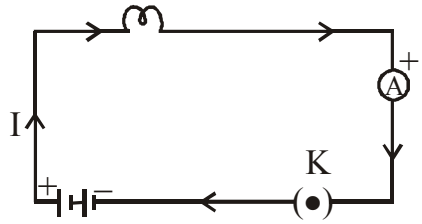
Chapter 6

Electricity and Its Magnetic Effects

- **Types of Electricity :** There are two types of electricity
  (i) Static electricity (ii) Current or dynamic electricity
  Static electricity causes physical effects due to the charge at rest. *Current electricity* causes physical effects due to the moving charge.
- **Conductors:** It is a material which allows the current (charge) to pass through it, e.g. Aluminium, Copper, Silver (best).
- **Insulators:** It is a material which does not allow the current (charge) to pass through it, e.g. Rubber, Wood, Plastic.
- **Electric current and circuit : -** *Electric current is the rate of flow of charge.*
  The magnitude of electric current in a conductor is the amount of charge flowing through it in one second.
  If a net charge Q flows across any cross-section of a conductor in time t, then the current I, through the cross-section is
  $I = \frac{Q}{t}$
  The SI unit of electric charge is coulomb (C),
- An instrument called ammeter measures electric current in a circuit. It is always connected in series in a circuit through which the current is to be measured shows the schematic diagram of a typical electric circuit comprising a cell, an electric bulb, an ammeter and a plug key.

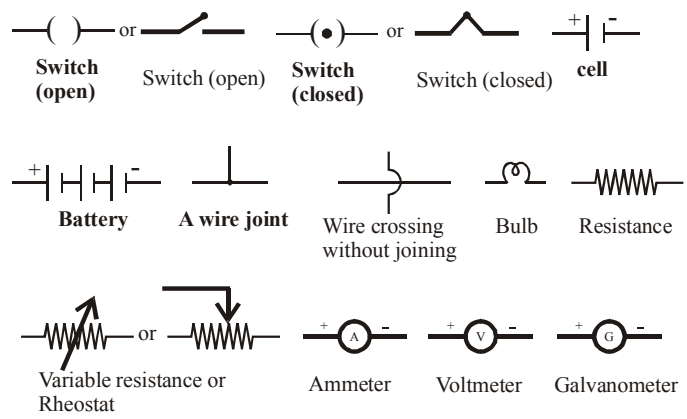


  One ampere is the amount of current when 1 coulomb of charge flows for 1 second, that is 1A = 1C/s.
- **Electric potential and potential difference :** When a unit test charge is placed outside an electric field which is produced by another charge it does not experience any force. When this test charge is brought inside the field, some work is done because the unit positive charge experiences a force which becomes more and more when the test charge moves near to the given charge. This amount of work done is known as electric potential.
  Potential difference is the difference between electric potentials of two distinct points inside an electric field. A and B are two considered points inside an electric field. When a unit positive test charge moves from A to B, some work is done. This amount of work done is known as *potential difference*.
  It is represented by V.

  Therefore, $V = \frac{W}{Q}$

- **One volt:** It is the potential difference when 1 joule of work is done to move a charge of one coulomb from one point to another inside an electric field.

  $\therefore \quad 1 \text{ volt} = \frac{1 \text{ joule}}{1 \text{ coulomb}}$, or $1V = 1JC^{-1}$.
- **Circuit Diagram :** It is a closed conducting path containing a source of potential difference or electric energy and a device utilizing the electric energy.
  Symbols of commonly used electrical components



  Ohm's law: According to Ohm's Law, *"Electric current is directly proportional to the potential difference between the two ends of a conductor at constant temperature"* i.e.

  $I \propto V$ or $V \propto I$ or $V = RI$

  where R is constant of proportionality which is known as Resistance. It is measured in *ohm* represented by Ω.

  One Ohm :- We know that $R = \frac{V}{I}$

  $1\,\Omega = \frac{1V}{1A} = 1V/A$.

  Resistance of a conductor is said to be 1 ohm if a potential difference of 1 volt across the ends of the conductor makes a current of 1 ampere to flow through it.

  $1\ k\Omega = 1$ Kilo Ohm $= 10^3\ \Omega$

  $1\ M\Omega = 1$ Mega Ohm $= 10^6\ \Omega$
- **Cause of Resistance:** A conductor has large number of free electrons. When a potential difference is maintained across the ends of a conductor, the free electrons drift from one end to the other end of the conductor. During their movement, they collide with each other. These collisions oppose the movement of free electrons from one end to the other end of the conductor. This opposition to the flow of free electrons due to the collisions is called resistance. More is the collision suffered more is the resistance.

- **Factors Affecting Resistance of a Conductor :** There are four factors on which resistance of a conductor i.e., wire depends :
  (1) Length of wire or conductor.
  (2) Area of cross-section.
  (3) Nature of material of wire.
  (4) Temperature.
- **Resistivity and specific resistance :** Resistance of a conductor depends on length of wire and area of cross-section i.e.

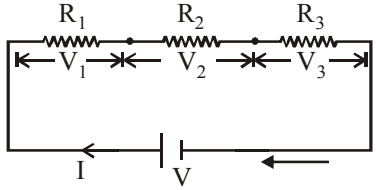
  $R \propto L;\ R \propto \frac{1}{A}$ i.e., $R \propto \frac{L}{A} \Rightarrow R = \frac{\rho L}{A}$

  ρ is a constant. This constant of proportionality is known as resistivity, which is represented by ρ (rho).

  Therefore, $\rho = \frac{RA}{L}$

  Resistivity of a conductor is measured in 'ohm meter' or 'Ω m'. Resistivity, which is also known as specific resistance is also defined as the resistance offered by a conductor of length 1 m having area of cross-section 1 m^2.
  Resistivity of a material does not depend on length or area of cross-section. Infact, it depends on the nature of materials. For a particular material (conductor) resistivity is constant, e.g., resistivity of silver is $1.6 \times 10^{-8}\ \Omega$ m.
- **Resistance of alloys:** It is found practically that the resistance of alloys is more than the resistance of its constituent metals. It means alloys have higher resistivity than their constituent metals e.g., nichrome which is an alloy of nickel and chromium has very high resistivity than its constituent metals i.e., Nickel and Chromium.
- **Resistance of a system of resistors :**
  (i) Combination of resistances in series : - When two or more resistances are connected end to end, they are said to be in series. When two or more resistances are connected in series, then current flowing in the circuit remains same i.e., it is equal in each and every resistance but PD gets distributed among these resistances. It means the sum of PDs or voltage across the different resistances is equal to the total voltage given to the circuit i.e.

$$V = V_1 + V_2 + V_3 + ...$$

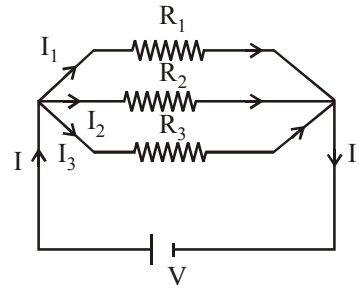


The equivalent resistance is given by,

$$R = R_1 + R_2 + R_3 + ...$$

(ii) Combination of resistances in parallel : - If two or more resistances are connected to the same end, they are said to be in parallel. When resistances are connected in parallel and put in a circuit with a battery of voltage 'V' volt which supplies a current of 'I' ampere, then :
(a) The PD across these resistances remain same i.e., 'V' volt.
(b) Current gets divided into parts in such a way that the total current in the circuit is equal to the sum of the currents flowing through each resistance.

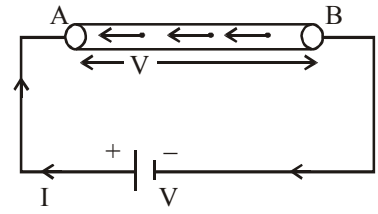
$$I = I_1 + I_2 + I_3 + ...$$



The equivalent resistance is given by,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ...$$

- **Heating Effect of Electric Current :** When the electric current is passed through a conductor then conductor gets heated, this effect is known as the heating effect of current. Consider a conductor AB connected to a cell of potential difference V. If W be the work done to carry the charge q from one end to another end of the conductor,



Then, $V = \frac{W}{q}$

$W = Vq$ ..... (1)

If I be the amount of current flowing through the conductor, then

$q = I.t$

$W = VIt$; from (1)

This work done is equal to heat (H) produced in a conductor.

$$\boxed{H = VIt}$$

But according to Ohm's law

$V = IR$

Then, $\boxed{H = I^2Rt}$ and $I = \frac{V}{R}$

Then, $\boxed{H = \frac{V^2}{R}t}$

i.e., $\boxed{H = VIt = I^2Rt = \frac{V^2}{R}t}$

Joule's Law of Heating Effect: It states that the amount of heat produced in a conductor is
(i) directly proportional to the square of current passing through it,
$H \propto I^2$ .... (1)
(ii) directly propotional to the resistance of conductor,
$H \propto R$ .... (2)
(iii) Directly proportional to the time for which current passed ,
$H \propto t$ .... (3)

Combining (1), (2) and (3).

