Chapter: 4

Q.1 Textbook activity question **4**

1 If in the circuit, the resistor is replaced by a motor, in which form will the energy given by the cell get transformed into?

Ans P = Electrical power = $\frac{\text{Energy}}{\text{Time required}} = \frac{V_{AB}\,Q}{t} = V_{AB}\,I$ ... (1)

$\because \frac{Q}{t} = I$,

The source of energy, the cell, gives in time t, the energy P × t to the resistor. If I is the current flowing continuously through the circuit, the heat produced in the resistor in time t will be

$H = P \times t = V_{AB} \times I \times t$ ... (2)

According to Ohm's law,

$V_{AB} = I \times R$ ... (3)

$H = V_{AB}^2 \times \frac{t}{R}$ ... (4)

Similarly, $H = I \times I \times R \times t = I^2 \times Rt$ ... (5)

$H = I^2 \times R \times t$ is called Joules law of heating

Unit of electrical power

$P = V_{AB} \times I$ = Volt × Amp ... (6)

1 Volt × 1 Amp = $\frac{1J}{1C} \times \frac{1C}{1s}$ ... (7)

$\frac{1J}{s}$ = W (watt) ... (8)

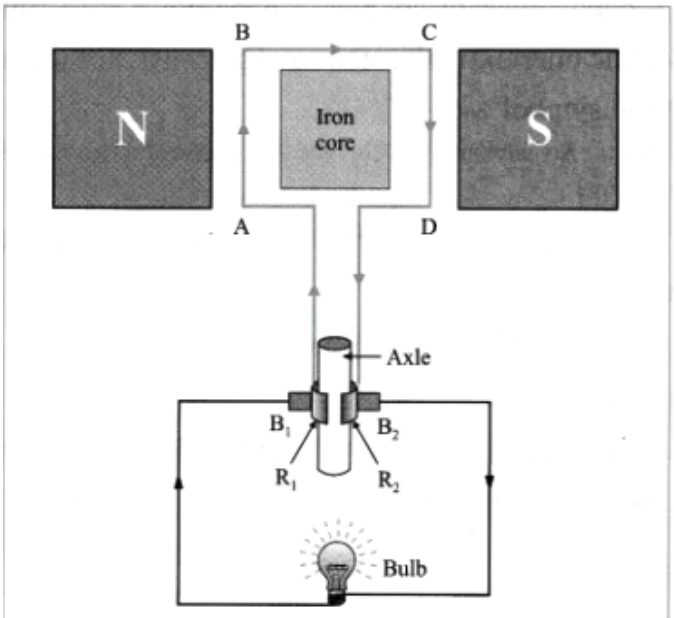
Thus the unit of electrical power is 1W (watt).

2 How do we decide that a given material is a good conductor of electricity or is an insulator?

Ans Any material can be categorised as a good conductor of electricity or an insulator based on its resistance value. Materials having very low resistance are good conductors of electricity while materials having very high resistance are insulators.

3 Draw the diagram of a DC generator. Then explain as to how the DC current is obtained.

Ans Figure shows the construction of a DC generator.



N and S : Poles of the magnet, R_1 and R_2 : Split rings, B_1 and B_2 : Carbon brushes, ABCD : Armature coil

Working:

The axle is rotated with a machine from outside.

When the armature coil of the generator rotates in the magnetic field, electric potential difference is produced in the coil due to electromagnetic induction. This produces a current as shown by the glowing of the bulb or by a galvanometer. The direction of the current depends on the sense of rotation of the coil.

In a DC generator, one brush is always in contact with the arm of the coil moving up while the other brush is in contact with the arm of the coil moving down in the magnetic field. Hence, the flow of the current in the circuit is always in the same direction and the current flows so long as the coil continues to rotate in the magnetic field.

[Note In the case of a DC generator, the current is in the same direction during both the halves of the rotation of the coil. The magnitude of the current does vary periodically with time. In this respect, it differs from the current supplied by an electric cell.]

4 Iron is a conductor of electricity, but when we pick up a piece of iron resting on the ground, why don't we get electric shock?

Ans To get an electric shock, the object should be charged. Pieces of iron on the ground are not charged. Thus, even though iron is a good conductor of electricty, we do not get an electric shock while lifting it from the ground.

Q.2 Multiple Choice Questions **2**

1 Electromagnetic induction means -

a. Charging of an electric conductor.
b. Production of magnetic field due to a current flowing through a coil.
c. Generation of a current in a coil due to relative motion between the coil and the magnet.
d. Motion of the coil around the axle in an electric motor.

Ans Option c.

