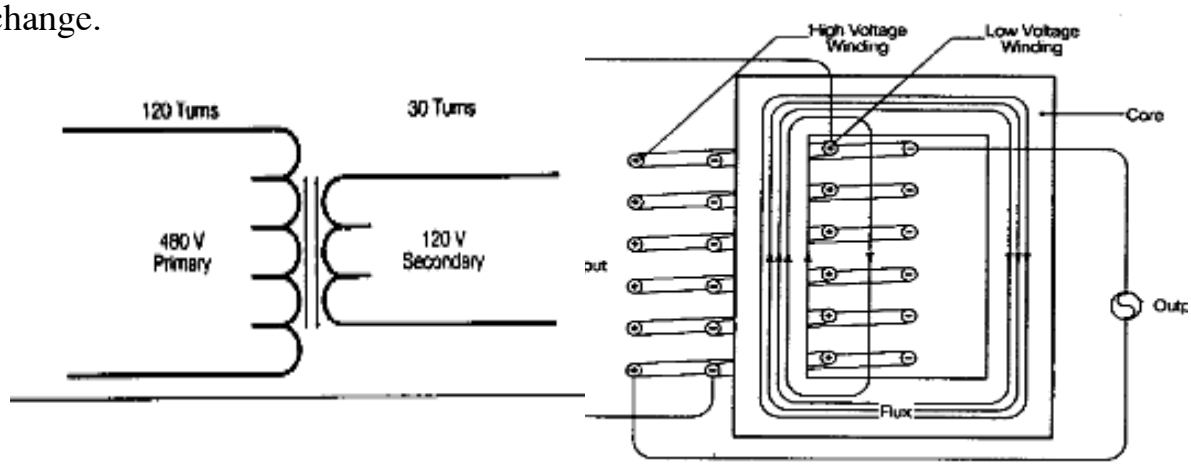
NOTE: Direct current (DC) is not transformed, as DC does not vary its magnetic fields

A transformer usually consists of two insulated windings on a common iron (steel) core:

The two windings are linked together with a magnetic circuit which must be common to both windings. The link connecting the two windings in the magnetic circuit is the iron core on which both windings are wound. Iron is an extremely good conductor for magnetic fields. The core is not a solid bar of steel, but is constructed of many layers of thin steel called laminations. One of the windings is designated as the primary and the other winding as the secondary. Since the primary and secondary are wound the on the same iron core, when the primary winding is energized by an AC source, an alternating magnetic field called flux is established in the transformer core. The flux created by the applied voltage on the primary winding induces a voltage on the secondary winding. The primary winding receives the energy and is called the input. The secondary winding is discharges the energy and is called the output.



The primary and secondary windings consist of aluminum or copper conductors wound in coils around an iron core and the number of ?turns? in each coil will determine the voltage transformation of the transformer. Each turn of wire in the primary winding has an equal share of the primary voltage . The same is induced in each turn of the secondary. Therefore, any difference in the number of turns in the secondary as compared to the primary will produce a voltage change.



Unit 5

THE MOVING COIL

I. Reading and comprehension:

Construction and component

The essential component of a moving coil meter are a permanent magnet and a moving coil. The magnet is U-shaped or semi-circular and is made of a material such as Alcomax. Each pole terminates in a soft-iron pole piece shaped and positioned as in figure 5.1.

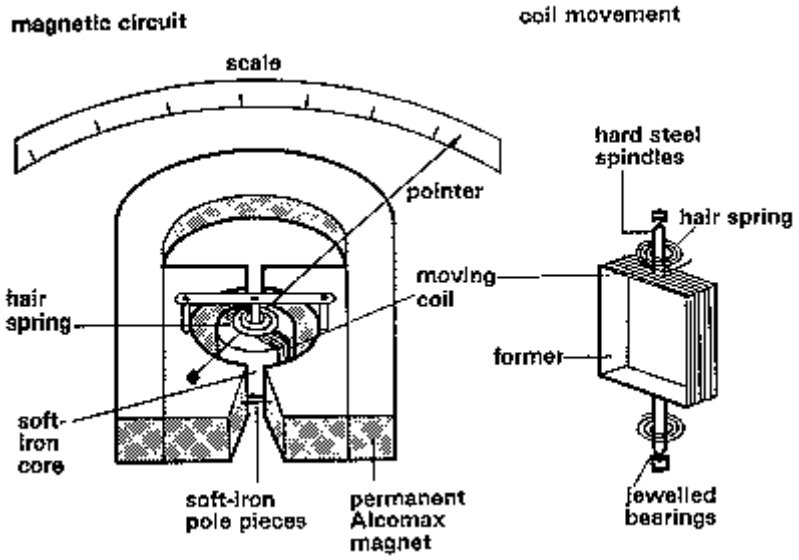


Figure 5.1

The moving coil, which gives the instrument its name, is composed of fine copper wire wound on a thin rectangular aluminum former. The former is mounted centrally on hard steel spindles and can rotate around a fixed cylindrical soft-iron core. The core is placed between the pole pieces in such a manner thatan annular gap is formed between it and the pole pieces. A pointer is attached to the former and traverses a linear scale.

The spindles which bear the moving coil are mounted on jeweled bearing two spiral hair springs are attached to the spindles. They are wound in apposition and are adjusted so that they balance when the pointer is at the zero mark.

Operation

This instrument operates on the principle that when a current carrying conductor is placed in a magnetic field, a force is exerted on the conductor which causes it to move.

When the meter is inserted in a live circuit, current flows through the control springs into the coil. This sets up a magnetic field around the coil which reacts with the radial magnetic field of the permanent magnet. The reaction produces a torque which tends to rotate the coil. Since the strength of the permanent magnet's field is uniform, this torque is directly proportional to the current flowing in the coil. As the coil rotates, the control springs tighten thus opposing the motion of the coil. When the deflecting force of the coil is balanced by the controlling force of the springs, the coil comes to rest. The extent of the coil's movement, and hence the size of the current flowing through the coil, is indicated on the scale by the pointer.

EXERCISE 1: *Describing position*

Say where the following components arte located. Use the expressions you learnt in Unit 1.

1. the pole pieces.
2. the core.
3. the pointer
4. the former.
5. the springs.

EXERCISE 2: *Describing functions*

This table describes the function of the component of the meter. The functions are in the wrong order. Write a sentence to describe the function of each

component using the methods you learnt in unit 2. note that the springs have two functions.

Now add part 1 of the reading passage a description of the function of these component. Begin like:

The function of the moving coil meter is to detect the presence of a direct current. Its essential components……

Component	Function
1. core	To provide controlling torque.
2. former	To reduce friction and wear.
3. spring	To produce a powerful uniform magnetic field.
4. bearings	To carry the coil.
5. magnet	To serve as leads to carry current to the coil.
	To produce radial filed lines within the gap.

EXERCISE 3: *phrasing*

Rewrite the following sentences rephrasing the words in italics with expressions from the passage which have similar meaning:

1. The meter is inserted in *a circuit with a current flowing through it*.
2. The coil is rotated by *turning force*.
3. The strength of the permanent magnet's field is *always the same*.
4. The turning force *varies directly with* the current flowing through the coil.
5. *The force which rotates the coil* is balanced by *the force which restrains the coil*

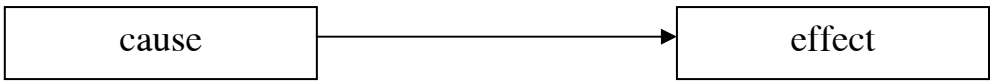
II. Use of language:

1. Cause and effects 1

Study this sentence

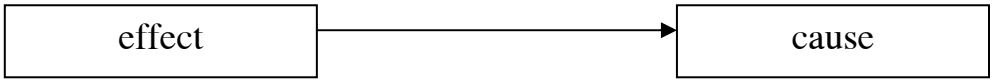
Insulation breakdown leads to short circuit.

This sentence contains a cause and effect. We can link a cause and an effect as follow



Insulation	causes	short circuit
Breakdown	results in	
	Produces	
	Leads to	
	Gives rise to	
	Is the cause of	

We can also put the effect first



Short circuits	are caused by	insulation breakdown
	Result from	
	Arise from	
	Are the effect of	
	Are the result of	
	Are the consequence of	
	Are due to	

When a cause has several effects or when an effect has a number of possible causes, we put *can* or *may* before the causative expression.

Example:

Sparking MAY be cause by worn brushes

Or: sparking CAN be caused by a worn commutator.

Similarly, instead of *the* cause/effect/result/consequence of, we write *one* cause/effect/result/consequence of.

Example:

Worn brushes are ONE cause of sparking

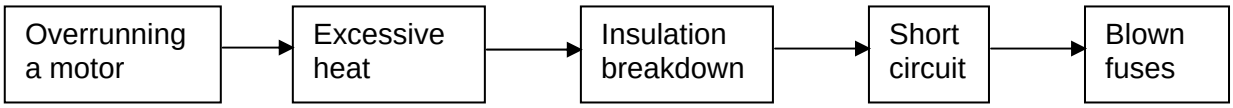
A worn commutator is ONE cause of sparking.

Now match these cause and effect pairs. Then link them using the expressions given above. Write two sentences for each example, one with the cause first and the other with the effect first.

CAUSE	EFFECT
1. glare	arching across the points
2. eddy currents	power losses in transformers
3. excessive heat	serious accidents
4. faulty soldering	breakdown of the motor
5. sparking	discomfort to the eyes
6. failure of a point capacitor	damage to semiconductor
7. exceeding the motor rating	bad joints
8. faulty earth connections	interference in receivers

2. Cause and effect chains

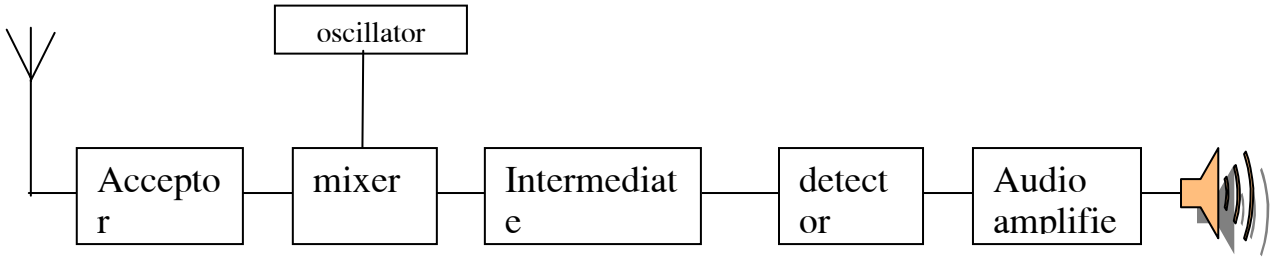
Describe this cause and effect chain. Use different expressions for each link



Now rewrite your description starting at the end of the chain and working backwards.

2. Describing the reception of a signal

Put these events, which describe the progress of a signal through a receiver, in sequence with the help of the diagram. Then link the sentences in pairs using time clauses with *before* and *after*.



a. the signal is again amplified.

b. The desired signal is fed to the acceptor circuit.

c. The signal is amplified
d. The signal is fed to a loudspeaker
e. The signal is mixed with a signal from the oscillator to give a standard intermediate frequency
f. The signal is rectified by the detector.

3. Short relative clause

Study these sentences:

1. A telephone dial consists of small keys
2. those keys has many characters and numbers

We can link them using a relative clause:

1+2. A telephone dial consists of small keys HAVING many characters and numbers.

A telephone dial consists of small keys WITH many characters and numbers.

Sometimes we can reduce a relative clause to an adjective

Example:

3. high quality instrument use resistors.
4. the resistors are wire wound.

3+4. high quality instruments use resistors WHICH ARE WIREWOUND

high quality instruments use WIREWOUND resistors.

Make this paragraph shorter by reducing the relative clauses. Use all the methods of reduction you have learned in this unit.

The telephone is an instrument which enables us to transmit speech via wire (wireless ness). The body of the telephone contains an induction coil, capacitors, resistors, a regulator, which controls the sensitivity of the instrument, and a bell. The handset contains a microphone and a receiver which are enclosed by screwed caps at the ends of the handset. The bell contains a hammer which is operated by a solenoid. The hammer is set between two domes which is eccentrically mounted. The dial is mounted on the face of the telephone. It consists of small keys which have characters and numbers. When those keys are pressed in, it causes spring contacts to open

and close a number of times which respond to the number dialed. This transmits pulses down the line causing selectors, which connect the calling line to the line which is called, to operate.

III. Further- reading:

Oscillator

The Basics

One of the most commonly used oscillators is the pendulum of a clock. If you push on a pendulum to start it swinging, it will oscillate at some **frequency** -- it will swing back and forth a certain number of times per second. The length of the pendulum is the main thing that controls the frequency.

For something to oscillate, energy needs to move back and forth between two forms. For example, in a pendulum, energy moves between **potential energy** and **kinetic energy**. When the pendulum is at one end of its travel, its energy is all potential energy and it is ready to fall. When the pendulum is in the middle of its cycle, all of its potential energy turns into kinetic energy and the pendulum is moving as fast as it can. As the pendulum moves toward the other end of its swing, all the kinetic energy turns back into potential energy. This movement of energy between the two forms is what causes the oscillation.

Eventually, any physical oscillator stops moving because of **friction**. To keep it going, you have to add a little bit of energy on each cycle. In a pendulum clock, the energy that keeps the pendulum moving comes from the spring. The pendulum gets a little push on each stroke to make up for the energy it loses to friction.

An electronic oscillator works on the same principle.

Unit 6

PROCESS CONTROL SYSTEM

I. Reading and comprehension

Control systems provide a means of replacing human operators in many industrial processes. They are used widely to monitor and control pressure, temperature, motor speed, the flow of a liquid, or any other physical variable. They must be capable of fulfilling a number of functions. First, the physical variable to be controlled, such as the air temperature in the factory or the pressure of a hydraulic system, must be measure. Then its value must be compared with the desired value. Next, action has to be taken to reduce to zero the difference between the actual and desired value.