$H \alpha I^2 Rt$.

Here, constant of proportionality is 1.

$$\boxed{H = I^2Rt \text{ joule}}$$

Practical applications of heating effect of current

(i) Electric heater, electric iron and water heater, etc. work on the principle of the heating effect of current.

(ii) Electric bulb glows when electric current flows through the filament of the bulb.

(iii) Electric fuse in the electric circuit melts when large current flows in the circuit.

- **Electric Power :** The rate at which electric energy is consumed is called electric power.

$$\text{Power} = \frac{\text{Work}}{\text{Time}}$$

It is measured in 'watt'.

$$P = \frac{W}{t} = I^2R = VI = \frac{V^2}{R}$$

where P is the power, I is current flowing, V is the potential difference and R is the resistance.

Units of Power

SI unit of power is **watt (W)**

1 watt = 1 volt × 1 ampere = 1VA

1 kW = 1 Kilo Watt = 10^3W

1 MW = 1 Mega Watt = 10^6 W

1 GW = 1 Giga Watt = 10^9 W

$$\boxed{1 \text{ hp} = 746 \text{ watt}}$$

The commercial unit of electrical energy is Kilo Watt Hour (kWh). It is also called 'unit' or B.O.T. (Board of Trade Unit).

$$\boxed{1 \text{kWh} = 3.6 \times 10^6 \text{ joule}}$$

- **Magnetic Field :** Every magnet has a region around it in which it's force (attraction or repulsion) can be experienced. This region is known as magnetic field.

Direction of Magnetic field: It is given by direction of hypothetical north pole. When this north pole is placed in a magnetic field produced by another magnet, it will move in a direction within the field. This direction indicates the direction of magnetic field (MF).

Magnetic lines of force (or magnetic field lines): The path (straight or curved) along which unit north pole moves in a magnetic field (if it is free to do so) is called magnetic lines of force. They are imaginary lines.

Properties of Magnetic lines of force :

(i) Magnetic lines of force always start from the north pole of the magnet and end at the south pole of the magnet out-side the magnet.

(ii) Magnetic lines of force are very close to each other near the poles and widely separated when away from the poles.

(iii) Magnetic lines of force never intersect each other.

(iv) Closer the magnetic lines of force, stronger is the field and vice-versa.

(v) They are closed continuous loops.

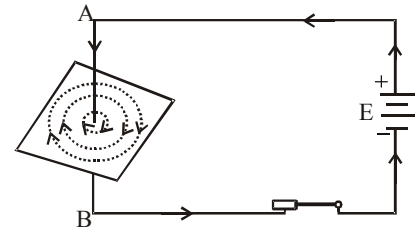
Types of Magnetic Fields :

(i) Uniform Magnetic Field : - The magnetic field is said to be uniform if its magnitude is equal and direction is same at every point in the space.

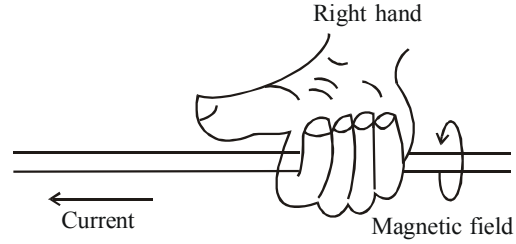
(ii) Non-Uniform Magnetic Field :- The magnetic field is said to be non-uniform if its magnitude is not equal and direction is not same at every point in space.

- **Magnetic Field Due to a Current Carrying Straight Conductor:** It is found that when current flows through the conductor, iron fillings arrange themselves in the form of concentric circles, around the wire.

These concentric circles represent magnetic lines of force of the wire carrying current. The direction of these lines of force can be observed by using a magnetic needle. The direction in which the north pole of the needle points is the direction of magnetic lines of force. When the current is flowing from A to B, direction of magnetic lines of force is clockwise.



- **Right Hand Thumb Rule :** According to this rule, if we imagine that we are holding a wire carrying current and thumb is stretched in the direction of current then the direction in which fingers will be wrapped gives the direction of magnetic lines of force. It means if the current is flowing in the upward direction then the direction of magnetic lines of force will be anticlockwise and if current is flowing in the downward direction then the direction of field will be clockwise.

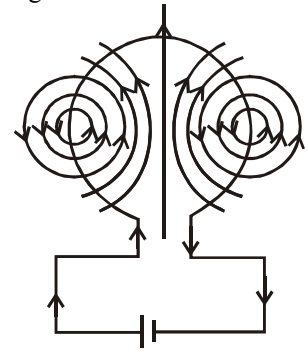


Factors on which strength of magnetic field around a straight wire carrying current depends:

(i) Strength of this magnetic field depends on current i.e., it is directly propotional to the current flowing through the conductor.

(ii) Distance from the wire : Strength of the Magnetic Field is inversely proportional to the distance from the wire carrying current.

- **Magnetic field around a circular loop carrying current:** When current passes through a circular wire, it produces a magnetic field around it. The lines of force of this field can be obtained by fixing a circular wire in a cardboard as shown in fig.



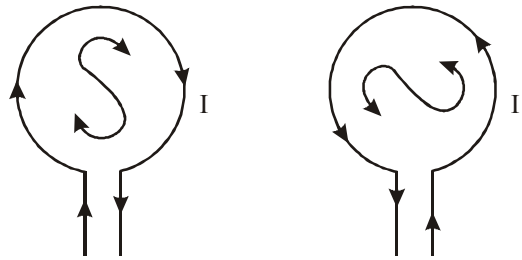
Factors on which the strength of magnetic field around a circular wire depends :

(i) The strength of field is directly proportional to the current flowing through the conductor.

(ii) It is inversely proportional to the radius of coil.

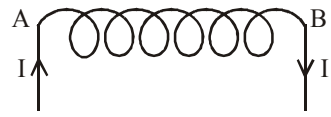
(iii) It is directly proportional to the number of turns of the circular wire.

- **Clock Rule:** It is applicable for circular loops. If the current flowing appears to be in anticlockwise direction in any circular loop, then this face acts as North Pole of the magnet. While if the current flowing appears to be in clockwise direction in a circular loop, then this face acts as South Pole of the magnet.



Clockwise direction of current **Anticlockwise direction of current**

- **Solenoid:** A solenoid is a coil of many turns of an insulated wire closely wound in the shape of a tight spring.



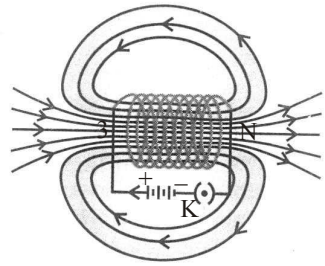
Magnetic Field Produced by a Solenoid: It is insulated copper wire which has given a large number of turns to form a cylinder. When current flows through this solenoid, it behaves like a magnet i.e. a magnetic field is produced around it may be noted that :

(i) Magnetic field inside the solenoid is uniform.

(ii) Magnetic field outside the solenoid is non uniform.

(iii) Inside the solenoid, the field lines moves from S to N pole and outside the solenoid, they move from N to S pole.

(iv) Magnetic field produced due to a solenoid is similar as a bar magnet.



Field lines of the magnetic field through and around a current carrying solenoid.

Factors on which magnetic field due to a solenoid depends :

(i) The number of turns of the wire forming a solenoid.
(Magnetie field) $B \alpha n$

(ii) The strength of current
$B \alpha I$

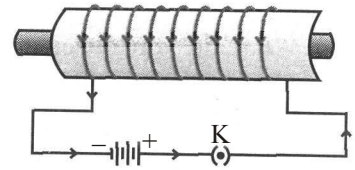
(iii) Nature of material inside the solenoid
$B \alpha \mu$ (where μ is permeability of material).

