4. Effect of Electric current

Extra Question

Q. 1) Electromagnetic Induction was discovered by

Ans :– Electromagnetic induction was discovered by Michael faraday and independently by Joseph Henry.

Q.2) Electromagnetic Induction was discovered by coulomb. Write the statement true or false

Ans :– False Electromagnetic Induction was discovered by faraday and Independently by Henry.

Q. 3) Define electric power

Ans :– Electric power is the electric work done per unit time OR

Electric power is the rate at which electric energy is use.

Q. 4) What is the production of magnetism by an electric current called?

Ans :– The production of magnetism by an electric current is called electromagnetism .

Q. 5) Is magnetic field a scalar or a vector?

Ans :– Magnetic field is a vector.

Q. 6) The negatively charged particle considered as a free particle moving in a metallic conductor.

Ans :– Electron.

Q. 7) Name the following

An alloy used to prepare a coil of high resistance for use in electric appliances such as an electric heater.

Ans :– Nichrome

Q. 8) Name the following

A device that converts electric energy into mechanical energy.

Ans :– Electric generator.

Q. 9) Tell the odd one out. Give proper explanation:

i) Fuse wire, bad conductor, rubber gloves generator

Ans :– Generator : It converts mechanical energy into electric energy, the remaining three do not.

Q. 10) odd one out from the following

Loud speaker, microphone, electric motor, magnet.

Ans :– Magnet It exerts a force on a magnetic material, the remaining three covert one form of energy into another.

Q. 11) Magnetic field increases as we go away from a magnet. It this statement is true or false.

Ans :–False. Magnetic field decreases as we go away from a magnet.

Q. 12) A galvanometer is used for …..

Ans :– A galvanometer is used for detecting the presence of current in a circuit as well as for some electrical measurements.

Q. 13) Electromagnetic Induction means …….

Ans :– Electromagnetic Induction means generation of a current in a coil and the magnet.

Q. 14) What does the electricity meter measure?

Ans :– The electricity meter measures electric energy consumption. It is expressed in ‘units’, where I unit means 1 kilowatt. Hour (3.6×10^6 joules)

Q. 15) Name the type of wire to which the main fuse is connected.

Ans :– The main fuse is connected to the live wire (phase wire).

Q. 16) What is overloading? When does it occur? What does it cause? How can overloading be avoided?

Ans :– A flow of large amount of current in circuit, beyond the permissible value of current, is called overloading.

It occurs when many electrical appliances of high power rating, such as a geyser, a heater, an oven, a motor, etc., are switched on simultaneously. This causes fire.

Overloading can be avoided by not connecting many electrical appliances of high power rating in the same circuit.

Q. 17) In India, what is the time interval in which AC changes direction?

Ans :– In India AC changes direction ever $\frac{1}{100}$ s.

Q. 18) What I s the periodic time of AC in India?

Ans :– In India the periodic time of AC is $\frac{1}{50}$ s.

Q. 19) State the right hand thumb rule.

Ans :– Imagine that you have held a current-x carrying straight conductor in your right hand in such a way that your thumb points in the direction of the current. Then turn your fingers around the conductor. The direction of the fingers is the direction of the magnetic lines of force produced by the current.

Q. 20) The right hand thumb rule is called Maxwell's cork-screw rule. What is the corkscrew rule?

Ans :– Maxwell's cork screw rule : If a right hand screw is rotated to advance in the direction of the current through a conductor, the direction of rotation of the screw gives the direction of the magnetic field produced by the current.

Q. 21) State the uses/applications of an electric motor.

Ans :– Uses/applications of an electric motor : (1) In domestic appliances such as a mixer, a blender, a refrigerator and washing machine

(2) In an electric fan, a hair dryer, a record player a tape recorder and a blower.

(3) In an electric car a rolling mill, an electric crane, an electric lift, a pump, a computer and an electric train.

Q. 22) State faraday's law of induction.

Ans :– Whenever the number of magnetic lines of force passing through a coil changes, a current is induced n the coil.