The basic components of a control system are an input transducer, an error sensor, a controller and an output transducer. The input transducer converts changes in the physical variable into electrical signal. Figure 6.1 shows one type of transducer which converts changes in pressure to frequency changes. Pressure changes move in L1 which forms part of a tuned circuit. This causes the frequency of the circuit to change, thus alternating the output frequency of the oscillator. The output is then fed to an error sensor.

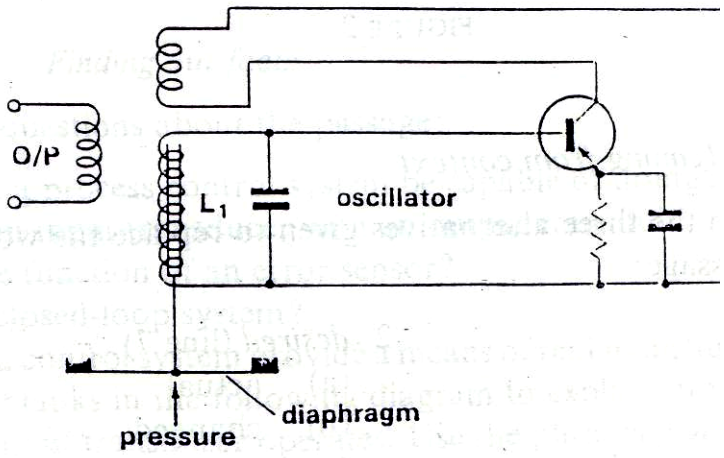


Figure 6.1

The error sensor measures the deviation between the actual and desired values for the variable. The controller receives the error sensor output and uses it to

control the variable either directly or indirectly. A simple controller is an electromagnetic relay which uses a small signal to control a much larger signal such as power supply output.

The output transducer converts the electrical output from the controller into whatever form of energy is required to change the physical variable. It may be a valve, a heater, a motor or any electrically operated piece if equipment. An example is a motor-operated valve which controls the flows of fluid in a pipeline. Let us take as an example a process system for controlling the speed of a DC motor. The input transducer measures the speed and converts it into a voltage. The error sensor compares this voltage with the voltage across a speed-setting potentiometer. The error sensor output is fed to the controller which sends a signal to the power supply of the motor. The increases or reduces the supply of current to the motor, thus controlling its speed.

The operation of a process control system is summarized in figure 6.2 which shows a closed loop system. In such a system of the action of the controller are constantly fed back to it.

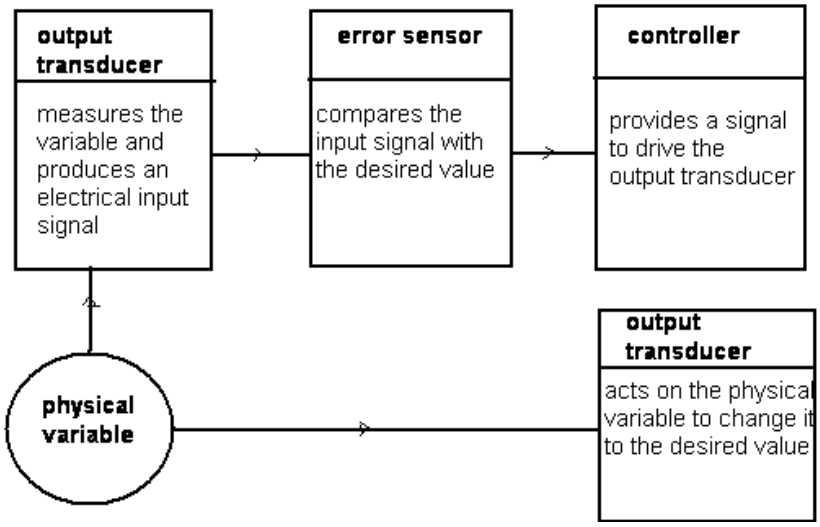


Figure 6.2

EXERCISE 1: *meaning from context*

Select a word from the three alternatives given to replace the word in italics taken from the passage:

1. *Monitor* (line 2)
   a- Warn
   b- Check
   c- Convert
2. *desired* (line 7)
   a- actual
   b- changed
   c- required
3. *deviation* (line 17)
   a- mistake
   b- bias
   c- difference
4. *converts* (line 22)
   a- changes
   b- controls
   c- generates.

EXERCISE 2: *contextual reference*

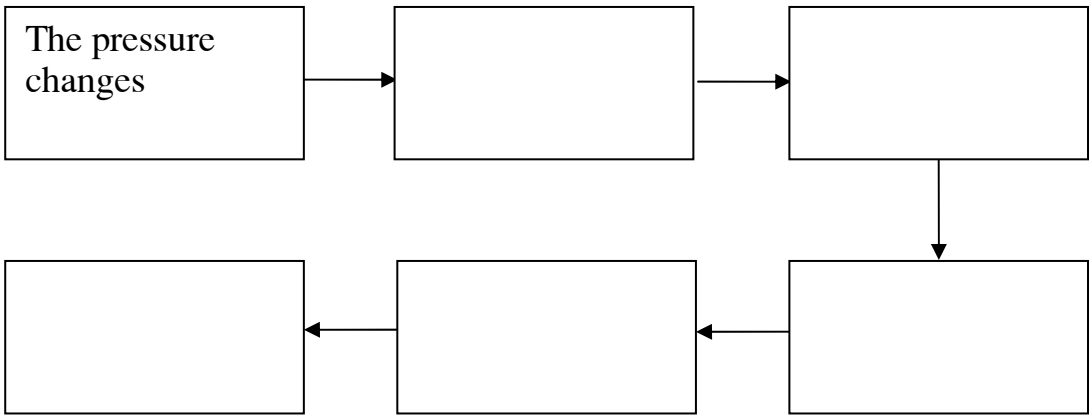
What do the pronouns in *italics* in these sentences refer to?

1. *They* must be capable of fulfilling a number of functions (line 4)
   a- control system
   b- industrial processes
   c- human operators.
2. Then *its* value must be compared with the desired value. (line 6)
   a- the pressure
   b- the air temperature
   c- the physical variable
3. *This* causes the frequency of the circuit to change, thus alternating the output frequency of the oscillator (line 14)
   a- moving the diaphragm in or out
   b- alternating the position of the ferrite core
   c- changing the pressure
4. *It* may be a valve, a heater, a motor, or any electrically-operated piece of equipment. (line 23)
   a- the output transducer
   b- the electrical output
   c- the physical variable
5. In *such a system* the results of the action of the controller are constantly fed back to it. (line 34)
   a- a process control system
   b- a closed-loop system
   c- a system for controlling the speed of a DC motor.

EXERCISE 3: *finding out facts*

Answer questions about the passage

1. What must a process control system be capable of doing?
2. Compare an input transducer with an output transducer.
3. What is the function of an error sensor?
4. What is a closed- loop system?
5. How does a control system provide a means of replacing human operators?
6. Fill in the blanks in the following diagram to explain how the frequency-changing input transducer operates. Use the phrases given.



II. Use of language:

Language study *Reduced time clauses*

Study these two actions:

1 *Ground waves pass over sand.*
2 *Ground waves lose energy.*

We can link these actions to make one sentence, using a time clause:

***When** ground waves pass over sand, they lose energy.*

Because the subject of both actions is the same – *ground waves* – there is a shorter method we can use to link the actions:

***When passing** over sand, ground waves lose energy.*

***When** + **-ing** shows that Action 2 happens during the same period as Action 1.*

Now study these two actions:

1 *The sky wave strikes the earth.*
2 *The sky wave bounces back again.*

Again we can link these actions to make one sentence. using

***When** the sky wave strikes the earth. it bounces back again.*

We can also link the actions in a shorter way:

***On** strik**ing** the earth. the sky wave bounces back again.*

On + -ing shows that Action 2 follows immediately after Acti

Link these pairs of actions. Use short ways when this is possib

1 **a** The switch is closed.
b Current flows through the primary of the transformer.

2 **a** The radar signal strikes a plane.
b The radar signal is reflected.

3 **a** A cell discharges quickly.
b A cell may become hot.

4 **a** The TV receives signals from the remote control.
b The TV follows your instructions.

5 **a** The radar receiver receives the reflected signal.
b The signal is compared with the transmitted signal.

6 **a** You choose a course in electronics.
b You think carefully about your future.

7 **a** Microwave signals strike a high building.
b Microwave signals are deflected.

8 **a** You make a recording.
b You should ensure the recording levels are satisfactory.

9 **a** The alarm detects an intruder.
b The alarm triggers an audible warning.

10 **a** The remote control button is pressed.
b The television set changes channel.

Word study *Word formation*

Study the verb and two related nouns below. One noun is used for a component. The other is an abstract noun used for a property.

amplify *amplifier* *amplification*

With the help of the reading passage, earlier units, and your own knowledge, fill the gaps in this table.

Verb	**Noun** (component)	**Noun** (property)
absorb	—	_____
attenuate	attenuator	_____
_____	—	communication
conduct	_____	conductivity
_____	inductor	_____
modulate	_____	modulation
reflect	reflector	_____
resist	_____	_____

Listen to the words in the table. Try to mark the stressed syllable.

III. Further reading:

Sensor

Without sensors, a robot is just a machine. Robots need sensors to deduce what is happening in their world and to be able to react to changing situations. This chapter introduces a variety of robotic sensors and explains their electrical use and practical application. The sensor applications presented here are not meant to be exhaustive, but merely to suggest some of the possibilities. Please do not be limited by the ideas contained in this chapter! Assembly instructions for the kit sensors are given in Section 2.6.

Sensors as Transducers

The basic function of an electronic sensor is to measure some feature of the world, such as light, sound, or pressure and convert that measurement into an electrical signal, usually a voltage or current. Typical sensors respond to stimuli by changing their resistance (photocells), changing their current flow (phototransistors), or changing their voltage output (the Sharp IR sensor). The electrical output of a given sensor can easily be converted into other electrical representations.

Analog and Digital Sensors

There are two basic types of sensors: *analog* and *digital*. The two are quite different in function, in application, and in how they are used with the RoboBoard. An analog sensor produces a *continuously varying* output value over its range of measurement. For example, a particular photocell might have a resistance of 1k ohm in bright light and a resistance of 300k ohm in complete darkness. Any value between these two is possible depending on the particular light level present. Digital sensors, on the other hand, have only two states, often called "on" and "off." Perhaps the simplest example of a digital sensor is the touch switch. A typical touch switch is an open circuit (infinite resistance) when it is not pressed, and a short circuit (zero resistance) when it is depressed.

Some sensors that produce a digital output are more complicated. These sensors produce *pulse trains* of transitions between the 0 volt state and the 5 volt state. With these types of sensors, the frequency characteristics or shape of this pulse train convey the sensor's measurement. An example of this type of sensor is the Sharp modulated infrared light detector. With this sensor, the actual element measuring light is an analog device, but signal-processing circuitry is integral to the sensor produces a digital output.

Unit 7

SEMICONDUCTOR DIODE

I. Reading and comprehension:

If two crystal of a semiconductor material, one of P-type and one of N-type, are joined together, a PN junction is formed. This junction can be used as a rectifier and is known as a PN junctions diode.

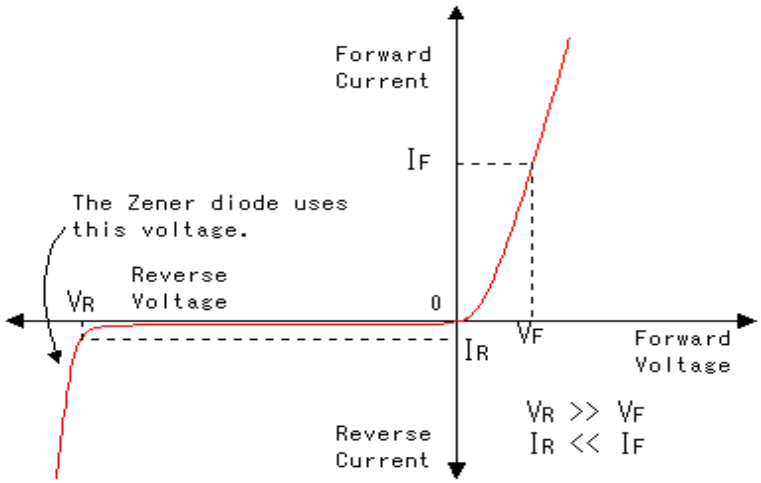


Figure 7.1

Figure 1 illustrates what happen when voltage is supplied across a silicon PN junction diode. The first quadrant of the graph shows the characteristics of the diode when the source is connected with the positive to the P-side of the conjunction and the negative to the N-side. In the other words, the diode is forward biased. With the forwards bias, the current at first increases slowly. When the applied voltage reaches about 600 mV, the current rises rapidly. The diode is then a good conductor. The current will continue to rise with increased voltage but eventually a point will be reached where the diode is destroyed by the heat.

The third quadrant shows the characteristics when the source is connected with the positive to the N-side and the negative to the N-side. When the diode is reserved biased, there is almost no current to flow. The junction is therefore a good rectifier: it conducts well in one direction and almost not at all in the other. However, there is a small reversed leakage current. This leakage

current remains substantially constant until what is known as breakage voltage (Vb) is reached. At this point, there is a sharp increase in the reverse current. This sudden increase in current is called Zender effect.

Normal diodes are never operated in the breakdown region but Zender diodes are designed to make use of the breakdown phenomenon. Because any slight increase in the voltage beyond the breakdown point causes a large increase in current. Zender diodes are often used as a kind of overspill to protect sensitive circuit from fluctuation in the power supply.