- **Electromagnet** : It is a piece of magnetic material like soft iron or hard steel which is placed inside a solenoid through which current is flowing.

There are two types of electromagnet :

(i) Permanent electromagnets.

(ii) Temporary electromagnets.



A current-carrying solenoid coil is used to magnetise steel rod inside it–an electromagnet.

Permanent Electromagnet: It is a type of electromagnet which is obtained by placing magnetic material like hard steel in the strong magnetic field produced by a coil.

These electromagnets are widely used in microphones, loudspeakers, voltmeters, speedometer etc.

Temporary Electromagnet: It is a type of electromagnet. It behaves like a magnet till the current flows through it, i.e., it stops behaving like a magnet when the flow of current is stopped.

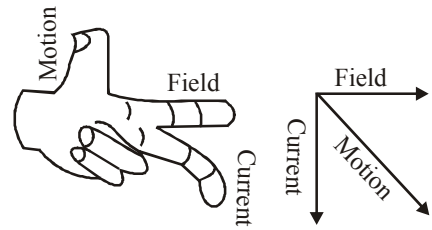
It is obtained by using soft iron as a core material i.e., by placing soft iron in a coil through which current is flowing.

Uses of electromagnets :

(i) They are used to lift heavy iron pieces.

(ii) They are used in many devices like electric bell, electric horn, telephone reciever etc.

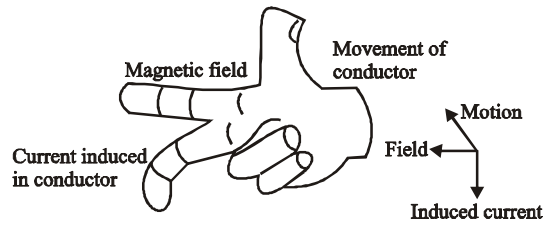
- **Fleming's Left Hand Rule :** According to this rule stretch thumb, fore finger and central finger of left hand in such a way that these fingers are perpendicular to each other. If fore finger is placed in the direction of Magnetic Field and middle finger in direction of current, then thumb will point towards the direction of force.



- **Electric Motor - DC Motor:** It is a device which is used to convert electrical energy into mechanical energy.
- **Principle :** It is based on the fact that when a conductor carrying current is placed in a Magnetic Field, a force is exerted on it.

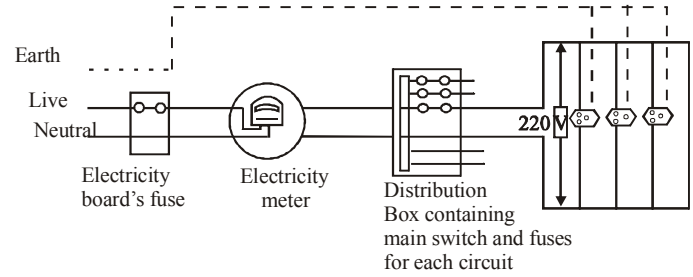
So, when a rectangular coil is placed in a magnetic field and current flows through it, then torque is produced and acts on the coil and it rotates.

- **Fleming's Right Hand Rule :** According to Fleming's right hand rule, stretch thumb, fore finger and middle finger in such a way that these three are perpendicular to each other. Now adjust thumb and fore finger in such a way that thumb indicates the direction of the motion of the conductor and the fore finger indicates the direction of MF, then the direction in which middle finger points is the direction of flow of current.



- **Electromagnetic Induction:** It is known that when a conductor carrying current is placed in a magnetic field, a force is exerted on the conductor. On the basis of this relation between magnetic field, current and the motion of conductor, Michael Faraday discovered that when a straight conductor moves in a magnetic field, current is generated in the conductor. This phenomenon of production of electric current is known as electro magnetic Induction and the current so obtained is called induced current.
- **Galvanometer**: A galvanometer is an instrument that can detect the presence of a current in a circuit.
- **Electric Generator :**
  Principle: It is based on the fact that when a straight conductor moves in a magnetic field, induced current is produced.
  If a rectangular coil which has large number of turns rotates in a magnetic field, large amount of induced current is produced which can be further utilized.
  D.C. Electric Generator: It is a type of generator which is used to produce induced current which forms in one direction (unidirectional called Direct Current).
  A.C. Generator: It generates alternating current (a.c.) that changes its polarity after every half rotation.

- **Domestic Circuit :** We receive supply of electric power through mains. One of the wires in the supply has red insulation called live wire. Another wire with black insulation is called neutral wire. Potential difference between them is 220 volt.



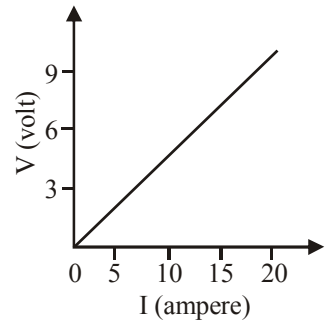
A schematic diagram of one of the common domestic circuits.

- **Short circuit:** It occurs when the insulation of wires get damaged and live and neutral wires touch each other.
- **Over loading:** When large number of electric appliances of high power rating are switched on at the same time, large amount of current is drawn in the circuit due to which copper wire gets heated which may lead to fire.
- **Fuse:** Fuse is a safety device having a very thin wire which is made up of either tin or alloy of tin and lead (or tin and copper).
  Fuse wire should be :
  (i) Very thin so that it has high resistance due to which it can produce more heating effect.
  (ii) It should have low meling point.
  Copper wire is not used as a fuse wire because :
  (i) Copper wire has high melting point,
  (ii) Copper wire has low resistance.

Exercise 1

DIRECTIONS : This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.

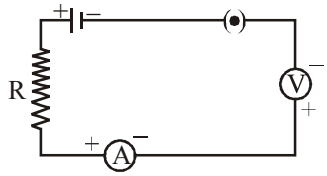
1. Among the following statements :
   (a) A discharge lamp uses a discharge tube which is filled with a gas at a very low pressure.
   (b) Always white light is emitted independent of gas taken in the lamp.
   (1) Only (a) is true
   (2) Only (b) is true
   (3) Both (a) and (b) are true
   (4) Both (a) and (b) are false
2. Among identical spheres A and B having charges as – 5 C and – 16 C
   (1) – 5C is at higher potential
   (2) – 16 C is at higher potential
   (3) both are at equal potential
   (4) it cannot be said
3. The resistance whose V – I graph is given below

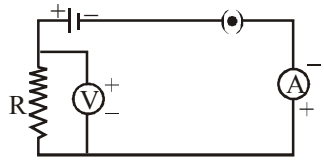


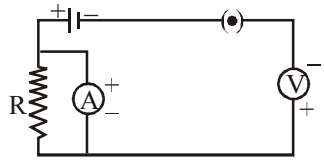
   (1) $\frac{5}{3}\Omega$ (2) $\frac{3}{5}\Omega$
   (3) $\frac{5}{2}\Omega$ (4) $\frac{2}{5}\Omega$
4. Direction of conventional current is from
   (1) Negative terminal to positive terminal
   (2) Positive terminal to negative terminal
   (3) In any direction
   (4) In both the directions

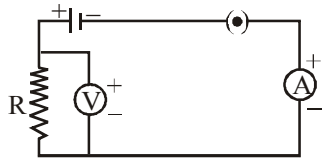
5. A piece of wire of resistance R is drawn to double its length. The new resistance is
(1) R (2) 2 R
(3) 4 R (4) $\frac{R}{4}$

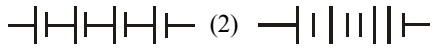
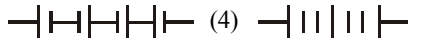
6. Identify the circuit in which the electrical components have been properly connected.