Q. 23) What is the value of frequency of AC in India?

Ans :– In India, the value of frequency of AC is 50 hertz.

Q. 24) What is one kilowatt-hour?

Ans :– One kilowatt. Hour is the electric energy used in one hour by an electrical appliance of power one kilowatt. It is equal to 3.6×10^6 J

Q. 25) State Joule's law about heating effect of electric current.

Ans :– Joule's law about heating effect of electric current : The quantity of heat produced in a conductor when a current flows through it is directly proportional to (1) the square of the current (2) the resistance of the conductor (3) the time for which the current flows.

Q. 26) Name the types of wires or cables used in the electric power supply provided by the state electricity Board for houses and factories.

Ans :– The wires or cables used in the electric power supply provided by the state Electricity Board are of three types : (1) phase wire (or live wire, the wire that carries an electric current) (2) neutral wire (3) the earth wire

Q. 27) Name the types of wire across which an electric appliance I connected.

Ans :– An electric appliance is connected across the live wire (phase wire) and the neutral wire.

Q. 28) Explain the term short circuiting. What does a short circuit lead to ?

OR

How does the short circuit form? What is its effects?

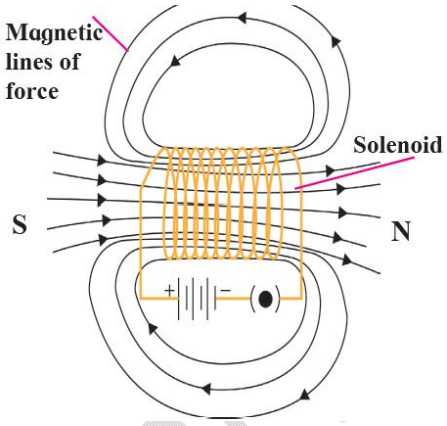
Ans :– If a bare live wire (phase wire) and a bare neutral wire touch each other (come in direst contact) or come very close to each other, the resistance of the circuit becomes very small and hence huge (very high) electric current flows through it. This condition is called a short circuit or short circuiting.

In this case, a large amount of heat is produced and the temperature of the components involved become very small and hence huge (very high) electric current flows through it. This condition is called a short circuit or short circuiting.

In this case, a large amount of heat is produced and the temperature of the components involved becomes very high. Hence, the circuit catches fire.

Q. 29) What is a solenoid? Compare the magnetic field produced by a solenoid with the magnetic field of a bar magnet.

Ans :– When a copper wire with a resistive coating is wound in a chain of loops (like a spring), it is called a solenoid.



The magnetic field lines (magnetic lines of force) due to a current-carrying solenoid solenoid are similar to those of a bar magnet. One face of the coil acts as the south pole and the other face as the north pole.

Q. 30) Write Fleming's left had rule.

Ans :– Fleming's left hand rule : The left hand thumb, index finger, and the middle finger are stretched so as to be perpendicular to each other. If the index finger is in the direction of the 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.

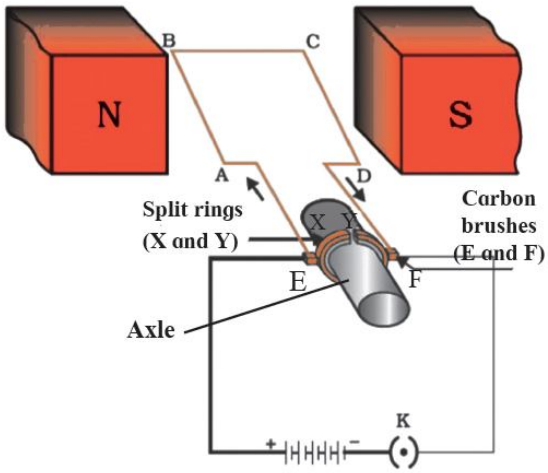
Q. 31) State the principle on which the working of an electric motor is based.

Ans :– An electric motor works on the principle that a current- carrying conductor placed in a magnetic field experiences a force. In this case, the forces acting on different parts of the coil of the motor produce the rotational motion of the coil.