2 Which of the statements given below correctly describes the magnetic field near a long, straight current carrying conductor?

a. The magnetic lines of force are in a plane, perpendicular to the conductor in the form of straight lines.
b. The magnetic lines of force are parallel to the conductor on all the sides of conductor.
c. The magnetic lines of force are perpendicular to the conductor going radially outward.
d. The magnetic lines of force are in concentric circles with the wire as the center, in a plane perpendicular to the conductor.

Ans Option d.

Q.3 Find the odd one out **5**

1 Loudspeaker, Microphone, Electric motor, Bar magnet

Ans **Bar magnet** - is the odd one out as it a magnet while the rest are devices working on electromagnetism.

2 Voltmeter, Ammeter, Galvanometer, Thermometer

Ans **Thermometer -** is the odd one out as it used to measure temperature of the body while the rest are devices used in an electric circuit.

3 Voltmeter, Ammeter, Galvanometer, Thermometer

Ans Thermometer

4 Fuse wire, bad conductor, rubber gloves, generator.

Ans Generator : Others do not generate electricity

5 Fuse, Bad conductor, Rubber shoes, Generator

Ans **Generator -** is the odd one out as it used to generate current while rests are the safety measures in using electricity.

Q.4 Give scientific reasons **10**

1 In electrical equipment producing heat e.g. iron, electric heater, boiler, toaster etc. an alloy such as Nichrome

is used not pure metals.

Ans i. Electrical equipment iron, electric heater, boiler and toaster works on principle of heating effect of electric current.
ii. Alloy like Nichrome has high resistance and do not gets oxidized.
iii. Pure metals have low resistance and they get easily oxidized.
iv. Thus, In the electic equipment producing heat e.g. iron, electric heater, boiler, toaster etc, an alloy such as Nichrome is used, not pure metals

2 In practice the unit KWh is used for the measurement of electrical energy rather than joule.

Ans i. The SI unit of electrical energy is joule and 'one joule is the amount of electrical energy consumed when an appliance of 1 watt power is used for 1 second'.
ii. Joule represents a very small quantity of energy and hence for commercial purpose bigger unit of electrical energy called 'kilowatt-hour' is used.
iii. One kilowatt-hour is the amount of electrical energy consumed when an electrical appliance having a power rating of 1 kilowatt is used for 1 hour.

3 For electric power transmission, copper or aluminium wire is used.

Ans i. For electric power transmission, copper or aluminium is used, because they are good conductors of electricity.
ii. Copper and aluminium can be easily converted into thin wires and have higher tensile strength(mechanical strength).
iii. They are easily available at a cheaper rate compared to other metal conductors.
iv. They can easily carry higher voltage over longer distances and have higher resistance to corrosion in weather conditions.

4 In the electric equipment producing heat e.g. iron, electric heater, boiler, toaster etc. an alloy such as Nichrome is used, not pure metals.

Ans In the electric equipment producing heat, such as iron, electric heater, boiler, toaster etc., an alloy such as Nichrome is used, not pure metals because of the following reasons::
(i) Resistivity of Nichrome is more compared to pure metal.
(ii) Melting point of Nichrome is high as compared to pure metal.
(iii) Nichrome does not get oxidised when heated in air whereas metal does.

5 Tungsten metal is used to make a solenoid type coil in an electric bulb.

Ans i. An electric bulb is an important application of heating effect of electric current.
ii. Tungsten has a very high melting point (3380°c) due to which it can withstand the extreme heat and does not melt.
iii. This tungsten filament gets heated on passage of electric current and emits light.
iv. The other properties of tungsten which makes it suitable for making filaments of electric bulb are its high flexibility, highest tensile strength and low rate of evaporation at high temperature.
v. Hence, tungsten metal is used to make a solenoid type coil in an electric bulb.

Q.5 Solve Numerical problems. **4**

1 Heat energy is being produced in a resistance in a circuit at the rate of 100 W. The current of 3A is flowing in the circuit. What must be the value of the resistance?

Ans Given: P = 100 W, Current = 3A.

To find: R=?

Formula: P = V x I , V = IR

Solution: P = V x I

V = 100/3 = 33.33V
V = IR
R = V/I
= 33.33/3 = 11.11Ω

The value of the resistance is 11.11Ω

2 Who will spend more electrical energy? 500 W TV set in 30mins or 600 W heater in 20 mins?

Ans **Given:** Power of TV set = 500W = 0.5KW
Power of heater = 600W = 0.6KW
Time taken by TV set (t) = 30 min = 0.5 hours
Time taken by the heater(t_2) = 20 min = 0.33 hours
To find: Electrical energy = ?