(1) 

(2) 

(3) 

(4) 

7. The proper representation of series combination of cells obtaining maximum potential is
(1)  (2)
(3)  (4)

8. Potential difference is defined as
(1) the amount of work done in moving a unit charge in a unit time
(2) distance between two terminals
(3) length of the connecting wire
(4) the amount of work done in moving a unit charge

9. A cooler of 1500 W, 200 volt and a fan of 500 W, 200 volt are to be used from a supply. The rating of fuse to be used is
(1) 2.5 A (2) 5.0 A
(3) 7.5 A (4) 10A

10. A fuse wire repeatedly gets burnt when used with a good heater. It is advised to use a fuse wire of
(1) more length (2) less radius
(3) less length (4) more radius

11. Rheostat is a device used to vary
(1) voltage (2) current
(3) resistance (4) power

12. The length of a wire is doubled, but its cross-section remains the same, then its resistance will become
(1) 4 times (2) 2 times
(3) $\frac{1}{2}$ times (4) 8 times

13. Electric iron uses wires of alloy as
(1) they do not oxidise at high temperatures
(2) they do not burn at high temperatures
(3) both (1) and (2)
(4) neither (1) or (2)

14. A student records that 36,000 joule of energy is used by him in an hour. The amount of electrical energy required to be used is
(1) 36 kW h (2) 100 kW h
(3) 0.001 kW h (4) 0.01 kW h

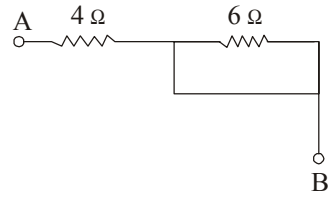
15. To increase the resistance in a network, one has to connect any given resistor in
(1) parallel (2) series
(3) can be (1) or (2) (4) only (1)

16. Heat produced due to flow of current through a conductor is given by the formula
(1) $H = I^2 R t$ (2) $H = V I t$
(3) $H = V^2 t / R$ (4) All of the above

17. A boy records that 4000 joule of work is required to transfer 10 coulomb of charge between two points of a resistor of 50 Ω. The current passing through it is
(1) 2 A (2) 4 A
(3) 8 A (4) 16 A

18. The two forms of energy released by a tungsten filament used in a bulb are
(1) electrical and light
(2) light and heat
(3) heat and electrical
(4) electrical only

19. The effective resistance between A and B is



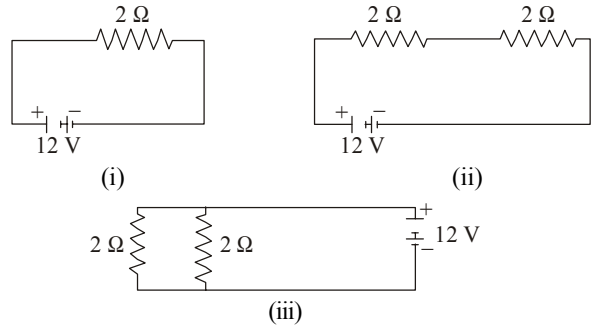
(1) 4 Ω (2) 6 Ω
(3) May be 10 Ω (4) Must be 10 Ω

20. The combined resistance of any number of resistances connected in series is equal to
(1) The sum of individual resistances
(2) The sum of reciprocals of individual resistances
(3) Product of individual resistances
(4) Highest individual resistance

21. An air conditioner of 2000 W, a fan of 500 W, a bulb of 40 W and a computer offering 30 W are used in a house hold using 220V. The power rating of the fuse to be used in this case is
(1) 10 A (2) 15 A
(3) < 20 A (4) < 5 A

22. Appliances : Parallel
Fuse : _____
(1) Series
(2) Parallel
(3) Series in appliances always
(4) Parallel in fuse always

23. In the following circuits heat produced in the resistor or combination of resistors connected to a 12V battery will be



(1) same in all the cases
(2) minimum in case (i)
(3) maximum in case (ii)
(4) maximum in case (iii)

24. The reciprocal of the combined resistance of any number of resistances connected in parallel is equal to
(1) the sum of reciprocals of individual resistances
(2) reciprocal of the product of individual resistances
(3) reciprocal of sum of all the resistances
(4) None of the above

25. A current of 1 A is drawn by a filament of an electric bulb. Number of electrons passing through a cross-section of the filament in 16 seconds would be roughly
(1) 10^{20} (2) 10^{16}
(3) 10^{18} (4) 10^{23}

26. Which of the following represents voltage?
(1) $\frac{\text{Work done}}{\text{Current} \times \text{time}}$
(2) Work done × Charge
(3) $\frac{\text{Work done} \times \text{Time}}{\text{Current}}$
(4) Work done × Charge × Time

27. If the current I through a resistor is increased by 100% (assume that temperature remains unchanged), the increase in power dissipated will be
(1) 100 % (2) 200 %
(3) 300 % (4) 400 %

28. When two or more resistors are connected in parallel,
(1) The current passing through each resistor is same
(2) The potential difference across each resistor is same
(3) Both of the above
(4) None of the above

29. A small rod is wound round with certain coils and current is allowed for sometime. When the rod was taken out, it was found not to attract iron. The material of the rod may be
(1) copper (2) cobalt
(3) steel (4) nickel

30. Two students make a solenoid each with same length but the number of turns. are in the ratio of 1 : 4 As they carry same current, the ratio of the magnetic field strength will be
(1) 1 : 2 (2) 1 : 4
(3) 3 : 2 (4) 4 : 1

31. The potential difference that can be produced using an AC generator be doubled by doubling the
(1) number of turns N only
(2) area of the coil A
(3) speed of rotation ω only
(4) magnetic field only

32. Power rating of an electric appliance indicates
(1) The rate of consumption of electrical energy
(2) Amount of heat evolved
(3) Brightness of the light
(4) Quality of the appliance

33. A circular coil of area A is rotated about its diameter with an angular velocity ω. The potential difference produce is (N – Number of turns)
(1) NAB (2) NABω
(3) ABω (4) Bω

34. Identify the incorrect statement:
Magnetic field lines due to a circular coil is
(1) circular near the wire
(2) straight along the axis
(3) leaving both the planes
(4) perpendicular to the plane

35. A moving charge experiences maximum force when the angle between its velocity and magnetic field is
(1) 0° (2) 30°
(3) 60° (4) 90°

36. Alloys are usually used in electrical heating devices because
(1) resistivity of an alloy is generally higher than that of constituent elements
(2) alloys do not oxidize readily at high temperature
(3) Both (1) and (2)
(4) Neither (1) nor (2)

37. Magnetic field lines caused by a solenoid
(1) are curves
(2) start at north and end at south
(3) closed loops
(4) uniform everywhere

38. A coil of insulated copper wire is connected to a galvanometer forming a loop and a magnet is
A: held stationary
B: moved away along its axis
C: moved towards along its axis
There will be induced current in
(1) A only (2) A and B only
(3) B and C only (4) A, B and C

39. A horizontal power line carries current from east to west. The direction of magnetic field at a point below the wire is directed
(1) upward (2) downward
(3) towards north (4) towards south

40. The region surrounding a magnet, in which the force of the magnet can be detected is said to have
(1) magnetic field (2) electric field
(3) magnetic poles (4) None of these

41. A coil of rectangular dimension is rotated in a magnetic field. The flux associated, changes due to the change in
(1) number (N)
(2) area (A)
(3) strength of field (B)
(4) angle between B and A

42. A proton is moving towards North with a velocity of 1.5×10^7 ms^{-1} in a uniform magnetic field of 5 Tesla directed eastward. The magnetic force experienced is
(1) 12×10^{-12} N (2) 12×10^{-10} N
(3) 7.5×10^7 N (4) 5.7×10^5 N

43. A conductor of length l carrying a current I placed in a perpendicular magnetic field experiences 5 N of force. If the length is doubled with halved magnetic field. The force experienced with doubled current is
(1) 5 N (2) 10 N
(3) 15 N (4) 2.5 N

44. A straight conducting wire is placed parallel to and over a compass needle. The deflection in the needle
(1) becomes opposite when the direction of the current is reversed
(2) remains in the same direction even on reversing the direction of current
(3) keeps fluctuating on passage of current in any direction
(4) Is negligible on reversing the direction of current

45. Two long wires carrying current in the opposite direction perpendicular to the plane of the paper are at a distance of r from a point. The magnetic field at that point is proportional to
(1) r (2) $\frac{1}{r}$
(3) $\frac{1}{r^2}$ (4) zero

46. A magnet having a pole strength m is cut along its length into two equal parts. The strenght of the pole of each of the magnets is
(1) $\frac{m}{2}$ (2) 2 m
(3) m (4) 4 m