Q. 32) Explain the construction and working of an electric motor. Draw a neat diagram and label it.

Ans :– figure 4.19 shows the construction of an electric motor. Here a rectangular loop ABCD of copper wire with resistive coating is placed between the north pole and south pole of a strong magnet, such as a horseshoe magnet, such that the branches AB and CD are perpendicular to the direction of the AB and CD are perpendicular to the direction of the magnetic field. The ends of the loop are connected to the two halves, X and Y, of split rings -X and Y of split rings – X and Y have resistive coating on their

inner surfaces and re tightly fitted on the axle. The outer conducting surfaces of X and Y are in contact with two stationary carbon brushed, E and F, respectively.



Working : (1) When the circuit is completed with a plug key or switch, the current flows in the direction E – A – B C – D – F. As the magnetic field is directed from the north pole to the south pole, the force on AB is downward and that on CD is upward by Fleming's left had rule. Hence AB moves downward and CD upward. These forces are equal in magnitude and opposite in direction. Therefore, as observed from the side AD the loop ABCD and the axle start rotating in anticlockwise direction.

(2) After half a rotation, X and Y come in contact with brushes F and E respectively and the current flows in the

direction EDCBAF. Hence the force on CD is downward and that on AB is upward. Therefore the loop and the axle continue to rotate in the anticlockwise direction.

(3) After every half rotation, the current in the loop is reversed and the loop and the axle continue to rotate in anticlockwise direction.

When the current is switched off, the loop stops rotating after some time.

Q. 33) What is (1) an electric generator (2) an AC generator (3) a DC generator?

Ans :– (1) A device which converts mechanical energy into electric energy is called an electric generator.

(2) A generator which converts mechanical energy into electric energy in the form of an alternating current (AC) is called an AC generator.

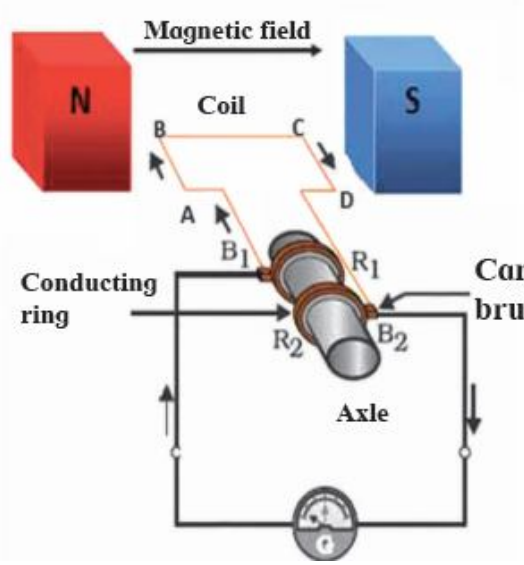
(3) A generator which converts mechanical energy into electric energy in the form of a direct current (DC) is called a DC generator.

Q. 34) State the principle on which the working of an electric generator is based.

Ans :– The working of an electric generator is based on the principle of electromagnetic induction. When the coil of an electric generator rotates in a magnetic filed, a current is induced in the coil this induced current then flows in the circuit connected to the coil.