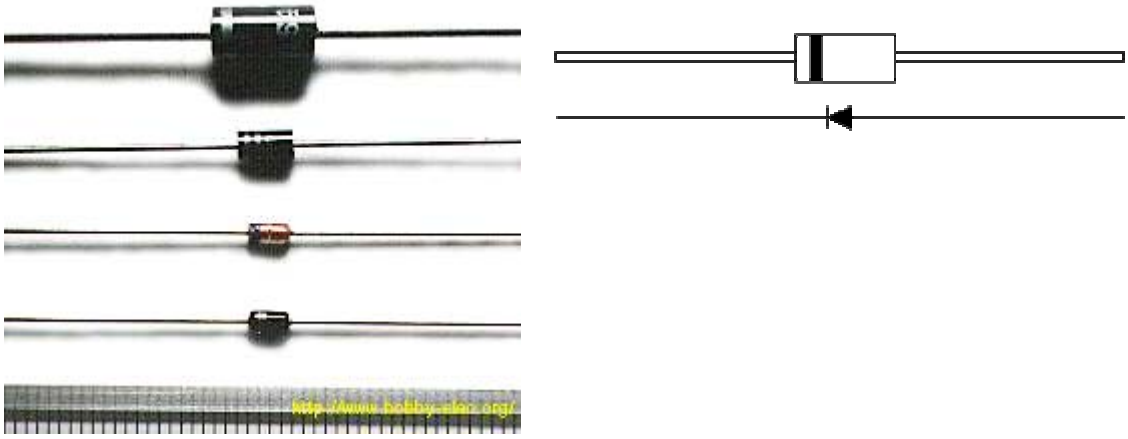


Figure 7.2: Typical diodes

EXERCISE 1:

Select the words from the three alternatives given which is most similar in meaning to the word in italics it is used in the passage:

1. *Characteristics* (line 5)

A. Typical behaviour.
B. Voltage figures.
C. Graph.

2. *Substantially* (line 18)

A. Almost
B. Greatly.
C. Hardly.

3. *Sharp* (line 19)

A. slight.
B. steep.
C. Cutting.

4. *Phenomenon* (line 22)

A. voltage.
B. effect.
C. result.

5. Fluctuations (line 25).

A. rises and falls.

B. increases.

C. Failures

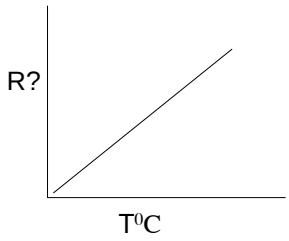
EXERCISE 2: *Checking facts and ideas*

Decide if these statements are true or false. Quote from the passage to support your decision:

1. The first quadrant of the graph shows the characteristics of the diode in the forward bias.
2. For forward voltage over 600 mV, the diode conducts well.
3. When the source is connected with the negative to the N-side and the positive to the P-side, the diode is reverse biased.
4. When a reverse voltage is at first applied, a diode conducts badly.
5. Zender diodes are never used beyond breakdown point.

II. USE OF LANGUAGE:

1. Time clause



Time clauses relate two actions in time. In this section we will study clauses relating:

1. Simultaneous actions.

For example:

As the voltage increases, the current rises.

Study this graph, it represents two actions which

Happens at the same time, i.e., two simultaneous actions.

Action (i) the temperature rises.

Action (ii) the resistance rises.

We can link two simultaneous actions using *as*.

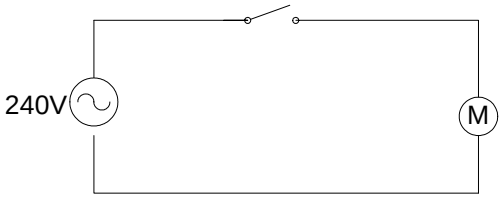
For example:

As the temperature rises, the resistance rises.

We will represent simultaneous actions like this:

Action 1
Action 2

2. Actions in immediate succession.



Study this circuit and note how action (i) is followed immediate by action (ii)

Action (i): the switch is closed.

Action (ii) the motor starts.

We can link action in immediate succession by using *when* or *as soon as*.

Example:

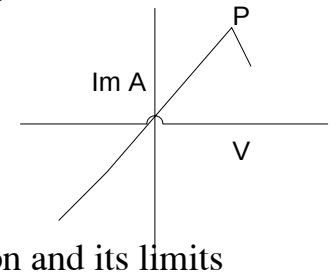
EX: When the switch is pressed, the light goes on.

When the switch is closed, the motor starts

We will represent actions in immediate succession like this:

Action (i)	Action (ii)

3. An action and its limits.



This graph shows that an action and its limits

EX: the current increases *until* the diode is destroyed by heat.

The current rises steadily *until* point P is reached.

We will represent this relationship like this:

action		limits

2. Describing purpose

Study these ways of description the purpose of Random Access Memory (RAM)

RAM is used for the temporary storage of programs and data

RAM is used for storing programs and data temporarily.

RAM is used to store programs and data temporarily.

Now identify each of electronic components or pieces of equipment described below. Compare answers with your partner.

1. It is used to change AC voltage from small to large or from large to small.
2. It is used to measuring very small current.
3. It is used as part of a burger alarm to detect movement.
4. it is used for receiving of RF signals.
5. It is used for protecting circuit from surge in voltage.
6. It is used to master down different recordings to make a master tape.
7. It is used to find buried metal

3. Word study:

Study this term from electronics:

Semiconductor

We can divide it into three parts:

Semi conduct or

Semi is a prefix which means "half", while *or* is a suffix add to the verb *conduct* to make noun. From this we can work out that a *semiconductor* is a component which half conducts, i.e. it conducts in one direction only

Knowledge of common prefixes can help us to work out the meaning of some unfamiliar term in electronics:

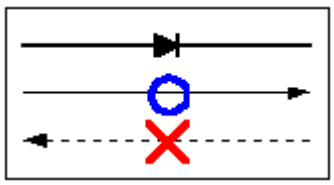
Study this table. Try to think of other examples to add. Compare your examples with those of other group

Explain to the other group the meaning of any terms which they are unfamiliar with:

Prefix	Meaning	Example	Other
de-	reverse the action	decouple	_____
dis-	opposite	discharge	_____
micro-	small	microchip	_____
multi-	many	multimedia	_____
tele-	far	television	_____
trans-	across	transmitter	_____

III. FURTHER-READING

Diodes



A diode is a semiconductor device which allows current to flow through it in only one direction. Although a transistor is also a semiconductor device, it does not operate the way a diode does. A diode is specifically made to allow current to flow through it in only one direction.

Some ways in which the diode can be used are listed here.

- A diode can be used as a rectifier that converts AC (Alternating Current) to DC (Direct Current) for a power supply device.
- Diodes can be used to separate the signal from radio frequencies.
- Diodes can be used as an on/off switch that controls current.

This symbol —▶|— is used to indicate a diode in a circuit diagram.

The meaning of the symbol is (Anode)—▶|—(Cathode).

Current flows from the anode side to the cathode side.

Although all diodes operate with the same general principle, there are different types suited to different applications. For example, the following devices are best used for the applications noted.

- Voltage regulation diode (Zener Diode)

  The circuit symbol is —▶|—.

  It is used to regulate voltage, by taking advantage of the fact that Zener diodes tend to stabilize at a certain voltage when that voltage is applied in the opposite direction.

- Light emitting diode

  The circuit symbol is —▶|—.

  This type of diode emits light when current flows through it in the forward direction. (Forward biased.)

- Variable capacitance diode

  The circuit symbol is —▶|—.

The current does not flow when applying the voltage of the opposite direction to the diode. In this condition, the diode has a capacitance like the capacitor. It is a very small capacitance. The capacitance of the diode changes when changing voltage. With the change of this capacitance, the frequency of the oscillator can be changed.

Unit 8

CATHODE RAY TUBE

I. Reading for comprehension

Cathode Ray Tube (CRT) is used in oscilloscope, radar receivers and televisions. The type described here is that in oscilloscopes. By means of a CRT, an oscilloscope not only shows the size of a signal, but also how the signal varies with time. In other words, it shows the waveform of the signal.

The CRT operates as follows. First electrons are emitted from a heated cathode. Then these electrons are accelerated to give them velocity. Next they are formed into a beam which can be deflected vertically and horizontally. Finally they are made to strike a screen coated on its inner surface with a phosphor.

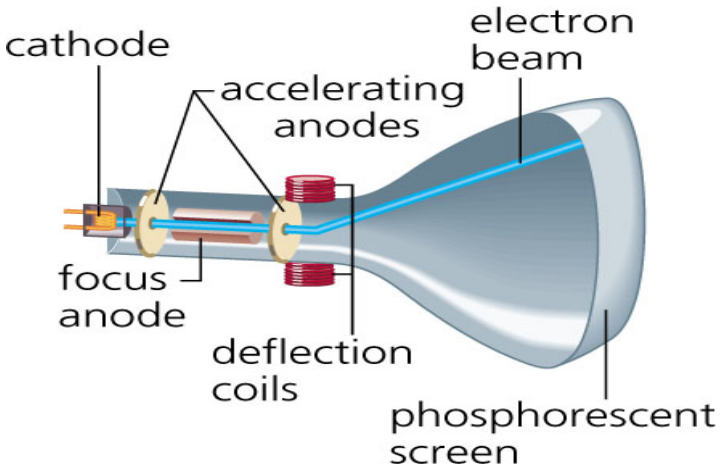


Figure 8.1

The CRT comprises an electron gun and a deflection system enclosed in a glass tube with a phosphor coated screen. The electron gun forms the electrons into a beam. It contains a cathode which is heated to produce a stream of electrons. On the same axis as the cathode is a cylinder known as the grid. By varying the negative potential on the grid, the intensity of the beam can be varied. A system of three anodes follows. These accelerate the beam and also operate as a lens to focus the beam on the screen as a small dot. Varying the potential on the central anode, a_2, allows the focus to be adjusted.

On the leaving the electron gun, the beam passes through two sets of plates which are at right angles to each other. The first set of plates are the Y plates. As these are near the anode, they have a greater effect on the beam. Therefore, the signal is applied to this set. They control the vertical deflection of the beam. The second set are the X plates. On an oscilloscope the output from time base oscillator is applied across these plates as a means of moving the beam horizontally at a regular intervals. Hence the horizontal axis of an oscilloscope is the time axis. By means of the deflection system, then, the beam cab be made to traverse the screen both horizontally and vertically.

The final element is the phosphor-coated screen. When the electron beam strikes the screen, the phosphor coating fluoresces. Various colours of light are produced depending on the phosphor used.

EXERCISE 1 *Meaning from context.*

Select a word from the three alternatives given which is most similar in meaning to the word in italics it is used in the passage:

1. *Emitted*
a. scattered
b. given off
c. absorbed

2. *Deflected*
a. moved
b. bent
c. changed

3. *Intensity*
a. focus
b. brightness
c. shape

4. *Adjusted*
a. reduced
b. varied
c. increase

5. *Regular*
a. frequent
b. equally time
c. varying

6. *Fluoresces*
a. lights
b. emits electrons
c. turns green

EXERCISE 2 *Finding out facts*

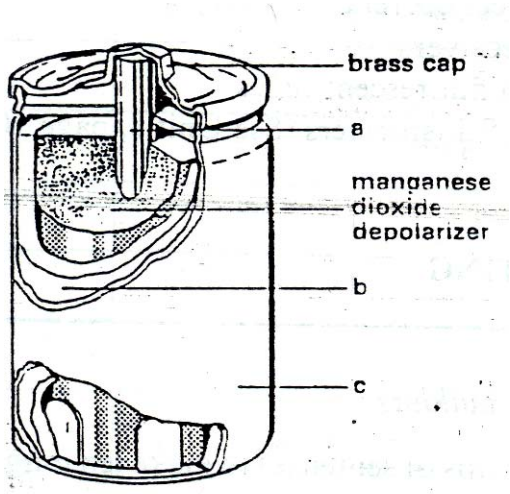
Answer these questions about the passage

1. Why is an oscilloscope better than e meter?
2. What is the source of electrons for the electron beam?
3. What is the function of the electrons gun?

4. How is the intensity of the beam controlled?
5. In what way is the system of anodes like a lens?
6. What does the time base do?
7. Why is the signal applied to the Y plates?

EXERCISE 3: *Diagram labeling*

1. electrolyte
2. carbon rod
3. negative electrode
4. zinc case
5. positive electrode



II. Use of language

1. Describing a process

To make the correct sequence of a number of events clear, we often use sequence words like these:

a. First/firstly/first of all.
b. Second/secondly
c. Third/thirdly.
d. Then
e. Next
f. After that
g. Finally.