47. Regarding a transformer which of the following is incorrect?
(1) Principle is induction
(2) Varying potential is required
(3) Energy is produced or lost
(4) Performs based on the number of turns

48 At every point of a current carrying circular loop, the concentric circles representing the magnetic fields around it would become
(1) larger and larger as we move away from the wire
(2) so large at the centre of circular loop that they look like straight lines
(3) Both (1) and (2)
(4) Neither (1) nor (2)

49. In order to find the direction of induced current one uses
(1) Fleming's left-hand rule
(2) Fleming's right- hand rule
(3) Right-hand thumb rule
(4) Screw rule

50. MRI stands for
(1) Magnets Resonant Imaging
(2) Magnetic Resonance Imaging
(3) Magnetic Radar Imaging
(4) Magnets Radial Imagic

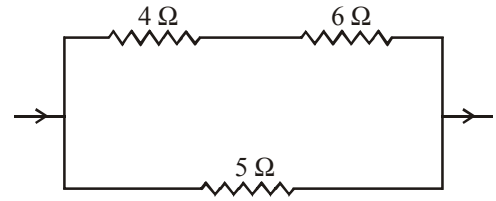
51. Which of the following instruments is used to measure magnetic field ?
(1) Thermometer (2) Pyrometer
(3) Hygrometer (4) Flux meter

52. Which of the following statements is not true?
(1) The pattern of the magnetic field around a conductor due to an electric current flowing through it depends on the shape of the conductor
(2) The magnetic field of a solenoid carrying a current is similar to that of a bar magnet
(3) Magnitude of magnetic field is directly proportional to the quantity of current flowing through the current
(4) Magnetic field produced by the passage of current through a straight wire is permanent

53. The direction of magnetic lines of force of a bar magnet is
(1) from south to north pole
(2) from north to south pole
(3) across the bar magnet
(4) from south to north pole inside the magnet and from north to south pole outside the magnet

54. The lines of force due to earth's horizontal magnetic field are
(1) parallel and straight (2) concentric circles
(3) elliptical (4) curved lines

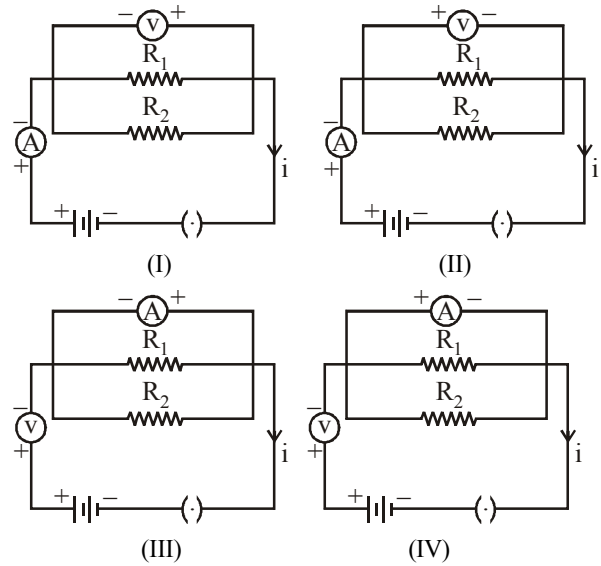
55. In the circuit given below the heat produced in the 5 ohm resistor due to the current flowing through it is 10 calorie per second. The heat generated in the 4 ohm resistor is



(1) 2 cal/s (2) 3 cal/s
(3) 4cal/s (4) None of these

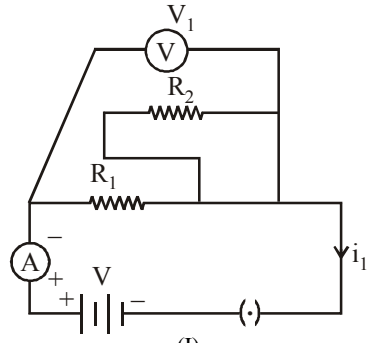
56. Increase in number of turns of a coil in the solenoid will
(1) have no effect on the strength of magnetic field
(2) will add to the strength of the magnetic field
(3) will decrease the strength of the magnetic field
(4) will change the direction of the magnetic field

57. In the experiment of finding the equivalent resistance of two resistors connected in parallel, the voltmeter and the ammeter have been correctly connected in circuit :

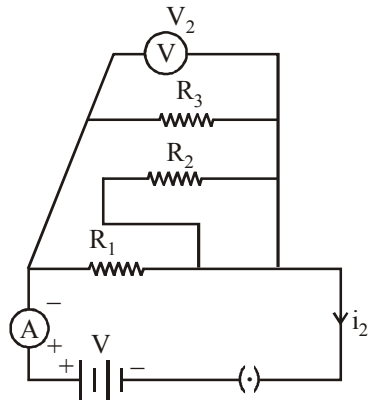


(1) I only (2) II only
(3) III only (4) IV only

58. Circuit I : Ammeter reads current i_1 and voltmeter reads V_1
Circuit II : Ammeter reads current i_2 and voltmeter reads V_2



(I)



(II)

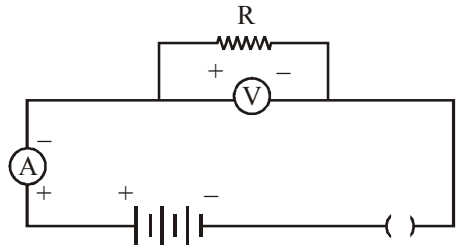
The relationship between the readings is :
(1) $i_1 > i_2$; $V_1 = V_2$ (2) $i_1 < i_2$; $V_1 = V_2$
(3) $i_1 > i_2$; $V_1 > V_2$ (4) $i_1 < i_2$; $V_1 < V_2$

59. A student did the experiment to find the equivalent resistance of two given resistor R_1 & R_2. First when they are connected in series and next when they are connected in parallel. The two values of the equivalent resistance obtained by him were R_s and R_p respectively. He would find that :
(1) $R_s < R_p$
(2) $R_s > R_p$
(3) $R_s = R_p = \left(\frac{R_1 + R_2}{2}\right)$
(4) $R_s = R_p$ but not equal to $\left(\frac{R_1 + R_2}{2}\right)$

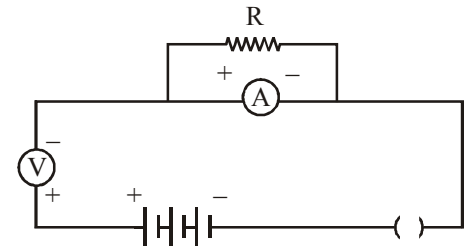
60. An electromagnet consists of a core of _____ wrapped around with a coil of _____ copper wire.
(1) soft iron, insulated
(2) aluminium, insulated
(3) soft iron, uncovered
(4) magnet, uncovered

61. The correct set up for studying the dependence of the current on the potential difference across a resistor is :

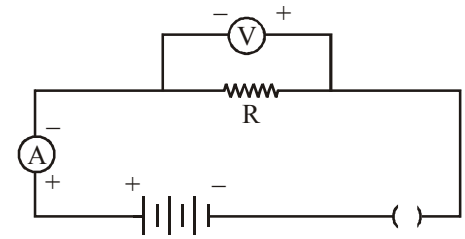
(a)



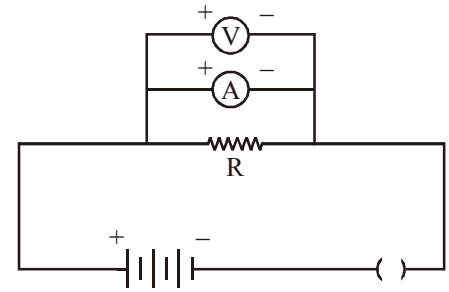
(b)



(c)



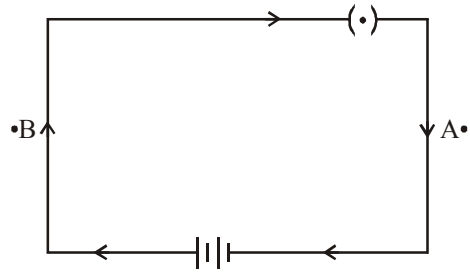
(d)



(1) (a) (2) (b)
(3) (c) (4) (d)

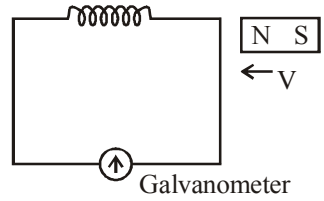
62. Two bars of soft iron exactly alike are given. One of them is a magnet. Without using any thing more, how would you find which is a magnet :
(1) By bringing two bars near and noting which one is attracting. The attracting one is a magnet.
(2) By bringing two bars near and noting which one is repelling. One which repels is an ordinary iron.
(3) By rubbing one bar with the other and noting which becomes magnet. The bar which is magnetised is an ordinary iron.
(4) One bar is placed flat horizontal on the table and the other bar is held vertical with its one end on the middle of first bar. If there is attraction between the two, the vertical bar is magnet otherwise ordinary iron.