Q. 35) Explain the construction and working of an electric motor. Draw a neat diagram and label it.

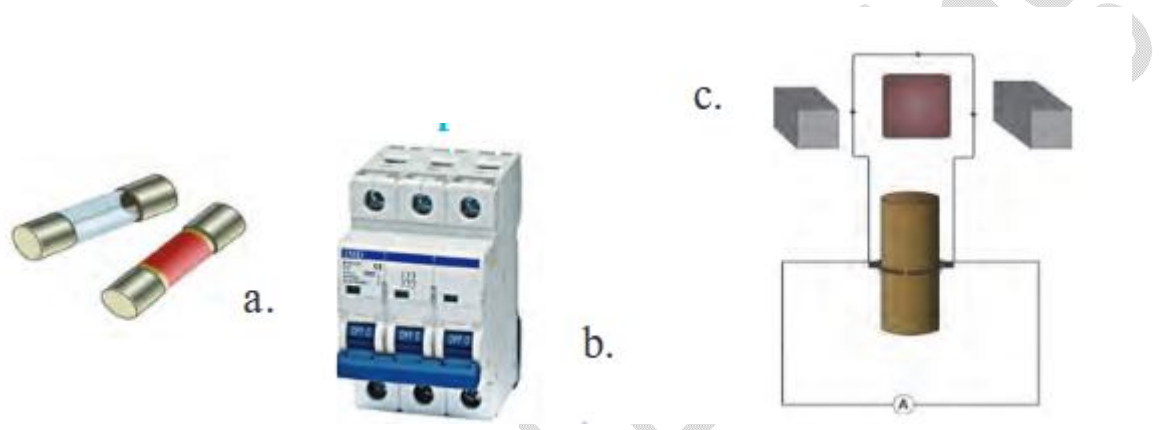
Ans :– figure 4.28 shows the construction of an AC electric generator. Here, a coil ABCD of copper wire is kept between the pole pieces (N and S) of a strong magnet. The ends of the coil are connected to the conducting rings R_1 and R_2 via carbon brushes B_1 and B_2. The rings are fixed tot eh axle and there is a resistive coating in between the rings and the axle. The stationary brushes are connected to a galvanometer used to show the direction of the current in the circuit.



Working : When the axle is rotated with a machine from outside, the coil ABCD starts rotating. Suppose the coil rotates in clockwise direction as observed from the side AD. Then as the branch AB moves upward, the branch CD moves downward. By Fleming's right hand rule, the induced current flows in the direction A – B C – D and in the external circuit, it flows from B_2 to B_1 through the galvanometer. The induced current is proportional to the number of turns of the copper, wire in the coil. After half a rotation, AB and CD interchange their places. Hence, the induced current flows in the direction D – C – B – A. As AB is always in contact with B1 and CD is in contact with B_2 the current in the external circuit flows from B_1 to B_2

through the galvanometer. Thus the direction of the current is the external circuit is opposite to that in the previous half rotation. The process goes on repeating and alternating current is generated.

Q. 36) Identify the figure and explain their use.



Ans :–(a) Fuse:- A fuse protects electrical circuits and appliances by stopping the flow of electric current

(b) MCB- when current in circuits increases suddenly this switch opens and current stops.

(c) DC generator

Q. 37) for electric power transmission, copper or aluminium wire is used

Ans :– (1) Copper and aluminium are good conductors of electricity.

(2) Copper and aluminium have very low resistivity. Hence, when and electric current flows thought a wire of copper or aluminium, heat produced is comparatively low. Therefore for electric power transmission copper or aluminium wire is used.

Q. 38) In practice the unit kW.h is used for the measurement of electric energy, rather than the joule.

Ans :– (1) If an electric device rated 230 V, A is operated for one hour, electric energy used

= Vit = 230 V × 5A × 3600 s = 4140000 joules.

(2) If this energy is expressed in k.W.h it will be $\frac{4140000}{3.6\times10^6}$ kW.h = 1.15 kW.h (more convenient). Hence, in practice the unit kW.h is used for the measurement of electric energy, rather than the joule.

Q. 39) Tungsten is used to make a solenoid type coil in an electric bulb.

Ans :– (1) The intensity of light emitted by the filament of a bulb depends on the temperature of the filament. It increases with the temperature.

(2) The melting point of the material used to make the filament of a bulb should be very high so that the filament can be heated to a high temperature by passing a current through it without melting it. This enables us to obtain more light. The melting points of tungsten is very high.

Hence, tungsten is used to make a solenoid type coil (filament) in an electric bulb.

Q. 40) Electric motor and Electric generator

Ans :–

Electric motor	Electric generator
1) A battery is used in an electric motor to pass a current through the coil.	1) A battery is not used in an electric generator.
2) In this case, a current-carrying coil is set in rotation due to the magnetic field.	2) In this case, a potential difference and hence a current is produced when the coil is set into rotation in the magnetic field by an external agent.
3) Split rings are used in an	3) Rings used in an AC generator

electric motor.	are not split.
4) In this case, electric energy is converted into mechanical energy.	4) In this case mechanical energy is converted into electric energy.