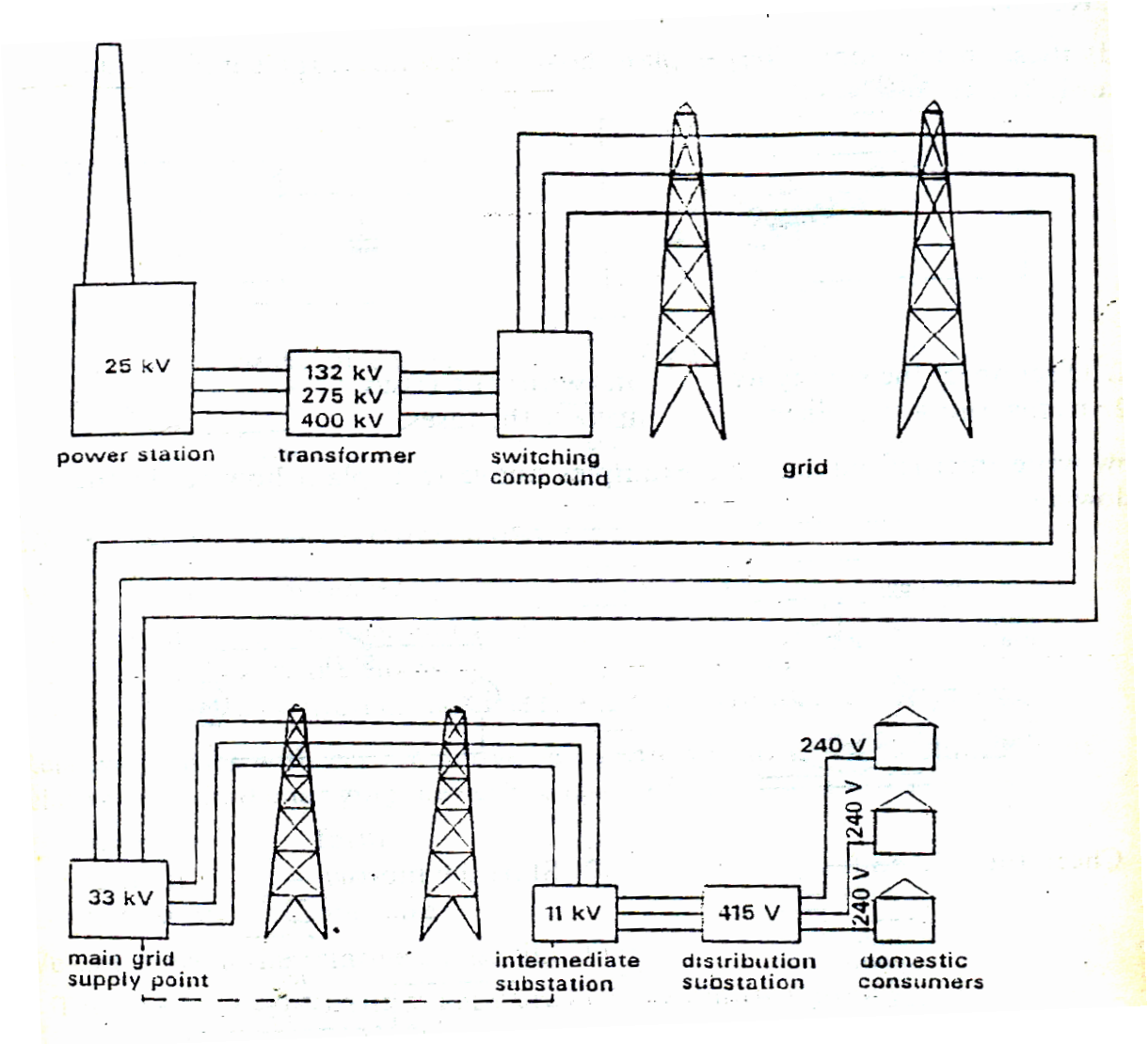
(a) and (g) must come first and last respectively, but the others can be used in any order and can be repeated.

Now replace each number in your description of soldering a resistor into place with a sequence word to make the order of events clear.

The following diagram shows the distribution of power from the power station to the consumer. The sentences which follow it describe the

distribution. Put the sentences in the correct order and mark this order using sequence words.

a. it is fed to distribution substation where it is reduced to 415 V. 3 phase and 240V, 1 phase.
b. It is stepped up by a transformer to 132, 275 or 400kV for long-distance distribution.
c. It is distributed via the grid system to main grid supply point where it is stepped down 33kV of distribution to heavy industry,
d. It is distributed to the domestic consumer.
e. In the UK, electrical energy is generated at power station at 25kV.
f. It passes via the switching compound to the grid.
g. It is distributed via overheat or underground cables to intermediate substations where it is further reduced to 11kV for light industry



2. Cause and effect

Study this sentence:

Dust on records causes crackle

it contains a cause and an effect. Identify them

we can link a cause and effect as allows

cause		**effect**
Dust on record	***causes***	*crackle.*
	Leads to	
	Results in	
	Is the cause of	

We can also put the effect first

Effect		**cause**
Crackle	***is caused by***	*dust on record.*
	Results from	
	In the effect of	
	Is due to	

Items in *A* can be causes or effects of items on *B*. Match the pair. Compare your answer with your partner. For example:

Main frequency interference *hum*

Main frequency interference ***results in*** *hum*

A	B
1. distortion	a. interference on radios
2. noise generated within components	b. too high a recording level
	c. the tape rubbing against the head
3. over heating a transistor	d. scratches on records
4. dirty heads	e. hiss
5. a build-up of oxide on the head	f. damage
6. jumping	g. poor recording
7. unwanted	

3- Sentence building:

Join the following groups of sentences to make ten longer sentences. Use the words printed in italics above each group. You may omit words and make

whatever changes you think are necessary in the word order and punctuation of the sentences

1. *Which*

A resistor is a device

A Resistor is used to add resistance to a circuit

2. *Both*

Many types of resistors are made.

Fixed and variable resistors are made.

3. *Either……..…or*

Most resistors are made from two materials.

Resistance wire and compressed graphite are used.

4. *Such as, which*

Wire wound resistor consists of a coil of resistance wire.

Nichrome is a resistance wire.

The resistance wire is wound on a former.

5. *To*

A ceramic coating is applied over the winding.

The ceramic coating insulates the winding

6. *For example*

For small currents, carbon resistors are used.

Small current are usual in radio work.

7. *Which*

Carbon resistors are made of compressed graphite. (than chì)

The graphite is formed into small tubes.

8. *Which*

Connections are made with wires.

The wires are attached to the ends of the resistor.

9. *Either…..or….*

Variable resistor may have a coil of resistance wire.

Variable resistors may have carbon track (rãnh)

10. *So that*

The wire or track is mounted.

A sliding contact can rub (làm nhẵn) over it to select the resistance required.

III. Further reading:

Electron beams

Electron beams are used in the cathode-ray tube (or picture tube) of traditional television screens. In the cathode-ray tube, the electrons race toward a hollow anode so that a narrow, fast beam of electrons shoots out through the hole in the anode. The higher the positive charge on the anode, the greater the speed—and thus the energy—of the beam. The tube must be emptied of air to prevent the electrons from being slowed or scattered by collisions with air molecules. The beam of electrons is focused so that it hits a specific spot on the television screen, which is covered with luminescent material. When the electrons hit this material, they excite its atoms. The excited atoms then lose this extra energy by releasing flashes of light. A changing electromagnetic field inside the picture tube affects the negatively charged electrons and makes the electron beam rapidly scan across the screen, moving horizontally and vertically. The flashes caused by the beam build up a continually changing picture.

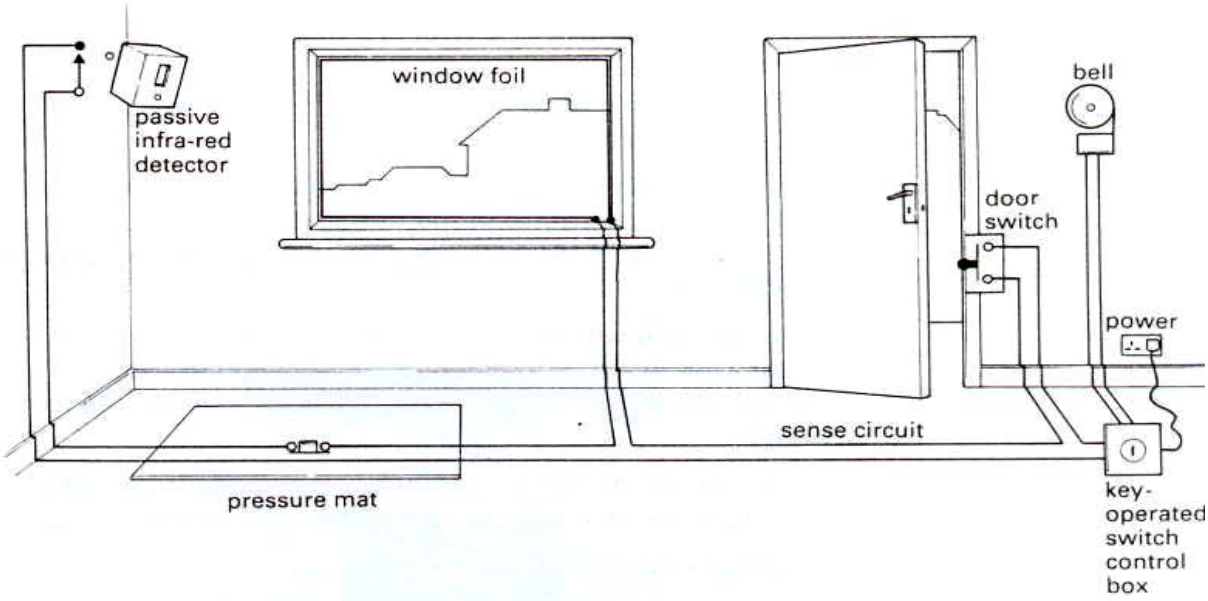
Unit 9

ALARM SYSTEMS

I. Reading and comprehension

Study the diagram at the top of the following page. Try to answer these questions:

1 What does this diagram show a circuit of?
2 How many detection devices does it show? Name them.
3 What warning device does it show?
4 Why is the control box switch operated with a key?
5 How does the system work?
6 What problem is there with this circuit?



Work in groups of four. Find out how one of these devices works by reading the appropriate paragraph in this text. Your teacher will tell you which device to read about. Then explain briefly to your group how the device works.

1 door switch
2 window foil
3 pressure mat
4 passive infra-red detector

Detection devices

Magnetic switches

These are used on windows and doors. A magnet mounted on the moving part of the window or door trips a switch mounted on the frame when the window or door is opened.

Break detectors

These are fitted on the inside surface of glass in windows and doors. Some use a thin metal foil which is glued around the edge of the glass: if the glass is broken the foil breaks too. Others are vibration sensors, and respond to the shock of the glass being broken.

Pressure mats

These are fitted under the carpet – at the bottom of the stairs, for example. The pressure of someone stepping on them causes two thin metal plates inside to come in contact, setting off the alarm. Because they're constantly being walked on, pressure mats can get 'tired' quite quickly, and should be regularly tested and replaced if necessary.

Motion sensors

These may use passive infra-red, ultrasonic, or microwave energy to detect movement within their range.

How could the system shown in Task 2 be improved? Note your ideas. Now read this text to check which of your ideas are described.

We can make the simple alarm circuit more effective by including some of these features.

Entry and exit delays These mean you won't set off the alarm when leaving or returning to the house. On the better systems, the delays are adjustable. An audible warning during the delay period is a useful reminder.

Automatic cut-off This will stop the alarm after it has sounded for a set time, so that the noise doesn't go on for hours if you're not there to reset the system. In better systems, the alarm automatically resets at the end of the alarm time.

Tamper protection The control panel incorporates sensors which will trigger the alarm if a burglar tries to force the box open.

Battery backup This means the alarm will continue to work in a power cut, or if an intruder disconnects the mains supply.

Match each action with its consequence. Then identify the device or feature described. For example:

Action: *Someone moves within its range.*
Consequence: *It detects the movement.*
Device = *motion sensor*

	Action		Consequence
1	A burglar disconnects the supply.	**a**	A magnet on the moving part trips a switch.
2	The glass is broken.	**b**	Tamper sensors trigger the alarm.
3	A door is opened.	**c**	The alarm continues to operate on batteries.
4	A window is opened.	**d**	Two thin metal plates come in contact.
5	You're not there to reset the system.	**e**	The foil breaks too.
6	A burglar tries to force the alarm open.	**f**	A magnet on the door trips a switch on the frame.
7	Someone steps on them.	**g**	The alarm stops after a set time.

Language study *If-sentences*

Study this action and its consequence:

Action: *A burglar tries to force the alarm open.*
Consequence: *Sensors trigger the alarm.*

We can link action and consequence like this:

1 ***If*** *a burglar tries to force the alarm open, sensors trigger the alarm.*
2 ***If*** *a burglar tries to force the alarm open, sensors will trigger the alarm.*
3 *Sensors will trigger the alarm* ***if*** *a burglar tries to force it open.*

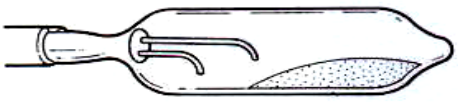
Complete these sentences with a suitable action or consequence.

1 If pressure mats are constantly walked on, ...
2 If you fit an exit delay, ...
3 If your system doesn't have an automatic cut-off, ...
4 If a burglar walks in front of a motion sensor, ...
5 Vibration sensors will respond if . . . .
6 Tamper sensors will trigger the alarm if . . . .
7 A magnet on the moving part trips a switch if . . . .
8 The alarm stops after a set time if . . . .

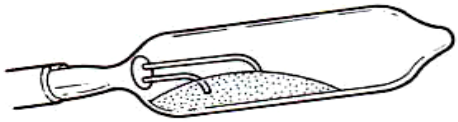
Speaking practice

Work in pairs, **A** and **B**. Find out from your partner how to perform the tasks you have been set. Explain to your partner how to perform his/her tasks with the help of the diagrams provided.

Example:



a



b

Task: *Operating a mercury switch.*

Useful language:

How do you operate a mercury switch? You tilt it.
How does a mercury switch work? By tilting it.

Student A: Your tasks are on page 175.
Student B: Your tasks are on page 182.

Word study *Word pairs, 1*

Each word in column **A** often goes before one word from column **B**. For example, *integrated circuit* (**1f**). Find the other word pairs.

	A		B
1	integrated	a	sensor
2	circuit	b	cell
3	alternating	c	switch
4	primary	d	supply
5	zener	e	diode
6	remote	f	circuit
7	reed	g	current
8	surface	h	bias
9	vibration	i	control
10	reverse	j	diagram
11	mains	k	wave

Technical reading *Alarm systems*

Use information from the text below to complete the tables/answer the questions.

1 Complete this table.

Sensing device	Used to detect
LDR	_____
_____	heat
_____	sound

2 What effect does light have on an LDR?
3 What is the purpose of RV1 in Fig. 2 on page 53?
4 Use words from the text to complete the following table:

Term	Opposite
cut-off	saturation
fixed resistor	_____
increases	_____
energize	_____
slow	_____
to cause	_____
forward bias	_____

5 How is the transistor in Fig. 2 protected from a large back EMF?

The three stages of a simple alarm system are shown in Fig. 1.