63. In the following figure, four set of observations are taken. Identify the correct observation.



(1) Magnetic field at point A is outwards, and at B is inwards.
(2) Magnetic field at point A is inwards, and at B is outwards.
(3) Magnetic field at both the points is inwards.
(4) Magnetic field at both the points is outwards.

64. In Faraday's experiment (figure below), choose the wrong statement :



(1) On increasing the speed of magnet, deflection in galvanometer increases.
(2) On reversing the direction of motion of magnet, deflection in galvanometer gets reversed
(3) On increasing the number of turns in coil, current decreases.
(4) On keeping the magnet fixed, but moving the coil, galvanometer resisters a current.

65. Direction of the force experienced by a current-carrying conductor when placed in a magnetic field is dependant on
(1) direction of the current alone
(2) direction of the magnetic field alone
(3) direction of current as well as the direction of magnetic field
(4) None of these

66. The magnitude of the force experienced by a current-carrying conductor when placed in a magnetic field will be
(1) maximum if the directions of current and magnetic field are perpendicular to each other
(2) minimum if the directions of current and magnetic field are perpendicular to each other
(3) maximum if the directions of current and magnetic field are opposite to each other
(4) maximum if the directions of current and magnetic field are same

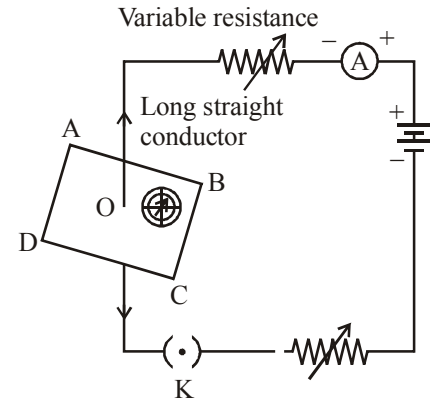
67. An electric motor is a device
(1) that works on the principle described by Fleming's left hand rule
(2) that converts electrical energy to mechanical energy
(3) Both (1) and (2)
(4) Neither (1) nor (2)

68. Which of the following statements cannot be related to an electric motor?
(1) A rectangular coil of insulated copper wire is placed between the two poles of a magnetic field such that two of its parallel sides are perpendicular to the direction of the magnetic field.
(2) The ends of the coil are connected to the two halves of a split ring.
(3) The inner insulated sides are attached to axle whereas the external conducting edges touch two conducting stationary bushes.
(4) The coil and the axle continuously rotate in one direction.

69. In domestic circuits, wires with red insulations are used as live wires, whereas
(1) the wires with black insulations are used as neutral (or negative) wires
(2) the wires with green insulations or steel wires are used as earth wires
(3) the wires with black insulations are used for positive terminals
(4) Only (1) and (2)

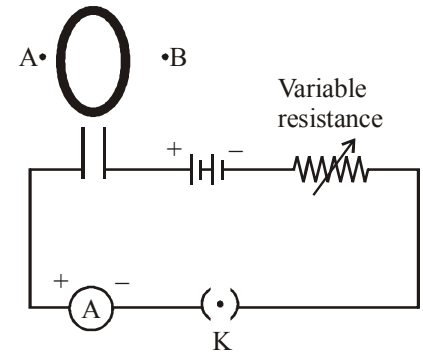
70. Parameters of electricity supply in India are
(1) Potential Difference of 220 V, Frequency of 50 hertz and Current Rating of 5A/15A
(2) Potential Difference of 150 V, Frequency of 40 hertz and Current Rating of 10 A
(3) Potential Difference of 220 V, Frequency of 60 hertz and Current Rating of 15A
(4) Potential Difference of 220 V, Frequency of 40 hertz and Current Rating of 5 A

71. If the key in the arrangement (Fig) is taken out (the circuit is made open) and magnetic field lines are drawn over the horizontal plane ABCD, the lines are



(1) concentric circles
(2) elliptical in shape
(3) straight lines parallel to each other
(4) concentric circles near the point O but of elliptical shapes as we go away from it.

72. A circular loop placed in a plane perpendicular to the plane of paper carries a current when the key is ON. The current as seen from points A and B (in the plane of paper and on the axis of the coil) is anti-clockwise and clockwise respectively. The magnetic field lines point from B to A. The N-pole of the resultant magnet is on the face close to



(1) A
(2) B
(3) A if the current is small, and B if the current is large
(4) B if the current is small and A if the current is large

Exercise 2

Matching Based MCQ

DIRECTIONS (Qs.1 to 6) : Match Column-I with Column-II and select the correct answer using the codes given below the columns.

1.

	Column-I	Column-II
(A)	Electric potential	(p) $E = E_1 + E_2$
(B)	Commercial unit of electrical energy	(q) $Q = i^2Rt$
(C)	Superconductor	(r) $v = W/Q$
(D)	Cells connected in series	(s) kWh
(E)	Heat produced in a conductor	(t) zero resistance

(1) A – (r); B – (s); C – (t); D – (p); E – (q)
(2) A – (s); B – (r); C – (t); D – (p); E – (q)
(3) A – (r); B – (t); C – (s); D – (p); E – (q)
(4) A – (r); B – (s); C – (t); D – (q); E – (p)

2.

	Column-I	Column-II
(A)	Fuse wires	(p) Rheostat
(B)	Bulbs	(q) Higher resistance
(C)	Higher power	(r) Parallel
(D)	Potential divider	(s) Series
(E)	Lower current	(t) Lower resistance

(1) A – (s); B – (r); C – (t); D – (p); E – (q)
(2) A – (r); B – (s); C – (t); D – (p); E – (q)
(3) A – (s); B – (r); C – (t); D – (q); E – (p)
(4) A – (s); B – (r); C – (p); D – (t); E – (q)

3.

	Column-I	Column-II
(A)	An electric motor works on	(p) to a battery
(B)	An electric motor is also	(q) direct current
(C)	A commutator is used to	(r) reverse the direction of flow of current.
(D)	Commutator rings are connected	(s) known as DC MOTOR

(1) A – (q); B – (s); C – (p); D – (r)
(2) A – (s); B – (q); C – (r); D – (p)
(3) A – (q); B – (s); C – (r); D – (p)
(4) A – (q); B – (r); C – (s); D – (p)

4.

	Column-I	Column-II
(A)	The fuse wire is generally an alloy of	(p) The metal of an electrical appliance is earthed
(B)	Electric fuse is connected in	(q) The live wire and the neutral wire come in direct contact
(C)	To avoid the risk of electric shocks	(r) Lead and tin
(D)	A short - circuit occurs whenever	(s) Series in the begining of the electric circuit

(1) A – (r); B – (s); C – (q); D– (p)
(2) A – (r); B – (s); C – (p); D – (q)
(3) A – (s); B – (r); C – (p); D – (q)
(4) A – (r); B – (p); C – (s); D – (q)

5.

	Column-I	Column-II
(A)	Ohm	(p) $\frac{\rho L}{A}$
(B)	Resistance	(q) $\frac{1\text{ volt}}{1\text{ ampere}}$
(C)	Resistivity	(r) zero resistance
(D)	Super conductor	(s) ohm-meter

(1) A – (p); B – (q); C – (s); D – (r)
(2) A – (q); B – (s); C – (p); D – (r)
(3) A – (q); B – (p); C – (r); D – (s)
(4) A – (q); B – (p); C – (s); D – (r)

6.