Q. 41) Heat energy is being produced in a resistance in a circuit at the rate of 100W. the current of 3 A is flowing in the circuit. What must be the value of the resistance?

Ans :– Data : P = 100W, I = 3 A, R = ?, $P = I^2R$

$\therefore$ Resistance, $R = \frac{P}{I^2} = \frac{100W}{(3A)^2} = \frac{100}{9}\ \Omega = 11.11\ \Omega$

Q. 42) Two tungsten bulbs of wattage 100 W and 60 W power work on 220 V potential difference. If they are connected in parallel, how much current will flow in the main conductor?

Ans :– Data : $P_1 = 100$ W, $P_1 = 60$ W V = 220V

I = ? $\therefore$ $I = \frac{P}{V}$

P = VI $\therefore$ $I_1 = \frac{P1}{V}$ and $I_2 = \frac{P2}{V}$

Current in the main conductor, I = I_1 + I_2 (parallel connection)

$= \frac{P_1}{V} + \frac{P_2}{V} = \frac{P_1+P_2}{V} = \frac{100W+60W}{220V} = \frac{160}{220}$ A

= 0.727 A = nearly 0.73A.

Q. 43) Who will spend more electrical energy 500 W TV set in 30 mins, or 600 W heater in 20 mins?

Ans :– Data : P_1 = 500 W, t_1 = 30 min = $\frac{30}{60}$ h

= $\frac{1}{2}$ h, P_2 = 600 W, t_2 = 20min = $\frac{20}{60}$ h = $\frac{1}{3}$ h

Electrical energy used = Pt

TV set : P_1t_1 = 500 W × $\frac{1}{2}$ h = 250W.h

Heater : P_2t_2 = 600 W × $\frac{1}{2}$ h = 200W.h

Thus, the TV set will spend more electrical energy than the heater.

Q. 44) An electric iron of 1100 W is operated for 2 hours daily. What will be the electrical consumption expenses for

that in the month of April? (The electric company charges Rs. Per unit of energy)

Ans :– Data : P = 1100W, t = 2 × 30 = 60 h, Rs5 per unit of energy, expenses = ?

$$N = \frac{Pt}{100W.h/unit} = \frac{1100W \times 60h}{1000W.h/unit} = 66 \text{ units.}$$

∴ Electrical consumption expenses

= 66 units × Rs. 5 per unit

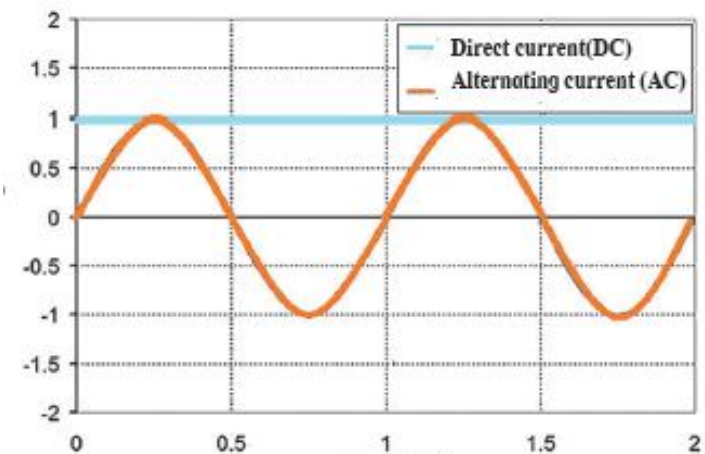
= Rs. 330.

Q. 45) What is a direct current (DC)?

Ans :– A nonoscillatory current that flows only in one direction is called a direct current (DC). It can change in magnitude, but its direction remains the same.