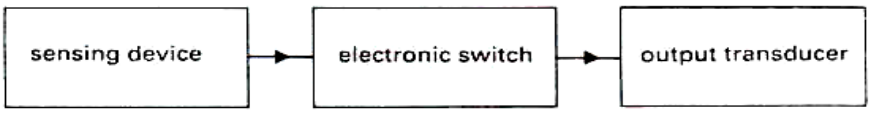


Fig. 1

The first stage is a sensing device that changes its resistance when it detects a particular form of energy. For example, a microphone may be used to detect sound, a thermistor to detect heat, or an LDR (light-dependent resistor) to detect light.

The second stage is an electronic switch. In its simplest form, this could be a single transistor. The transistor switches between cut-off and saturation as the input resistance changes.

The third stage is an output transducer which is switched off and on by the electronic switch. The output transducer could be a buzzer, a light, or a relay which operates a more powerful circuit.

An example of a simple alarm circuit is shown in Fig. 2.

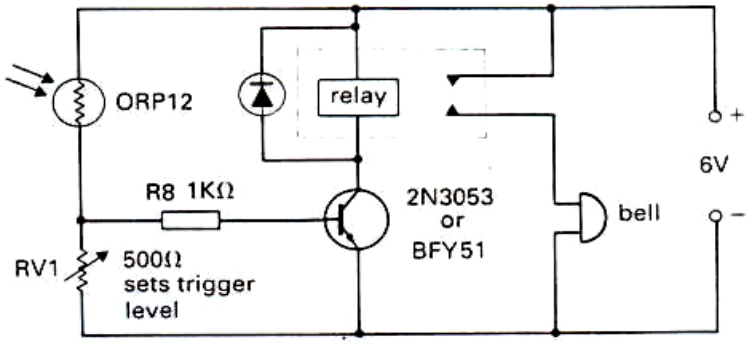


Fig. 2

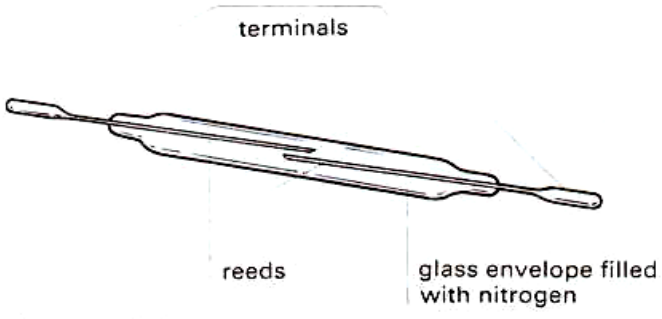
The LDR forms a potential divider with the variable resistor RV1. When light falls on the LDR, its resistance decreases. This causes the base voltage of the transistor and the bias current to increase. The transistor switches on and there is a rapid rise in the collector current until the transistor goes into saturation. The increased current causes the relay to operate and switch on the output circuit. The sensitivity of the input can be adjusted using RV1.

In a similar way, the relay is de-energized when the light source is removed from the LDR. A large back EMF, which would destroy the transistor, could be generated across the relay. To prevent this, a diode is connected in reverse bias across the relay.

Writing *Explanations*

Explanations provide answers to *Why?* and *How?* questions. Try to answer these questions about the diagram below.

1 What does the diagram show?
2 Why are the reeds sealed in a glass envelope?
3 Why does the envelope contain nitrogen?
4 How does it operate?

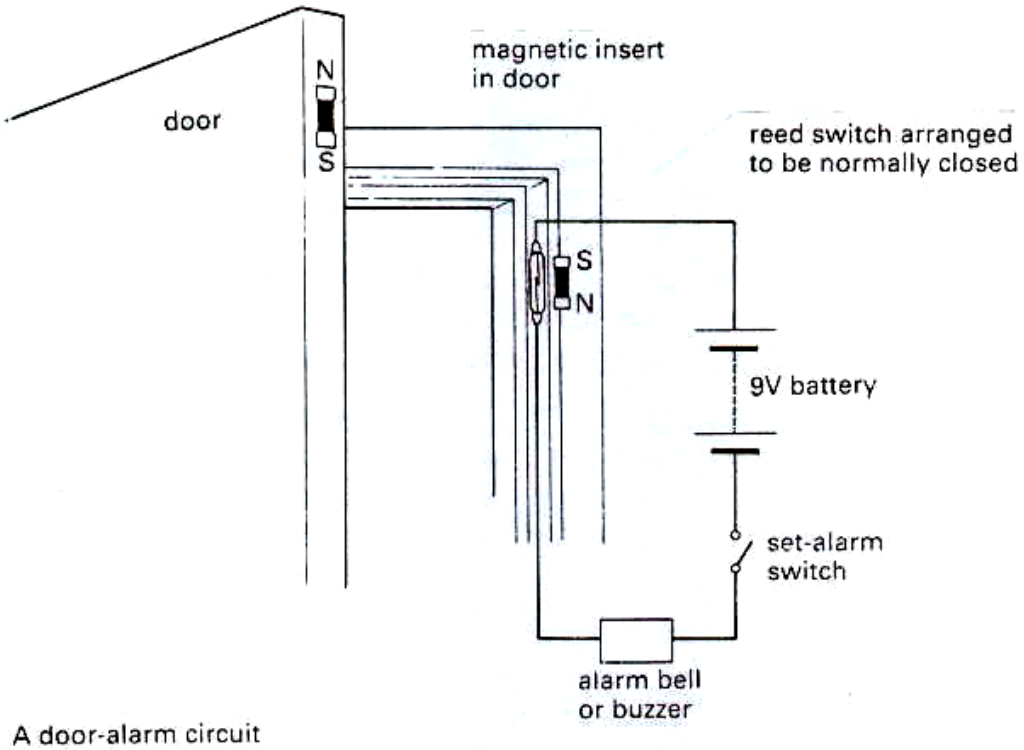


A reed switch

Now study this explanation, which has been written to answer the questic on the previous page.

The diagram shows a reed switch. It consists of two reeds made of ferromagnetic material. They are easily magnetized and demagnetized. The reeds are sealed in a glass envelope to protect them. The envelope contains nitrogen, which helps to prevent corrosion of the contacts. When a magnet is brought close to the reeds, they are magnetized, attract each other, and close. When the magnet is removed, the reeds open.

Study this simple circuit.



A door-alarm circuit

Explain what this diagram shows and how it operates. Your explanation should include answers to these questions:

1 What are the components?
2 How are they connected?
3 What is the state of the system when the door is closed?
4 What happens if the door is opened?
5 Why does this happen?

Unit 10

MUSIC CENTRE

I. Reading and comprehension

Pre-reading:

Study this picture of a music centre

1. what form of audio input does it have?
2. What other form of audio input might be added?

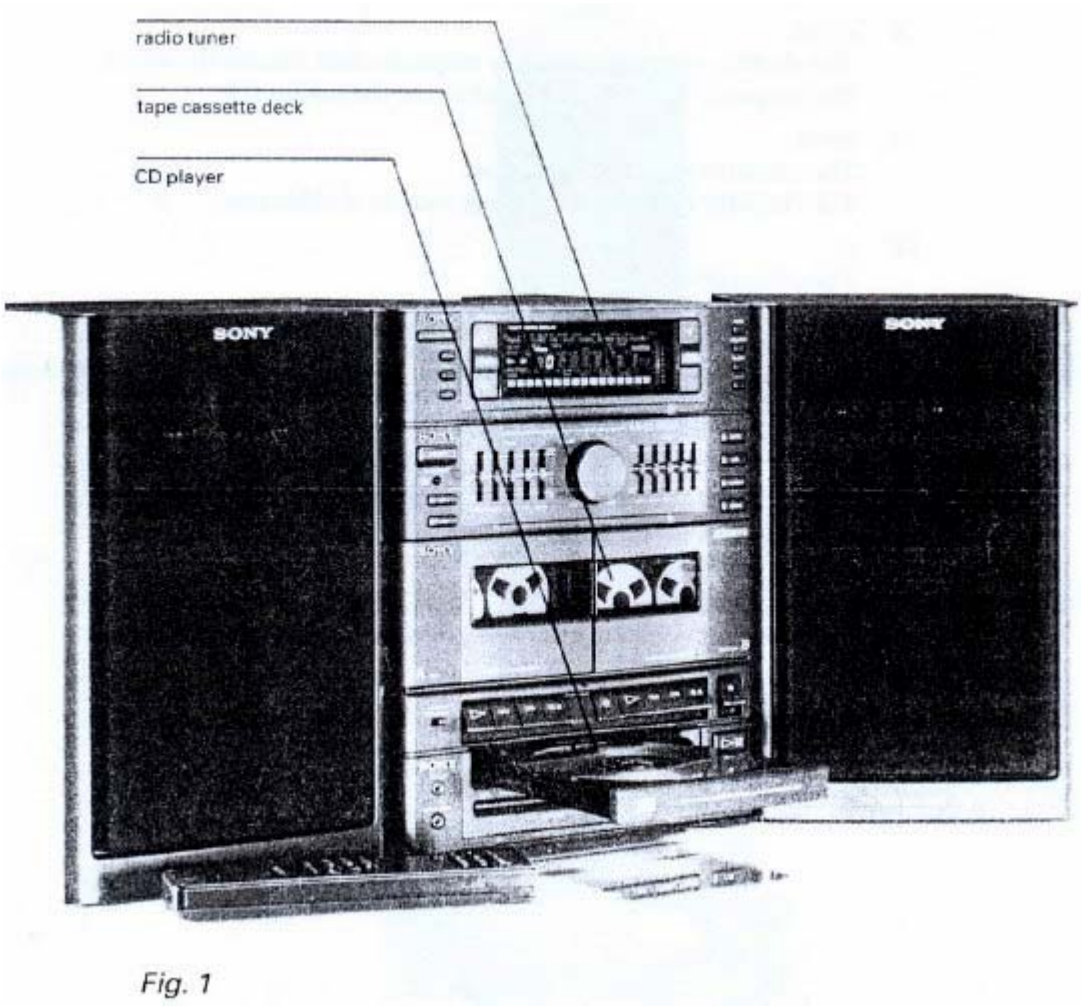


Fig. 1

Fig.1 shows a music centre. It contains a number of audio input devices: a CD player, a tape cassette deck. These allow the user to play music recorded in different formats. All these devices share a common amplifier and speaker system. Each part of the music centre is stacked on top of the other.

As Fig.2 shows, the common amplifier is made up of two sections. The first section is the pre-amplifier (pre-am), which provides tone, volume, and

balance controls as well as amplification of the input signal voltage. The second section is the power amplifier (power amp). This amplifies the power of the pre-amp signals to enable them to drive the loudspeaker system.

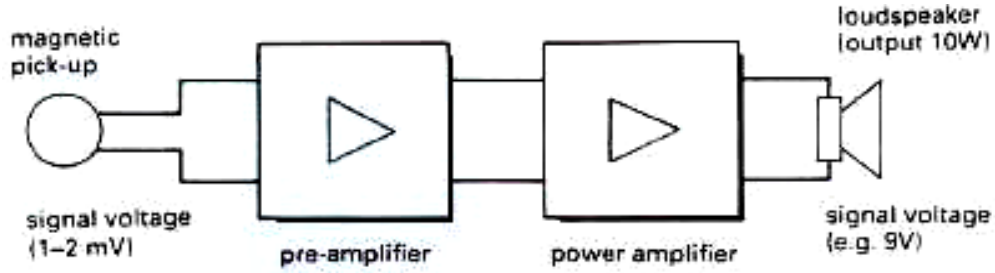


Fig. 2

Some music centres also contains a graphic equalizer. This allows the user to adjust the amplification of particular frequency ranges by moving an array of slider controls. In this way the reproduced sound can be varied to suit different acoustic conditions.

A music centre can be classified as a hi-fi (high-fidelity) system or a mid-fi system depending on the quality of its sound reproduction.

Find out after reading the text:

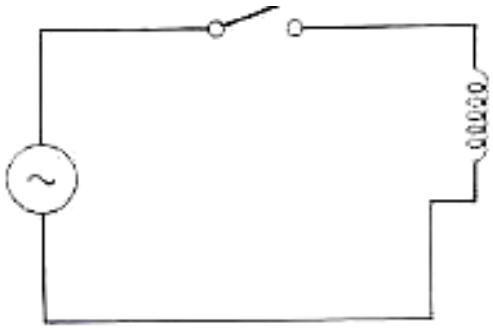
1. the function of a pre-amplification
2. the function of a power amplifier
3. the function of a graphic equalizer.
4. the difference between a hi-fi and a midi-fi system.

II. Use of language:

1. allowing and preventing verbs

What happens as a result of . . .

closing the switch?
opening the switch?



Closing the switch:
We can describe the result using these verbs:

Closing the switch	***allows*** / ***permits*** / ***enables***	*current* ***to*** *flow through the coil.*

Note that verbs like *allow* are followed by *to* and the infinitive.

Opening the switch:
We can describe the result using these verbs:

Opening the switch | **prevents** / **stops** | *current* **from** *flowing through the coil.*

Note that verbs like *prevent* are followed by *from* and the *-ing* form.

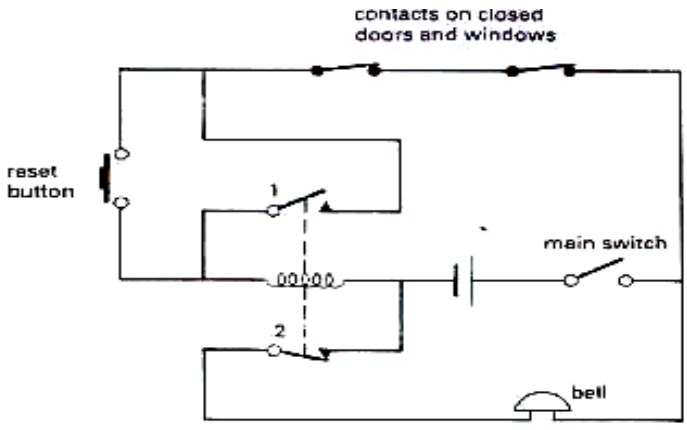
EXERCISE 1:

Now fill the gap in each sentence with an allowing or preventing verb. Also put each verb in brackets on the correct form.