	Column-I	Column-II
(A)	MCB	(p) Filament
(B)	Electromagnet	(q) Element
(C)	Electric kettle	(r) Electric bell
(D)	Electric bulb	(s) Safety device

(1) A – (s); B – (r); C – (q); D – (p)
(2) A – (p); B – (q); C – (r); D – (s)
(3) A – (r); B – (q); C – (p); D – (s)
(4) A – (q); B – (s); C – (r); D – (p)

Statement Based MCQ

7. Consider the following statements :
(a) An ammeter is always connected in series in the circuit.
(b) A voltmeter can only be connected in series in the circuit.
(c) A voltmeter has low resistance.
Which of these statement(s) is/are correct?
(1) (a) and (b) (2) (b) and (c)
(3) Only (a) (4) Only (c)

8. Consider the following statements :
(a) Ohm's law does not apply to radio waves and transistors.
(b) Ohmic conductors do not obey ohm's law.
Which of these statement(s) is/are correct?
(1) (a) only (2) (b) only
(3) Both (a) and (b) (4) Neither (a) nor (b)

9. Consider the following statements :
(a) The resistivity of copper wire is infinitely large.
(b) Resistivity is measured in ohm-metre.
(c) The resistivity of alloys decreases with the rise in temp.
(d) Metals have high resistivity.
Which of these statement(s) is/are correct?
(1) (a), (b) and (c) (2) (a) and (d)
(3) (b) and (c) (4) (b) only

10. Consider the following statements :
(a) The resistance of a wire is directly proportional to length.
(b) The resistance of a wire is directly proportional to area.
Which of these statement(s) is/are correct?
(1) (a) only (2) (b) only
(3) Both (a) and (b) (4) Neither (a) nor (b)

11. Consider the following statements :
    (a) The reciprocal of resistance is called specific resistance.
    (b) Electric conductors contain a large number of free electrons.
    Which of these statement(s) is/are correct?
    (1) (a) only (2) (b) only
    (3) Both (a) and (b) (4) Neither (a) nor (b)
12. Consider the following statements :
    (a) Current is a vector quantity.
    (b) The S.I. unit of electric charge is ampere.
    Which of these statement(s) is/are correct?
    (1) (a) only (2) (b) only
    (3) Both (a) and (b) (4) Neither (a) nor (b)
13. Consider the following statements :
    (a) Like magnetic poles attract each other, unlike poles repel.
    (b) North & South poles of a magnet can not be seperated.
    Which of these statement(s) is/are correct?
    (1) (a) only (2) (b) only
    (3) Both (a) and (b) (4) Neither (a) nor (b)
14. Consider the following statements :
    (a) An electric generator is a device that converts electrical energy into mechanical energy.
    (b) Slip rings are used in an A.C. generator.
    Which of these statement(s) is/are correct?
    (1) (a) only (2) (b) only
    (3) Both (a) and (b) (4) Neither (a) nor (b)
15. Consider the following statements :
    (a) Magnetic field produced by current in a straight wire has no poles.
    (b) The magnetic lines of force produced by a straight current carrying conductor are straight in nature.
    (c) To produce a strong magnetic field at its centre, we prefer a current carrying wire loop of larger radius.
    Which of these statement(s) is/are correct?
    (1) (b) and (c) (2) (b) only
    (3) (a) only (4) All are correct
16. Consider the following statements :
    (a) The strength of an electromagnet increases or decreases the amount of current flowing through it.
    (b) Right hand thumb rule can be employed to know the direction of magnetic field produced by a current carrying wire.
    (c) Melting point of the material of fuse wire should be extremely low.
    Which of these statement(s) is/are correct?
    (1) (a) and (b) (2) (c) only
    (3) (a) and (c) (4) (b) and (c)

Passage Based MCQ

DIRECTIONS (Qs. 17 to 25) : Read the passage(s) given below and answer the questions that follow.

PASSAGE - 1

Ohm's Law defines the relationships between (P) power, (E) voltage, (I) current, and (R) resistance. One ohm is the resistance value through which one volt will maintain a current of one ampere.

(I) Current is that flows on a wire or conductor like water flowing down a river. Current flows from negative to positive on the surface of a conductor. Current is measured in (A) amperes or amps.

(E) Voltage is the difference in electrical potential between two points in a circuit. It's the push or pressure behind current flow through a circuit, and is measured in (V) volts.

(R) Resistance determines how much current will flow through a component. Resistors are used to control voltage and current levels. A very high resistance allows a small amount of current to flow. A very low resistance allows a large amount of current to flow. Resistance is measured in Ω ohms.

(P) Power is the amount of current times the voltage level at a given point measured in wattage or watts

17. Which of the following statements does not represent ohm's law?
    (1) current / potential difference = constant
    (2) potential difference / current = constant
    (3) potential difference = current × resistance
    (4) current = resistance × potential difference
18. The unit of current is ..... .
    (1) ampere (2) watt
    (3) volt (4) coulomb
19. The potential difference required to pass a current 0.2 A in a wire of resistance 20Ω is .....
    (1) 100 V (2) 4 V
    (3) .01 V (4) 40 V
20. Two resistances of 100 Ω and zero ohm are connected in parallel. The overall resistance will be
    (1) 100 Ω (2) 50 Ω
    (3) 25 Ω (4) zero ohm
21. Three resistors 2 Ω, 3 Ω and 4 Ω are connected so that the equivalent resistance is 9 Ω. The resistors are connected ..... .
    (1) all in series
    (2) all in parallel
    (3) 2 Ω and 3 Ω in parallel and the combination in series with 4 Ω
    (4) 2 Ω and 3 Ω in series and the combination in parallel to 4 Ω

PASSAGE - 2

The electric generator is a machine for producing electric current. The electric generator or dynamo converts mechanical energy into electrical energy.

The generator is an appliction of electromagnetic induction. It works on the princi;e that when a wire is moved in a magnetic field, then the current is induced in the coil. A rectangular coil is made to rotate rapidly in the magnetic field between the poles of a horse shoe type magnet. When the coil rotates, it cuts the lines of magnetic force, due to which a current is produced in the generator coil. This current can be used to run the various electrical appliances.

22. An electric generator actually acts as
    (1) source of electric charge
    (2) source of heat energy
    (3) an electromagnet
    (4) a converter of energy
23. Electromagnetic induction is the
    (1) charging of a body with a positive charge
    (2) production of current by relative motion between a magnet and a coil
    (3) rotation of the coil of an electric motor
    (4) generation of magnetic field due to a current carrying solenoid

24. The brushes used in electric generator is made of which material
(1) Carbon (2) Aluminium
(2) Zinc (4) Soft iron

25. A commutator changes the direction of current in the coil of
(1) a DC motor
(2) a DC motor and an AC generator
(3) a DC motor and a DC generator
(4) an AC generator

Assertion Reason Based MCQ

DIRECTIONS (Qs. 26 to 34) : Following questions consist of two statements, one labelled as the **'Assertion'** and the other as **'Reason'**. You are to examine these two statements carefully and select the answer to these items using the code given below.

Code :

(1) Both A and R are individually true and R is the correct explanation of A:
(2) Both A and R are individually true but R is not the correct explanation of A.
(3) A is true but R is false
(4) A is false but R is true.

26. **Assertion :** Resistance of a copper wire of length 1 metre and area of cross-section 1 mm^2 is same as the resistance of an aluminium wire of length 1 metre and area of cross-section of 1 mm^2.
Reason : Resistance of a metallic conductor depends on the nature of the material of the conductor.

27. **Assertion :** Resistivity of objects of different shapes and sizes but made of same material is same.
Reason : Resistivity of an object is independent of its dimensions.

28. **Assertion :** Silver is the best metallic conductor of electricity.
Reason : Resistivity of the silver is the lowest among all metals.

29. **Assertion :** Coil of electric heater is made of an alloy rather than a pure metal.
Reason : Resistivity of an alloy is less than the resistivity of a pure metal.

30. **Assertion :** A metallic wire is neutral although it contains large number of free electrons.
Reason : In a metallic wire, net charge is zero.

31. **Assertion :** A soft iron far placed inside a solenoid carrying current is magnetised.
Reason : Magnetic field inside a long solenoid carrying current is non-uniform.

32. **Assertion :** The strength of magnetic field of a permanent magnet decreases with the increase in temperature.
Reason : A permanent magnet can be demagnetised by heating it.

33. **Assertion :** A charged particle moving parallel to direction of magnetic field experiences a force.
Reason : A charged particle moving at right angle to the direction of magnetic field experiences maximum force.