Formula: Electrical energy = Power $\times$ Time
Solution:

1. Electrical energy for TV set = P $\times$ t

   = 0.5 $\times$ 0.5
   = 0.25 KWh

2. Electrical energy for heater = P $\times$ t

   = 0.6 $\times$ 0.33
   = 0.198KWh

The TV set will spend more electrical energy.

Q.6 **Write Distinguish between** **2**

1 AC generator and DC generator.

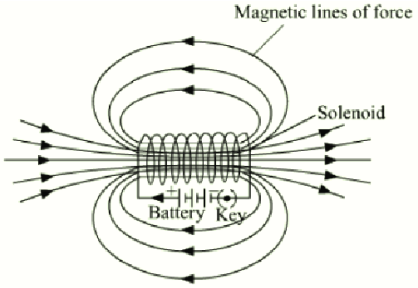
Ans

	AC generator	DC generator
i.	AC generator converts mechanical energy into electrical energy in the form of alternating current.	DC generator converts mechanical energy into electrical energy in the form of direct current.
ii.	The current flows out in different directions.	The current flows out in the same direction.

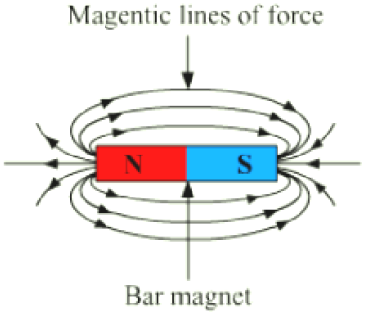
Q.7 **Give explanation using the given statements** **3**

1 What is a solenoid? Compare the magnetic field produced by a solenoid with the magnetic field of a bar magnet. Draw neat figure and name various components of a solenoid. Write one application of a solenoid.
Or
What is a solenoid? Compare the magnetic field produced by a solenoid with the magnetic field of a bar magnet. Draw neat figures and name various components.

Ans A solenoid is a long straight insulated wire, such as a copper coil, often wrapped around a cylinder-shaped body. The diameter of the solenoid is lesser than its length. It produces a magnetic field when electric current is passed through it.



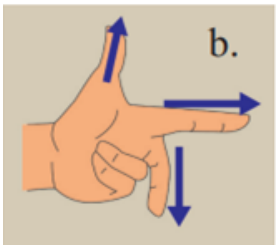
Magnetic field produced by a bar magnet is shown below:



On comparing field lines produced by a solenoid with that produced by a bar magnet, we observe that they are very much identical. Thus, a solenoid acts as a bar magnet when current is passed through it.

Q.8 **Write laws, theories and explain.** **3**

1 Name the following diagrams and explain the concept behind them.



Ans **Fleming's left hand rule :**

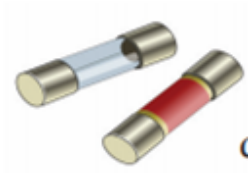
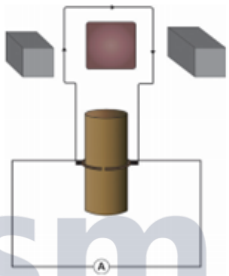
i. Stretch the thumb, the index finger and the middle finger in such a way that they will be perpendicular to each other.

ii. If the index finger is in the direction of magnetic field, and the middle finger points in the direction of the current, then the direction of the thumb is the direction of the force on the conductor.

iii. Fleming's left hand rule helps us to the direction of magnetic field of a conductor or the force acting on the conductor.

Q.9 **Write answers based on given diagram/figure** **3**

1 Identify the figures and explain their use.

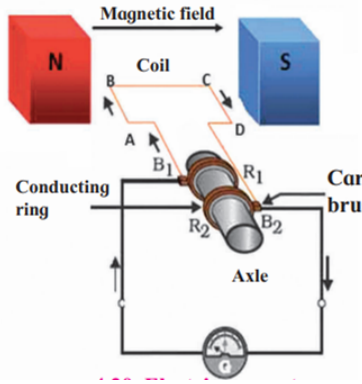
(a)	(b)	(c)
		

Ans

	Figure (a)
i.	It is a Fuse.
ii.	It is a safety device used to protect the appliances from getting damaged if there is excess current flowing in the circuit.
	Figure (b)
i.	It is miniature circuit breakers (MCB) switches.
ii.	When the current in the circuit suddenly increases these switches opens and the current stops. Thus MCB is used to protect the household wiring from the excessive flow of electric current through it.
	Figure (c)
i.	It is an Electric motor.
ii.	Electric motor is used in fans, refrigerators, mixers, computers, pumps, etc.

Q.10 **Answer the following** **12**

1 Identify the below diagram and explain the construction of it.



Ans The given diagram is an electric generator. Electric generator is a device that converts mechanical energy into electrical energy.