1. A graphic equalizer……the user (adjust) the amplification of different frequency ranges.
2. A fuse……a sudden rise in current (damage) equipment.
3. A mixing desk……..the sound engineer (improve) the quality of the sound recorded.
4. A heat sink……..output transistor (overheat)
5. A surge suppressor……..large current fluctuation (damage)
6. Special effects like reverb…….the engineer (alter) the sound of the recording.
7. Different inputs on the music centre……the user (play) CDs.
8. A safe tab…….the user (erase) the tape by accident.

EXERCISE 2:

Study this circuit of a burglar alarm. It contains a relay. The relay is shown in its unenergized form:



Now fill in the gaps in this

description with appropriate verb like *allow or prevent,* and put verb in brackets in the correct form. Compare answer with your partner.

Closing the main switch (1)……..current (pass) from the battery through the bell. As a result, the bell rings. Pressing the reset button (2)……current (flow) through the relay coil. This energizes the coil so that switch 1 closes and switch 2 opens. Opening switch 2 (3)……..current (flow) through the bell.

When any contact on a door or windows is opened, this (4)…….current (pass) through the relay coil. As a result, switch 1 opens and switch 2 closes. This (5)……..current (flow) from the battery to the bell, and the alarm rings.

2. Writing

Study this brief text about noise.

Noise can be a problem with amplifiers. There are several types of noise. One is crackle and another is hum.

Study this additional information:

Noise is any unwanted signals.
Crackle is produced randomly inside circuit components.
Hum is induced by the mains supply.

We can add the additional information like this:

Noise, ***which is any unwanted signals****, can be a problem with amplifiers.*
There are several types of noise. One is crackle, ***which is produced randomly inside circuit components****, and another is hum,* ***which is induced by the mains supply.***

When the information is additional, it is put in commas. For example:

Noise, ***which is any unwanted signals,*** *can be a problem with amplifiers.*

Without the words in bold, the sentence makes good sense.

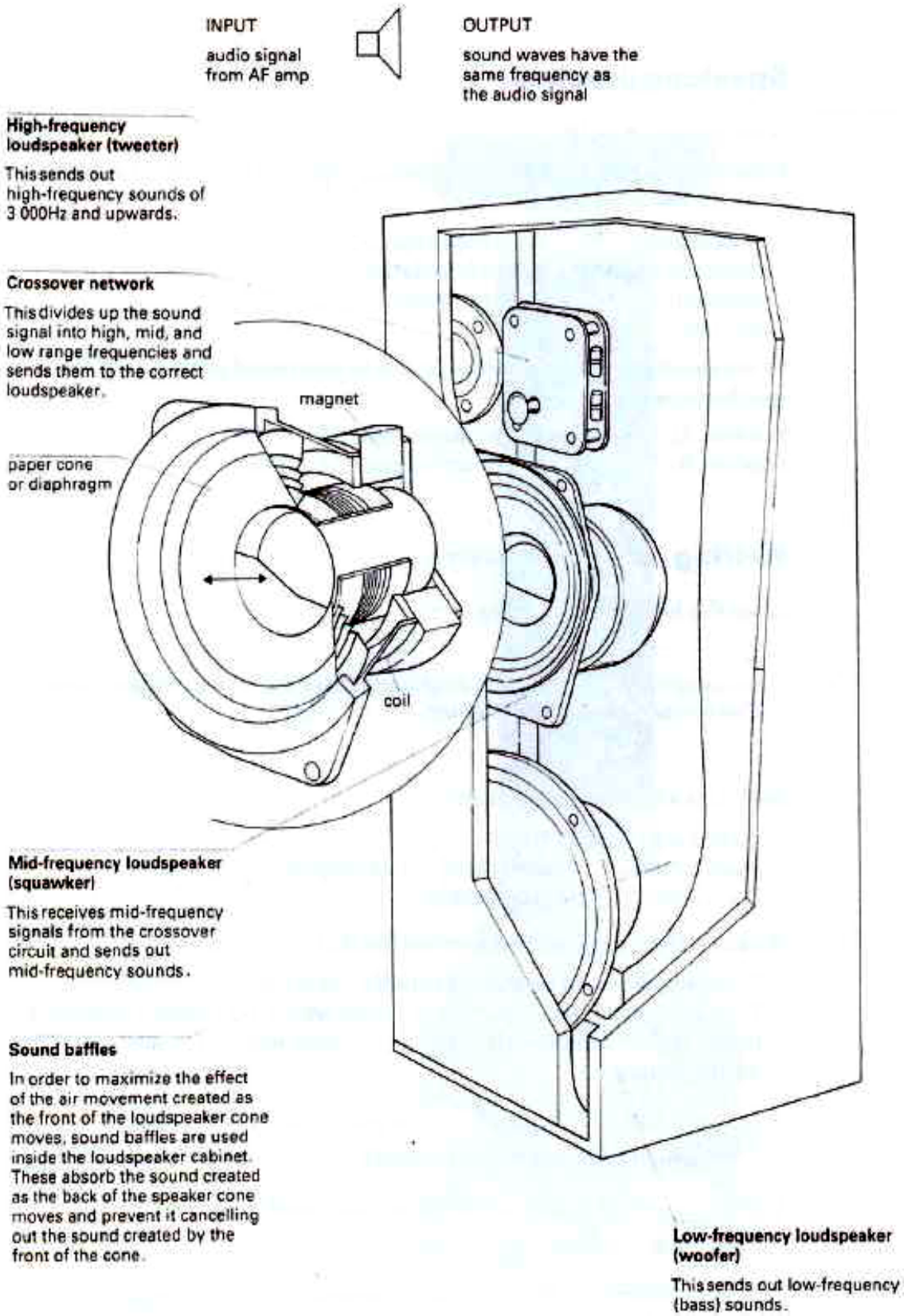
Noise can be a problem with amplifiers.

When the information is essential to the meaning of the statement, commas are not used. For example:

Noise ***which is produced inside components*** *is called crackle.*

Without the words in bold, the sentence would not make sense.

Now look at the diagram below and read the text opposite. Add information from the diagram to the text. The information added should answer the questions in brackets within the text. The first paragraph is done for you as an example.



Loudspeakers

the loudspeaker is the last important component of a music centre. It converts signals from the AF amplifier into sound wave (*what is the frequency of the sound waves?*)

Example:

the loudspeaker is the last important component of a music centre. It converts signals from the AF amplifier into sound wave ***which have the same frequency as the AF signals.***

A loudspeaker consists of a cone (*what is the cone made of?),* a coil, and a fixed magnet. The coil *(what is the coil attached to?)* is free to vibrate within the magnet. As AC signal from the amplifier pass through the coil, they create an alternating magnetic field. The interaction of this field with the fixed field od the magnet causes the coil to vibrate. The cone also vibrates and produces sound waves. The bigger the signal from the amplifier, the larger the vibration o the cone and hence the louder the sound.

Speakers for hi-fi system usually contains up to three individual units: a tweeter *(what kind of sounds does it send out?)*, a squawker *(what kind of sounds does it send out?)*, and a woofer (*what kind of sounds does it send out?)*. these are served by a crossover network *(what does it work?)*. They also contain sound baffles *(what do they do?)*

III. Further technical reading:

Stereo power amplifier

Try to answer these question about amplifier. Then read the text to see if you are correct.

1. what is meant by "complementary transistors"?
2. what prevents power transistors from overheating?
3. what is stereo sound?
4. what is the purpose of a balance control?

Power amplification is required to drive low impedance loudspeakers. Many power amplifiers use a pair of complementary transistors, i.e. one transistor is a PNP type and the other is an NPN type. The characteristics of these transistors must be carefully matched. This matched pair is connected in a push–pull configuration as shown in Fig. 1.

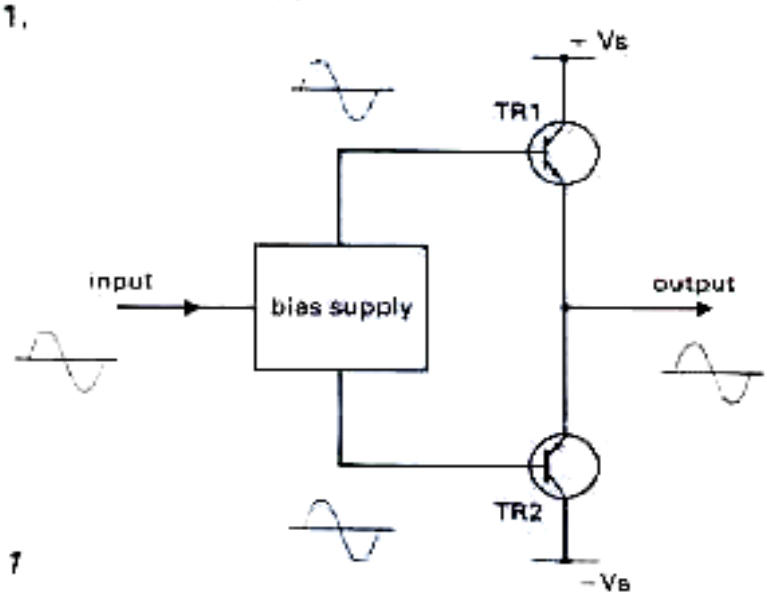


Fig. 1

This arrangement causes TR1 to be turned on and TR2 to be turned off during the positive half-cycle of the input signal. During the negative half-cycle, TR2 is turned on and TR1 is turned off. This means that the input signal is alternately 'pushed' and 'pulled' through the loudspeaker. Because power transistors dissipate a lot of heat, they must be attached to large heatsinks.

For stereo sound, two identical amplifiers are used (see Fig. 2).

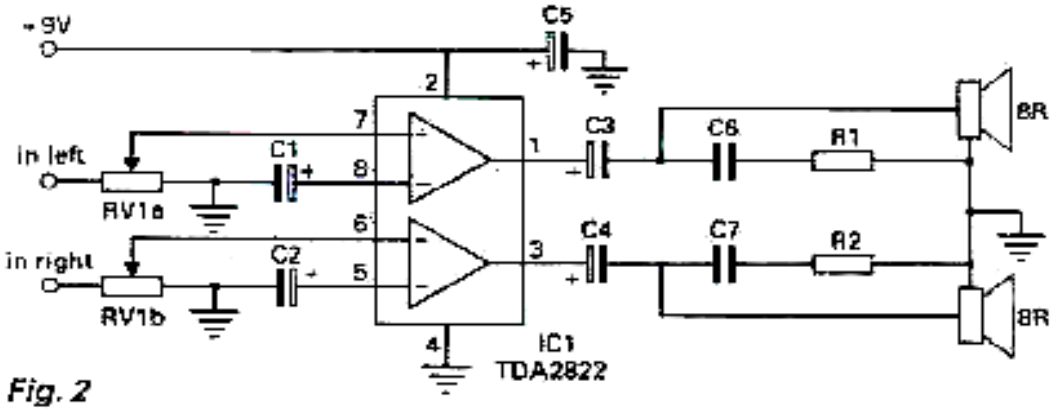
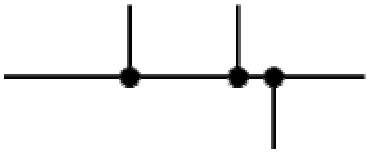
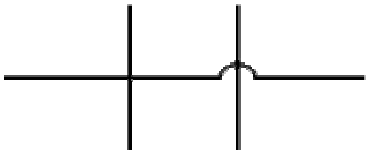


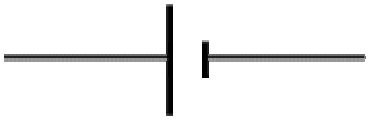
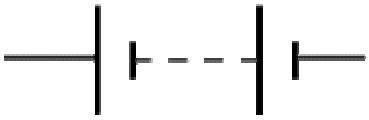
Fig. 2

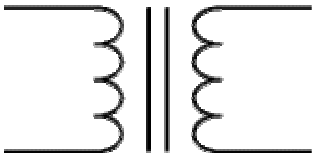
One channel amplifies the signals for the left-hand speaker and the other channel amplifies the signals for the right-hand speaker. In this case, a balance control is required to adjust the relative amplification of each channel.

CIRCUIT SYMBOLS

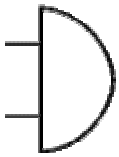
Circuit symbols are used in circuit diagrams which show how a circuit is connected together. The actual layout of the components is usually quite different from the circuit diagram. To build a circuit you need a different diagram showing the layout of the parts on stripboard or printed circuit board.

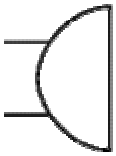
Wires and connections		
Component	**Circuit Symbol**	**Function of Component**
Wire		To pass current very easily from one part of a circuit to another.
Wires joined		A 'blob' should be drawn where wires are connected (joined), but it is sometimes omitted. Wires connected at 'crossroads' should be staggered 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. I prefer the 'hump' symbol shown on the right because the simple crossing on the left may be misread as a join where you have forgotten to add a 'blob'!

Power Supplies		
Component	**Circuit Symbol**	**Function of Component**
Cell		Supplies electrical energy. The larger terminal (on the left) is positive (+). A single cell is often called a battery, but strictly a battery is two or more cells joined together.
Battery		Supplies electrical energy. A battery is more than one cell. The larger terminal (on the left) is positive (+).
DC supply		Supplies electrical energy. DC = Direct Current, always flowing in one direction.

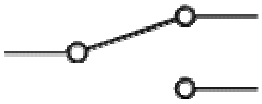
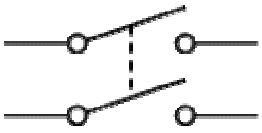
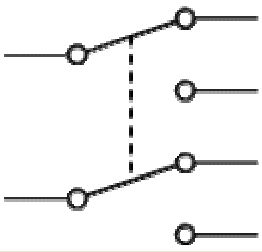
AC supply		Supplies electrical energy. AC = Alternating Current, continually changing direction.
Fuse		A safety device which will 'blow' (melt) if the current flowing through it exceeds a specified value.
Transformer		Two coils of wire linked by an iron core. Transformers are used to step up (increase) 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.
Earth (Ground)		A connection to earth. For many electronic circuits this is 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.