34. **Assertion :** When a bar maginatic is upshed into a coil of insulated copper wire connected to a galvanometer, induced current pass through the coil.
Reason : The change in magnetic field around a coil due to the movement of the magnetic towards the coil is reponsible for the induced current in the coil.

Correct Definition Based MCQ

35. Electric generator is a
(1) device which converts mechanical energy into electrical energy.
(2) device which converts electrical energy into mechanical energy.
(3) device which converts mechanical energy into light energy.
(4) device which converts mechanical energy into heat energy.

36. Electromagnet is
(1) hard iron bar placed inside a solenoid carrying current.
(2) copper bar placed inside a solenoid carrying current.
(3) soft iron bar placed inside a solenoid carrying current.
(4) aluminium bar placed inside a solenoid carrying current.

37. Electric current is
(1) amount of charge flowing per unit time
(2) amount of current flowing per unit time
(3) ne/t
(4) Both (1) and (2)

Feature Based MCQ

38. On the basis of following features identify the correct option.
(I) It has low melting point.
(II) It acts as a safety device.
(1) Tin-lead alloy (2) Iron
(3) Both (1) and (2) (4) Neither (1) nor (2)

39. On the basis of following features identify the correct option.
(I) It can be calculated by formula VI.
(II) It can be calculated by formula I^2R
(III) It can be calculated by formula V^2/R
(1) Electric energy
(2) Electric potential
(3) Amount of heat produced
(4) Electric power

40. On the basis of following features identify the correct option.
(I) It is use to step up a.c. potential difference.
(II) It is use to transmit a.c. to distant places.
(1) AC generator (2) DC generator
(3) Transformer (4) None of these

41. On the basis of following features identify the correct option.
(I) Its magnitude is either constant or variable.
(II) Direction of flow in a conductor remains the same.
(1) Direct current (2) Alternating current
(3) Both (1) and (2) (4) Neither (1) nor (2)

Hints & SOLUTIONS

Exercise 1

1. **(1)** **2.** **(1)** **3.** **(2)**

4. **(2)** Direction of conventional current is opposite to the direction of flow of current, i.e. from positive terminal to negative terminal.

5. **(3)** **6.** **(2)** **7.** **(1)**

8. **(4)** Electric potential difference between two points on a current carrying conductor is defined as the work done to move a unit charge from one point to the other.

9. **(4)** **10.** **(4)** **11.** **(2)**

12. **(2)** Resistance of a wire is directly proportional to the length and inversely proportional to the area of cross-section.

13. **(3)** **14.** **(4)** **15.** **(2)**

16. **(4)** The amount of heat generated is directly proportional to the square of current, resistance of the conductor and the time for which current is passed. Quantity of heat generated in t seconds, $H = I^2 R t$. On substituting $V = IR$, $I = V/R$ or $R = V/I$, we get these equations.

17. **(3)** **18.** **(2)** **19.** **(1)**

20. **(1)** In series, $R = R_1 + R_2 +$ ----

21. **(3)** **22.** **(1)** **23.** **(4)**

24. **(1)** In parallel, $1/R = 1/R_1 + 1/R_2 +$ ----

25. **(1)** **26.** **(1)** **27.** **(3)**

28. **(2)** The voltage across each resistor of a parallel combination is the same and is also equal to the voltage across the whole combination. Total current is the sum of currents flowing in the individual resistors.

29. **(1)** **30.** **(2)** **31.** **(2)**

32. **(1)** Power rating of an appliance indicates the amount of energy consumed by it in one hour.

33. **(2)** **34.** **(3)** **35.** **(4)**

36. **(3)** Alloys are usually used in electrical heating devices because resistivity of an alloy is generally higher than that of constituent elements. Alloys do not oxidize readily at high temperature.

37. **(3)** **38.** **(3)** **39.** **(4)**

40. **(1)** Magnetic field is the region around a magnet where the magnetic force is experienced.

41. **(4)** **42** **(1)** **43.** **(2)**

44. **(1)** The deflection in the needle becomes opposite when the mdirection of the current is reversed.

45. **(4)** **46** **(1)** **47.** **(3)**

48. **(3)** The concentric circles representing the magnetic fields become larger and larger.

49. **(2)** **50.** **(2)** **51.** **(4)**

52. **(4)** Electromagnetic effect is temporary.

53. **(4)** **54.** **(2)** **55.** **(1)**

56. **(2)** Each turn of a coil forms its own magnetic field.

57. **(2)** **58.** **(2)** **59.** **(2)**

60. **(1)** An electromagnet consists of a core of soft iron wrapped around with a coil of insulated copper wire.

61. **(1)** **62.** **(4)** **63.** **(4)**

64. **(3)**

65. **(3)** Fleming's left hand rule.

66. **(1)** The magnitude of the force experienced by a current-carrying conductor when placed in a magnetic field will be maximum if the directions of current and magnetic field are perpendicular to each other.

67.. **(3)** An electric motor is a device that converts electrical energy to mechanical energy.

68. **(4)** 'The coil and the axle continuously rotate in one direction' is not related, all other statements describe the construction.

69. **(4)** Wires with red insulations are conventionally used as live wires, whereas the wires with black insulations are used as neutral (or negative) wires and the wires with green insulations or steel wires are used as earth wires. It is not a rule.

70. **(1)** Parameters of electricity supply are different in different countries. In India they are:
Potential Difference of 220 V, Frequency of 50 hertz and Current Rating of 5A/15A.

71. **(3)** Only earth's magnetic field will be present.

72. **(1)** Misconception is that magnetic field lines point from north to south pole. The fact is that they emerge out of North pole and entre into South pole.

Exercise 2

1. **(1)** **2.** **(1)** **3.** **(3)**

4. **(2)** **5.** **(4)** **6.** **(1)**

7. **(3)** If you connected a voltmeter in series all you are doing is measuring the difference in potential across a strand of wire which will be zero (or very near). To measure voltage you connect the voltmeter in parallel so that you measure the voltage from the - to the + or the voltage drop across a load. For a voltmeter the higher the resistance the more accurate it is.

8. **(1)** There is a relationship between voltage across and current through a conductor . This relationship is called Ohm's law.

$$V / I = \text{Constant} = R$$

Those conductors which obey ohm's law are called ohmic conductors. The ohm's law is true only for ohmic conductors.

9. **(4)** **10.** **(1)** **11.** **(2)**

12. **(4)** Current is a scalar quantity. As we know, if two currents meet at a junction, the total current of the resultant current will be the algebraic sum of the two current and not the vector sum. The SI unit of quantity of electric charge is the coulomb. The coulomb is defined as the quantity of charge that has passed through the cross-section of an electrical conductor carrying one ampere within one second.

13. **(2)** **14.** **(2)**

15. **(3)** Magnetic field lines form in concentric circles around a cylindrical current-carrying conductor, such as a length of wire. The strength of the magnetic field at the centre of a circular coil carrying current is inversely proportional to the radius of the circular coil i.e. the field strength reduces as the radius of the coil increases.

16. **(4)** **17.** **(4)** **18.** **(1)**

19. **(2)** **20.** **(1)** **21.** **(1)**

22. **(4)** **23.** **(2)** **24.** **(1)**

25. **(3)**

26. **(4)** The resistance depend on the material of which it is made and can be expressed as:

$R = \rho L / A$ (1)

where

R = resistance (ohm)

ρ = resistivity coefficient (ohm m)

L = length of wire (m)

A = cross sectional area of wire (m^2)

The factor in the resistance which takes into account the nature of the material is the resistivity.

27. **(1)** **28.** **(1)**

29. **(3)** Alloys have higher resistivity than constituents metals.

30. **(1)**

31. **(3)** Magnetic field inside a long solenoid is uniform. This magnetic field magnetises the iron bar.

32. **(1)**

33. **(4)** Force acting on a charge moving in a magnetic field B is given by F = QvB sin θ is angle between $\vec{v}$ and $\vec{B}$ when charged particle move parallel to magnetic field $\theta = 0°$.

$\therefore$ $F = Qv \sin 0 = 0$ ($\because \sin 0° = 0$)

34. **(1)** **35.** **(1)** **36.** **(3)**

37. **(1)** **38.** **(1)** **39.** **(4)**

40. **(3)** **41.** **(1)**