Q. 46) What is an alternating current (AC)?

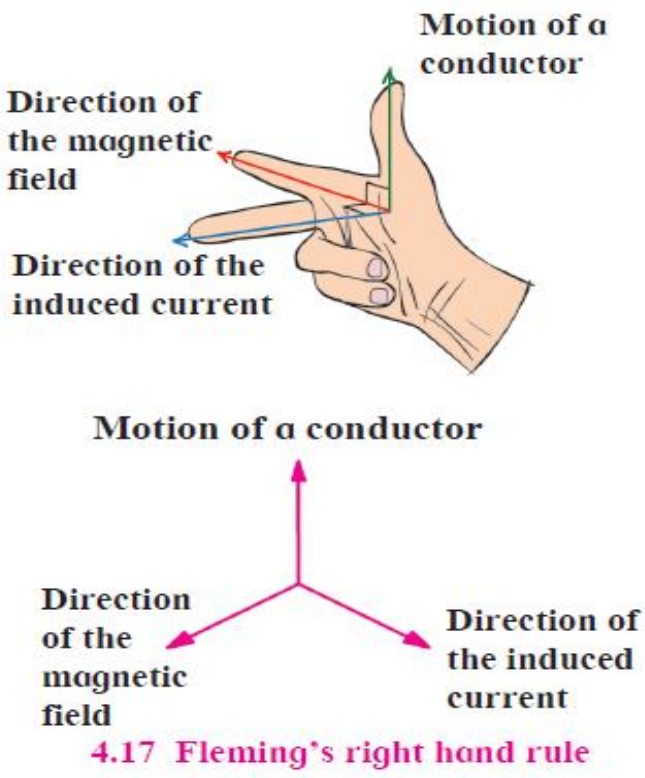
Ans :– A current that changes in magnitude and direction after equal intervals of time is called an alternating current (AC).



Electric current changes sinusoidally with time Electric current and potential difference are shown by the symbol ~.

Q. 47) State Fleming's right hand rule.

Ans :–



4.17 Fleming's right hand rule

Stretch the thumb, the index finger and the middle finger of the right hand in such a way that they are perpendicular to each other. In this position the thumb indicates the direction of the motion of the conductor, the index finger the direction of the magnetic field, and the middle finger shows the direction of the induced current.

Q. 48) What is a galvanometer used for? Explain in brief the working of galvanometer.

Ans :– Galvanometer is sensitive device used to detect the presence of current in a circuit as well as to determine the direction of the current in the circuit.

With suitable modification, it can be used to measure charge, current and voltage. It is working is based on the same principle as that of an electric motor. Here a coil is pivoted (or suspended) between the pole pieces of a magnet and a pointer is connected to the coil. As the coil rotates when a current is passed through it, the pointer also rotates. The rotation of the coil and hence the deflection of the coil is proportional to the current. The pointer deflects on both sides of the central zero mark depending on the direction of the current.

Q. 49) Match the columns :

Column I	Column II
1) The right hand thumb rule	(a) The direction of the force on a current-carrying conductor placed in a magnetic field.
2) Fleming's right hand rule	(b) The direction of the magnetic field around a straight conductor carrying current.
3) Fleming's left hand rule	(c) The direction of induced current in a conductor.

Ans :–

Column I	Column II
1) The right hand thumb rule	The direction of the magnetic field around a straight conductor carrying current.
2) Fleming's right hand rule	The direction of induced current in a conductor.
3) Fleming's left hand rule	The direction of the force on a current-carrying conductor placed in a magnetic field.

Q. 50) Which of the statements given below correctly describes the magnetic field near a long. Straight current-carrying conductor?

1) The magnetic lines of force are in a plane, perpendicular to the conductor in the form of straight lines.

2) The magnetic lines of force are parallel to the conductor on all the sides of conductor.

3) The magnetic lines of force are perpendicular to the conductor going radially outword.

4) The magnetic lines of force are in concentric circles with the wire as the center, in a plane perpendicular to the conductor.

Ans :– The magnetic lines of force are in concentric circles with the wire as the centre, in a plane perpendicular to the conductor.

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