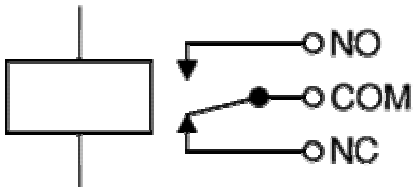
Output Devices: Lamps, Heater, Motor, etc.

Component	Circuit Symbol	Function of Component
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 (indicator)		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.
Heater		A transducer which converts electrical energy to heat.
Motor		A transducer which converts electrical energy to kinetic energy (motion).
Bell		A transducer which converts electrical energy to sound.

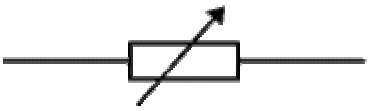
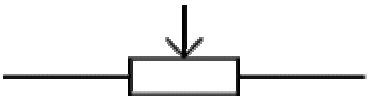
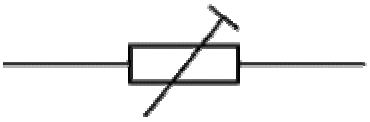
Buzzer		A transducer which converts electrical energy to sound.
Inductor (Coil, Solenoid)		A coil of wire which creates a magnetic field when current passes through it. It may have an iron core inside the coil. It can be used as a transducer converting electrical energy to mechanical energy by pulling on something.

Switches

Component	Circuit Symbol	Function of Component
Push Switch (push-to-make)		A push switch allows current to flow only when the button is pressed. This is the switch used to operate a doorbell.
Push-to-Break Switch		This type of push switch is normally closed (on), it is open (off) only when the button is pressed.
On-Off Switch (SPST)		SPST = Single Pole, Single Throw. An on-off switch allows current to flow only when it is in the closed (on) position.
2-way Switch (SPDT)		SPDT = Single Pole, Double Throw. A 2-way changeover switch directs the flow of current to one of two routes according to its position. Some SPDT switches have a central off position and are described as 'on-off-on'.
Dual On-Off Switch (DPST)		DPST = Double Pole, Single Throw. A dual on-off switch which is often used to switch mains electricity because it can isolate both the live and neutral connections.
Reversing Switch (DPDT)		DPDT = Double Pole, Double Throw. This switch can be wired up as a reversing switch for a motor. Some DPDT switches have a central off position.

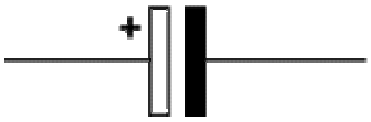
Relay		An electrically operated switch, for example a 9V battery circuit connected to the coil can switch a 230V AC mains circuit. NO = Normally Open, COM = Common, NC = Normally Closed.

Resistors

Component	Circuit Symbol	Function of Component
Resistor		A resistor restricts the flow of current, for example to limit the current passing through an LED. A resistor is used with a capacitor in a timing circuit.
Variable Resistor (Rheostat)		This type of variable resistor with 2 contacts (a rheostat) is usually used to control current. Examples include: adjusting lamp brightness, adjusting motor speed, and adjusting the rate of flow of charge into a capacitor in a timing circuit.
Variable Resistor (Potentiometer)		This type of variable resistor with 3 contacts (a potentiometer) 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.
Variable Resistor (Preset)		This type of variable resistor (a preset) is operated with a small screwdriver or similar tool. It is designed to be set when the circuit is made and then left without further adjustment. Presets are cheaper than normal variable resistors so they are often used in projects to reduce the cost.

Capacitors

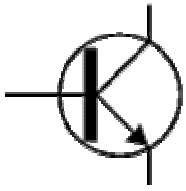
Component	Circuit Symbol	Function of Component
Capacitor		A capacitor stores electric charge. A capacitor is used with a resistor in a timing circuit. It can also be used as

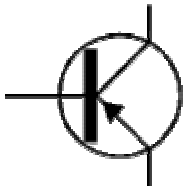
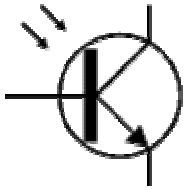
		a filter, to block DC signals but pass AC signals.
Capacitor, polarised		A capacitor stores electric charge. This type must be connected the correct way round. A capacitor is used with a resistor in a timing circuit. It can also be used as a filter, to block DC signals but pass AC signals.
Variable Capacitor		A variable capacitor is used in a radio tuner.
Trimmer Capacitor		This type of variable capacitor (a trimmer) is operated with a small screwdriver or similar tool. It is designed to be set when the circuit is made and then left without further adjustment.

Diodes

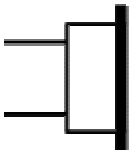
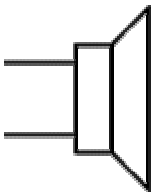
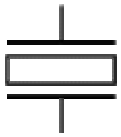
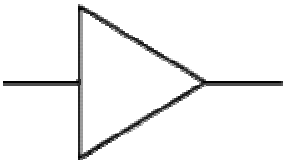
Component	Circuit Symbol	Function of Component
Diode		A device which only allows current to flow in one direction.
LED Light Emitting Diode		A transducer which converts electrical energy to light.
Zener Diode		A special diode which is used to maintain a fixed voltage across its terminals.
Photodiode		A light-sensitive diode.

Transistors

Component	Circuit Symbol	Function of Component
Transistor NPN		A transistor amplifies current. It can be used with other components to make an amplifier or switching circuit.

Transistor PNP		A transistor amplifies current. It can be used with other components to make an amplifier or switching circuit.
Phototransistor		A light-sensitive transistor.

Audio and Radio Devices

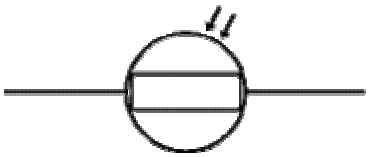
Component	Circuit Symbol	Function of Component
Microphone		A transducer which converts sound to electrical energy.
Earphone		A transducer which converts electrical energy to sound.
Loudspeaker		A transducer which converts electrical energy to sound.
Piezo Transducer		A transducer which converts electrical energy to sound.
Amplifier (general symbol)		An amplifier circuit with one input. Really it is a block diagram symbol because it represents a circuit rather than just one component.
Aerial (Antenna)		A device which is designed to receive or transmit radio signals. It is also known as an antenna.

Meters and Oscilloscope

Component	Circuit Symbol	Function of Component
Voltmeter		A voltmeter is used to measure voltage. The proper name for voltage is 'potential difference', but most people prefer to say voltage!

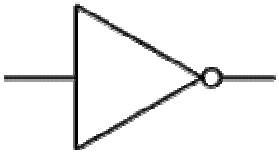
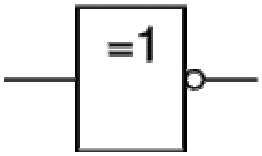
Ammeter		An ammeter is used to measure current.
Galvanometer		A galvanometer is a very sensitive meter which is used to measure tiny currents, usually 1mA or less.
Ohmmeter		An ohmmeter is used to measure resistance. Most multimeters have an ohmmeter setting.
Oscilloscope		An oscilloscope is used to display the shape of electrical signals and it can be used to measure their voltage and time period.

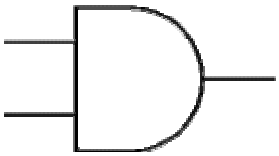
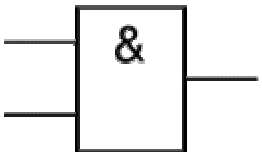
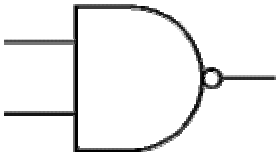
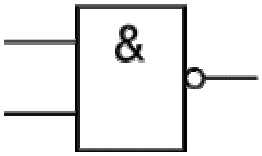
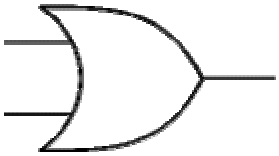
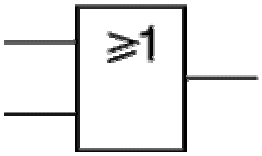
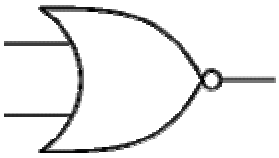
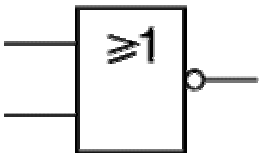
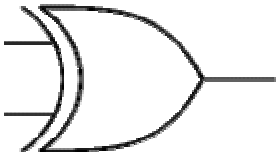
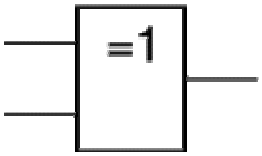
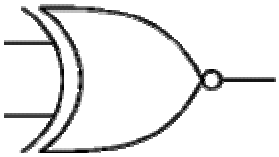
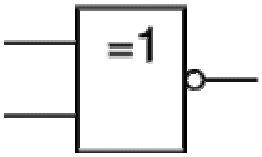
Sensors (input devices)

Component	Circuit Symbol	Function of Component
LDR		A transducer which converts brightness (light) to resistance (an electrical property). LDR = Light Dependent Resistor
Thermistor		A transducer which converts temperature (heat) to resistance (an electrical property).

Logic Gates

Logic gates process signals which represent **true** (1, high, +Vs, on) or **false** (0, low, 0V, off).
For more information please see the Logic Gates page.
There are two sets of symbols: traditional and IEC (International Electrotechnical Commission).

Gate Type	Traditional Symbol	IEC Symbol	Function of Gate
NOT			A NOT gate can only have one input. The 'o' on the output means 'not'. The output of a NOT gate is the inverse (opposite) of its input, so the output is true when the input is false. A NOT gate is also called an inverter.

AND			An AND gate can have two or more inputs. The output of an AND gate is true when all its inputs are true.
NAND			A NAND gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a Not AND gate. The output of a NAND gate is true unless all its inputs are true.
OR			An OR gate can have two or more inputs. The output of an OR gate is true when at least one of its inputs is true.
NOR			A NOR gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a Not OR gate. The output of a NOR gate is true when none of its inputs are true.
EX-OR			An EX-OR gate can only have two inputs. The output of an EX-OR gate is true when its inputs are different (one true, one false).
EX-NOR			

TÓM TẮT PHẦN NGỮ PHÁP DÀNH CHO TIẾNG ANH CHUYÊN NGÀNH

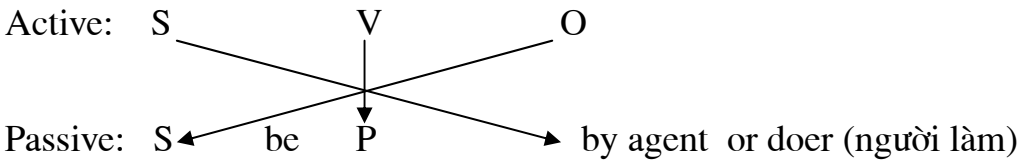
THE ACTIVE AND PASSIVE SENTENCES
(câu chủ động và câu bị động)

Identification (nhận biết):

- **Active sentences (câu chủ động)**: *Mr. Son teaches English.*
- **Passive sentences (câu bị động)**: *English is taught by Mr. Son.*

Usages (cách dùng).

Muốn chuyển một câu từ câu chủ động sang câu bị động ta thực hiện các bước sau:



Form (công thức)

S + BE + V_{PII} (+ BY OBJECT)

- ❖ Lấy tân ngữ của câu chủ động làm chủ ngữ của câu bị động .
- ❖ Nếu có trợ động từ trong câu chủ động, ta hãy đặt những trợ động từ đó liền ngay sau chủ ngữ mới.
- ❖ Thêm từ "**be**" sau trợ động từ hay các trợ động từ cùng một hình thức với động từ chính trong câu chủ động.
- ❖ Đặt động từ chính trong câu tác động sao cho trợ động từ và các động từ **be** ở hình thức quá khứ phân từ.
- ❖ Đặt chủ ngữ của câu chủ động sau động từ trong câu bị động với giới từ **by** đi trước (cũng có thể bỏ hănt nếu nó không quan trọng hoặc được hiểu ngầm

1. Simple present tense (thì hiện tại đơn)

Subject + am/is/are + Past participle **Subject + 'm not/isn't/ aren't + P.P**

Example:

Active: *Anna write a letter.*

Passive: *A letter is written by Anna.*

2. **Present continuous tense (thì hiện tại tiếp diễn)**

Subject + am/is/are being+ P II
Subject + 'm not/isn't/ aren't being + P II.
Am/is/are + Subject + being P II ?

Example:

Active: *The factory is recruiting new employees*

Passive: *New employees are being recruited by the factory*

3. **Past simple tense (thì quá khứ đơn)**

Subject + was/were + P II
Subject + wasn't/ weren't + P II.
Was/ were + Subject + P II ?

Example:

Active: *John Loggies Baird invented television in 1925*

Passive: *television was invented by John Loggies Baird in 1925*

(ti vi được John Loggies Baird phát minh vào năm 1925)

4. **Past continuous tense (thì quá khứ tiếp diễn)**

Subject + was/were being P II
Subject + wasn't/ weren't being P II.
Was/ were + Subject being + P II ?

Example :

Active: *Rescue workers were delivering relief in Afghanistan*

Passive: *Relief was being delivered by rescue workers in Afghanistan.*

5. **Present perfect tense (thì hiện tại hoàn thành)**

Subject + has/have +been + PII
Subject + hasn't/haven't + been + PII.
Has/have + S been + P II ?

Example:

Active: Many local people have witnessed this event.

Passive: This event has been witnessed by local people.