Construction : The main components of the electric generator are:

i. **Coil and strong magnets :**
A rectangular loop of copper wire ABCD placed between the two pole pieces of a magnet.

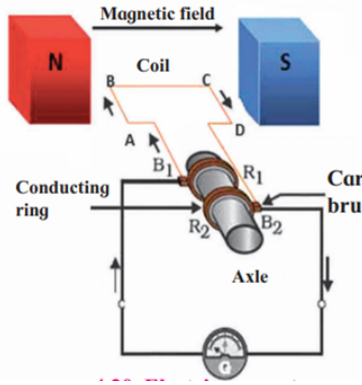
ii. **Conducting rings :**
The two ends of the coil are connected to the conducting rings R_1 and R_2 via carbon brushes.
Both the rings are fixed to the axle, but there is a restive coating in between the ring and the axle.
The axle is rotated with the help of a machine from outside. Because of this, the coil ABCD starts rotating.

iii. **Brushes :**
The stationary carbon brushes B_1 and B_2 are connected to a galvanometer, which shows the direction of current in the circuit.

2 How does a short circuit occur / form? What is it's effect ?

Ans i. If a live wire and a neutral wire come in direct contact or touch each other, short circuit takes place.
ii. During, a short circuit, the resistance of the circuit becomes very small and hence, huge amount of current flows through it.
iii. This produces a large amount of heat and raises the temperature.
iv. As a result, the circuit catches fire.
v. If any inflammable material (such as wood, cloth, plastic etc) exists around that place it can catch fire.
vi. Therefore, a fuse wire is used as a precautionary measure.

3 Observe the following diagram and answer the questions given below:



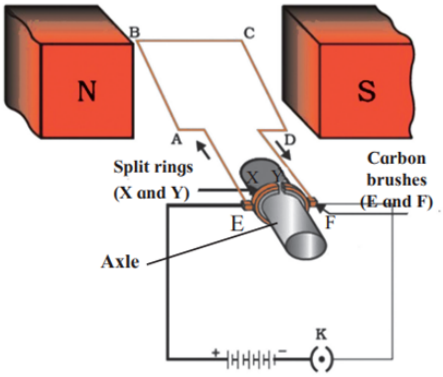
(a) Identify the above diagram.
(b) Write the principle on which the above appliance works.
(c) Write the working of the above appliance.
(d) Write the use of the above appliance.

Ans (a) It is a working electric generator.
(b) AC generator works on the principle of Faraday's law of electromagnetic induction. The direction of the induced current is found with the help of fleming's right-hand rule.
(c) **Working:**
(i) The axle is rotated with help of a machine from outisde, the coil ABCD starts rotating.
(ii) On rotating the axle, branch AB moves upward and branch CD moves downwards hence, coil ABCD rotates clockwise.
(iii) According to Fleming's right-hand rule, electric current flows in the direction A → B → C → D.
(iv) After half rotation, the branch AB and CD exchange their positions and the induced current flows as

D → C → B → A.

(d) This appliance is majorly used in an electric motor.

4 Explain the construction of the given diagram.



Ans Electric motor is a device that converts electrical energy into mechanical energy.

Construction : The main components of the electric motor are:

i. Coil :

A rectangular loop of copper wire having a resistive coating.

ii. Strong magnets :

The rectangular coil is placed in between two pole pieces (N and S) of a strong magnet.

These magnets are placed in such a way that branches of the coil AB and CD are perpendicular to the direction of the magnetic field.

iii. Split rings :

It consists of two halves(X and Y) of a metallic ring. The ends of the rectangular coil are connected to these rings.

The two halves of the ring have resistive coating on their inner surface and are tightly fitted on the axle.

iv. Brushes :

The two halves of the split ring, X and Y, have their outer conducting surfaces in contact with the two stationary brushes,(E and F) respectively.

v. Battery :

The battery supplies the current to the coil.

Q.11 **Answer the following in detail** **5**

1 Which device is used to produce electricity ? Describe with a neat diagram ?

i. Electric motor

ii. Galvanometer

iii. Electric Generator(DC)

iv. Voltmeter

Ans **i. Electric motor :**

Electric motor does not produce electricity but converts electrical energy into mechanical energy. Ex: Working of an electric fan.

ii. Galvanometer :

Galvanometer is used to know the direction and the presence of current in the circuit.

iii. Electric Generator(DC) :

Electric generator is used to produce electricity. Electric generators are devices that convert mechanical energy into electrical energy.

iv. Voltmeter :

Voltmeter is used to measure the potential difference between two points of a conductor.