(nhiều người dân địa phương đã từng chứng kiến sự kiện này)

6. Past perfect tense (thì quá khứ hoàn thành)

Subject + had +been + P_{II}
Subject + hadn't + been + P_{II}.
Had + S been + P_{II}?

7. Simple future tense (thì tương lai đơn)

Subject + will/shall +be + P_{II}
Subject + won't/shan't + be + P_{II}.
Shall/will + S been + P_{II}?

Example:

Active: *In the future, modern machines will replace human operators*

Passive: *In the future, human operators will be replaced by modern machines (người vận hành sẽ được thay thế bằng các máy móc hiên đại)*

8. Near future tense (thì tương lai gần)

Subject + am/is/are going to be + P_{II}
Subject + 'm not/isn't/aren't going to + be + P_{II}.
Am/is/are + S going to be + P_{II}?

Example:

Active: *Scientists are going to complete this project by 2008*

Passive: *This project is going to be completed by scientists by 2008.*

(dự án này sẽ được các nhà khoa học hoàn thành trước năm 2008)

9. Modal verbs (các động từ khuyết thiếu)

Subject + can/must/have to/may be + P_{II}
Subject + can't/mustn't/ don't(doesn't) have to/may not + be + P_{II}.
Can/must/may + S be + P_{II}?
Do/does + S + have to be P_{II}?

This program can meet demands.

Demands can be met by this program

(*các nhu cầu có thể được chương trình này đáp ứng)*

ⓘ **Notice** (chú ý)

- Ta có thể bỏ ***by me, by him, by her, by it, by us, by you, by them, by someone, by somebody, by people*** trong các bị động nếu không muốn nêu rõ tác nhân, hoặc thấy không quan trọng.
- Nếu câu bị động có các trạng từ (ngữ) chỉ nơi chốn thì đặt chúng trước (by + tân ngữ bị động).

  EX: *the police found him in the forest.*

  He was found in the forest by police.
- Nếu câu chủ động có các trạng ngữ chỉ thời gian thì đặt chúng sau **by + tân ngữ bị động.**

  EX: *My parents are going to buy a car tomorrow.*

  A car is going to be bought by my parents tomorrow.
- Nếu động từ có 2 tân ngữ thì chọn một trong 2 tân ngữ làm chủ ngữ trong câu bị động. Tuy nhiên, tân ngữ về người or tân ngữ thứ nhất được ưu tiên nhiều hơn.

  EX: *He gave us a book*

  We were given a book

  Or: *A book was given us*

Exercise 1:

Change the following sentences into passive sentences

1. Somebody has taken my briefcase.
2. She had finished her report by noon.
3. The mad dog bit the little boy.
4. The police have arrested five suspects.
5. The doctor ordered him to take a long rest.
6. Lightning struck the house.
7. A group of students have met their friend at the railway station.
8. The didn't allow Tom to take these books home.
9. The teacher won't correct exercises tomorrow.
10. This is the second time they have written to us about this.
11. Mr. Son taught us English for 1 year.
12. They didn't look after the children properly.
13. Nobody swept this street last week.

14. People drink a great deal of tea in England
15. People speak English all over the world.
16. Tom was writing two poems.
17. She often takes her dog for a walk.
18. They can't make tea with cold water.
19. The chief engineer was instructing all the workers of the plant.
20. Somebody has taken some of my book away.
21. They will hold a meeting before May Day.
22. They have to repair the engine of the car.
23. The boys broke the window and took away some pictures.
24. People spend a lot of money on advertising everyday.
25. They may use this room for the classroom.
26. The teacher is going to tell a story.
27. Mary is cutting the cake with a sharp knife.
28. The children looked at the woman with a red hat.
29. She used to pull my hat over my eyes.
30. For the past years, I have done all my washing by hands.
31. The police haven't found the murderer yet.
32. They sold one of her own paintings at 1,000
33. I will put your gloves back in your drawer.
34. People speak English in almost every corner of the world.
35. You mustn't use this machine after 5:30 p.m
36. Luckily for me, they didn't call my name.
37. After class, one of the students always erases the chalk board.
38. You must clean the wall before you paint it.
39. The told the new student where to sit.
40. I knew that they had told him of the meeting.
41. Nobody has ever treated me such kindness.
42. No one believes his story.
43. A sudden increase in water pressure may break the dam.
44. We must take goof care of books borrowed from the library.
45. A man I know told about it.
46. We can't never find him at home for me he is always on the move.
47. They use milk for making butter and cheese.

Exercise 2:

Change following sentences from active to passive (questions form)

1. Do they teach English here?
2. Will you invite her to your wedding party?
3. Did our English teacher give us some exercises?
4. Is she going to sing a song?
5. Have they changed the window of the laboratory?
6. Is she making big cakes for the party?
7. Has Tom finished the work?
8. Are the police making inquires about the thief?
9. Must we finish the test before ten?
10. Will buses bring children home?
11. When will you do the work?
12. How many days did she spend finishing the work?
13. What books are people reading this year?
14. How did the police find the lost man?
15. How long have they waited for the doctor?
16. What time can the boys hand in their paper?
17. Why didn't they help him?
18. Who is giving her flowers?
19. Who looked after the children for you?

RELATIVE CLAUSES
(mệnh đề quan hệ)

I. IDENTIFICATION (XÁC ĐỊNH):

- Relative clause còn được gọi là Adjective clause (mệnh đề tính ngữ) vì nó là mệnh đề phụ được dùng để bổ nghĩa cho danh từ đứng trước nó (tiền ngữ).
- Relative clause được nối với mệnh đề chính bởi các đại từ quan hệ Who, Which, Whose, That or các trạng từ quan hệ When, Where, Why.
- Vị trí: Relative clause đứng sau các danh từ mà nó bổ nghĩa.

II. CLASSIFICATION (SỰ PHÂN LOẠI)

Có hai loại mệnh đề thường dùng:

1. Defining relative clauses (mệnh đề quan hệ xác định):

- Mệnh đề này mô tả cho danh từ đứng trước nó để phân biệt nó với các danh từ cùng loại khác. Một mệnh đề loại này cần thiết để hiểu rõ danh từ (chủ ngữ).

The man who told me this refused to give me his name

"*who told me this*" là mệnh đề quan hệ. Nếu chúng ta bỏ câu này thì nghĩa của câu không rõ ràng, chúng ta không biết đang nói về ai. Chú ý là: không dùng dấu phẩy giữa một danh từ và một mệnh đề quan hệ.

- Mệnh đề quan hệ xác định theo sau thường là **the+ Noun**, chúng cũng có thể được sử dụng với công thức **a/an+ N** không cần có THE và các đại từ bất định

All, none, anybody, somebody, those….

Các từ trên thỉnh thoảng xác định danh từ và các đại từ theo cách gián tiếp. Các danh từ/đại từ trong trường hợp đó thường là tân ngữ của động từ or giới từ:

I met someone who said he knew you.

The guidebook is about devices which are necessary for our work.

Thỉnh thoảng các mệnh đề này được tách ra từ danh từ/ đại từ bằng một từ or cụm từ.

I saw something in the paper which interest you.

Nhưng bình thường Relative clause có thể được thay thế trực tiếp sau đại từ/danh từ của chúng.

The noise that he makes woke everybody up.

She was annoyed by something that I had said.

2. **Non-defining** relative clause

- Mệnh đề quan hệ không xác định đượcc thay thế sau các danh từ mà đã xác định cụ thể rồi. Do đó, chúng không xác định danh từ nhưng ít khi thêm một thông tin vào danh từ, vì mệnh đề chính đã được hiểu đủ nghĩa rồi.
- Không giống như mệnh đề xác định, chúng không cần thiết trong câu và có thể bị loại bỏ vẫn không không gây ra sự xáo trộn (hiểu nhầm).

- Mệnh đề không xác định được ngăn mệnh đề chính bằng các phẩy. Các đại từ có thể không bao giờ bị loại bỏ trong mệnh đề không xác định.
- Cấu trúc của mệnh đề không xác định dùng phổ biến trong văn viết hơn là văn viết.
- Trước các danh từ thường có: *this, that, those, these, my, his, their…….hoặc tên riêng.*

That man, whom you saw yesterday, is Mr. Smith.
This is Mrs. Jones, who helped me last week.
Anna, whose sister I know, has won an Oscar.

III. USAGES (cách dùng)

	Subject (chủ ngữ)	**Object** (tân ngữ)	**Possessive** (sở hữu)	**Adverb of time (** thời gian)	**Adverbs of place (** nơi chốn)	**Adverbs of reason** (lý do)
For person	Who	Whom	Whose	When	Where	Why
	That	That				
For objects	Which	which	Of which	When	Where	Why
	That	that				

1. Who:

- **Who** là đại từ quan hệ chỉ người (relative clause).
- **Who** đứng sau chủ ngữ chỉ người và làm chủ ngữ cho động từ đứng sau nó. (Subject)

The man who robbed you has been arrested.
The is the girl who has won the medal.
Peter, who had been driving all day, suggested stopping at the next town.
I' invited Ann, who lives0 in the next flat.

2. Whom:

- **Whom** là đại từ quan hệ chỉ người.

- **Whom** đứng sau chủ ngữ chỉ người và làm tân ngữ cho động từ đứng sau nó. (Object)

The woman whom you saw yesterday is my aunt.

The boy whom you are looking for is Tom.

She introduced me to her husband, whom I hadn't met before.

Peter, with whom I play tennis on Sundays, was fitter than me.

The girls whom he employs are always complaining about their pay.

3. Which:

- **Whic**h là đại từ quan hệ chỉ vật.
- **Which** đứng sau tân ngữ chỉ vật và làm chủ ngữ (S) hoặc tân ngữ (O) cho động từ đứng sau nó.

The subject which you are studying is difficult.

This is the book which I like best.

His house, for which he paid £10,000, is now worth £50,000.

This machine, which I have looked for 20 years, is still working perfectly.

The dress whgich I bought yesterday is very beautiful.

4. That

- **That** là đại từ quan hệ dùng chung cho cả người lẫn vật.
- **That** có thể dùng thay thế cho *WHO, WHOM, WHICH* trong mệnh đề quan hệ Defining relative clause (MĐQH xác định)

That is the bicycle that belongs to Tom.

My dad is the person that I admire most.

I can see a girl and her dog that are running in the park.

5. Whose

- **Whose** là đại từ quan hệ chỉ người.
- **Whose** đứng sau chủ ngữ và thay thế cho tính từ sở hữu trước danh từ, whose cũng được dùng cho vật (= of which)
- **Whose** luôn đi kèm với một danh từ.

The boy whose bicycle you borrowd yesterday is Tom.

John found a cat whose leg was broken.

The film is about a spy whose wife betrays him.

This is George, whose class you are teaching English,

Mr. John, whose children are grown up, was retired last year.

6. When

- **When** là trạng từ quan hệ chỉ thời gian.
- **When** đứng sau chủ ngữ chỉ thời gian.

May day is the day when people hold a meeting.

That was the time when he managed the company.

I'll never forgot the year when I was a freshman.

7. Where

- **Where** là trạng từ quan hệ chỉ nơi chốn.
- **Where** đứng sau các chủ ngữ chỉ nơi chốn.
- **Where** được dùng để thay thế cho *AT/ON/IN+ WHICH; THERE.*

That's a place where I was born.

Hanoi is the place where there are elegant people.

Do you know the city where has the longest bridge in the world?

8. Why:

- **Why** là một trạng từ quan hệ chỉ thời gian.
- **Why** đứng sau tiền ngữ "*THE REASON*"
- **Why** được dùng để thay thế cho "*FOR THE REASON*"

Please tell me the reason why you are so late.

He told me the reason why he had been absent form class the day before.

"That's why you go away" is a song by MLTR.

Exercises:

1. The last record, the record was produced by this company, became a gold record.
2. Checking account, the checking account requires a minimum balance, are very common now.
3. The professor, you spoke to the professor yesterday, is not here today.
4. John, John's grade are the highest in the school, has received a scholarship.

5. Philips bought a camera. The camera has three lenses.
6. Frank is a man. We are going to nominate Frank to the office of treasurer.
7. The doctor is with a patient. The patient's leg was broken in an accident.
8. Jane is a woman. Jane is going to China next year.
9. Janet wants a typewriter. The typewriter self-corrects.
10. This book, I found the book last week, contains some useful information.
11. Mr. Bryant, Mr. Bryant's team has lost the game, looks very sad.
12. James wrote an article. The article indicated that he disliked the president.
13. The director of program, the director graduated from Harvard University, is planning to retire next year.
14. This is a book. I have been looking for this book all year.
15. William, William's brother us a lawyer, wants to become a judge.
16. She is the most intelligent woman. I've ever met this woman.
17. This doctor is famous. You invited him yesterday.
18. Do you know the music? It is playing on the radio.
19. The police want to know the hotel. Mr. Foster stayed there two weeks ago.
20. The examination lasted two days. I was successful in this examination.
21. These children are orphans. She is talking care of these children.
22. The two young men are not good persons. You are acquainted with them.
23. I have not decided the day. I'll go to London on that day.
24. He doesn't want to sell the house. He was born in this house.
25. The airport is the most modern one. We are going to arrive at this airport.
26. We enjoy the city. We spent our vacation in this city.
27. One of the elephants had only one tusk. We saw these elephants at the zoo.
28. I look at the noon. It was very bright that evening.
29. My dad goes swimming everyday. You met him this morning.
30. The man is my father. I respect this man most.

31. Please post these letters. I wrote them this morning.
32. The building is the church. Its town can be seen from afar.
33. Mary and Margaret are twins. You meet them yesterday.
34. I'll introduce you to the man. His support is necessary for your project.
35. They are repairing the tubes. Water is brought into our house through the tubes.
36. In the middle of the village there is a well. The villagers take water from this well to drink.
37. This is a rare opportunity. You should take advantage of it to get a better job.
38. The boy is my cousin. You made fun of him.
39. A man answered the phone. He said Tom was out.
40. She could not come to the party, that party was held marvelously by James.