Magnetic Effects of Electric Current

Multiple Choice Questions

1. A toaster of 4 kW is running in an existing circuit 110 volt that has a stream ranking of 4 A. Find the stream of electrons drawn by the toaster.

(a) 36.36 A

(b) 23.34 A

(c) 14.6 A

(d) 9.06 A

Ans. (a) 36.36 A

Explanation :

The stream of electrons drawn by the toaster is 36.36 A

Given, P = 4 kW, V = 110 V

To find, I = ?

We know that,

Power = VI

$= 110 \times I$

$4{,}000 = 110 \times I$

$I = 36.36$ A

2. The most important safety method used for protecting home appliance from short circuiting on overloading is:[NCERT Exemplar]

(a) earthing

(b) use of fuse

(c) use of stablizers

(d) use of fuse electric meter

Ans. (b) use of fuse

Explanation :

Use of fuse is most important safety method protecting home appliances from overloading all short circuiting.

3. A finite straight wire carries a current of 3 A, where it is a 2 m long and weighs around 240 g. If it is suspended in the mid-air by a uniform magnetic field then calculate the field B. [Acceleration due to gravity = 9.8 m/s^2]

(a) 0.39 T

(b) 0.42 T

(c) 0.61 T

(d) 0.37 T

Ans. (a) 0.39 T

Explanation :

Given, Mass of the wire = 240 g = 0.24 kg

Length of the wire = 2 m

Current I = 3 A

Magnetic field B = ?

The force acting on the current carrying wire in uniform magnetic field

$F = BIl \sin \theta$

$F = BIl \ (\theta = 90°)$

Weight of the wire, $w = mg = 0.24 \times 9.8$ N

In the position of suspension

$BIl = mg$

$$B = \frac{mg}{Il}$$

$$B = \frac{(0.24 \times 9.8)}{(3 \times 2)}$$

$$B = \frac{(2.352)}{(6)}$$

The magnetic field (B) is 0.39 T

4. If it takes 520 turns to make a solenoid that is 40 cm long with a radius of 1.2 m that carries a current of 6 A, then determine the magnetic field inside the solenoid.

(a) 7.2×10^{-3} T

(b) 9.8×10^{-3} T

(c) 8.4×10^{-4} T

(d) 10.2×10^{-4} T

Ans. (b) 9.8×10^{-3} T

Explanation :

Given, I = 6 A, L = 40 cm = 0.4 m, *r* = 1.2 m,
N = 520

We know that,

$$B = \frac{\propto_o NI}{L}$$

On substituting the values in above formula

$$= \frac{(4\pi \times 10^{-7} \times 520 \times 6)}{0.4}$$

$$= \frac{(4 \times 3.14 \times 10^{-7} \times 520 \times 6)}{0.4}$$

$= 97968 \times 10^{-7}$

$= 9.8 \times 10^{-3}$ T

The magnetic field inside the solenoid is 9.8×10^{-3} T

5. A 3 pin mains plug is fitted to the cable for a 1 kW electric kettle to be used on a 250 V a.c. supply which of the following statements is not correct?

(a) The fuse should be filled in the live wire.

(b) A 13 A fuse is the most appropriate value to use.

(c) The neutral wire is coloured black.

(d) The green wire should be connected to the earth pin.

Ans. (b) A 13 A fuse is the most appropriate value to use

Explanation :

P = 1 kW = 1000 W, V = 250 V

Current, I = $\frac{P}{V}$

$= \frac{1000}{250}$

= 4 A

Because current drawn is 4 A, a fuse of 13 A cannot be considered the most appropriate.

6. Calculate the magnetic field produced by the solenoid of length 50 cm with no. of turns in the coil 210 when the current passing through it 8 A. (Given permeability, $\mu_0 = 4p \times 10^{-7}$ Wb/Am)

(a) 4.22×10^{-7} T

(b) 42.24×10^{-7} T

(c) 422.2×10^{-7} T

(d) 422.2×10^{-5} T

Ans. (d) 422.2×10^{-5} T

Explanation :

$B = \mu_0 n_i$

where, $n = \frac{N}{L}$

$= \frac{4\pi \times 10^{-7} \times 210 \times 8}{0.50}$

$= 422.2 \times 10^{-5}$ T

7. The strength of an electromagnet after the limit cannot be increased by increasing the current through the solenoid. What is the reason behind this phenomenon?

(a) Electrons start to corrode the solenoid.

(b) Voltage through the solenoid gradually starts to decrease.

(b) Resistance of the solenoid increases.

(d) Current flowing through the solenoid is saturated.

Ans. (d) Current flowing through the solenoid is saturated.

Explanation :

The strength of an electromagnet after the limit cannot be increased by increasing the current through the solenoid because current flowing through the solenoid is saturated.

8. Two wires are placed in parallel; repulsion force and current in these two wires are "***f***" and "***i***" respectively. What will be a force if the current is doubled in each wire ?

(a) $2f$

(b) $\frac{f}{2}$

(c) $\frac{2f}{4}$

(d) $4f$

Ans. (d) $4f$

Explanation :

If the current is doubled in each wire the force will be $4f$. This can be explained as follows:

We know that the force of repulsion per unit length between two wires carrying current in opposite direction is:

$$\frac{F}{l} = \frac{\mu_0 i_1 i_2}{2\pi d}$$

Thus when both i_1 and i_2 are doubled, the force between them becomes four times.

9. H_1 and H_2 are heats produced by two copper wires have the same length and different diameters when they are connected in series and parallel respectively. From the above, we infer what of the following ?

(a) $H_1 > H_2$

(b) $H_1 < H_2$

(c) $H_1 = H_2$

(d) $H_1 \neq H_2$

Ans. (b) $H_1 < H_2$

Explanation :

When wire are connected in series,

$R_s = R_1 + R_2$

in parallel, $R_p = \frac{R_1 R_2}{R_1 + R_2}$

$\because R_s > R_p$

$\therefore H_1 < H_2 [\square H \propto \frac{1}{R}]$

Then $H_1 < H_2$ which implies option (b) is correct.

10. The strength of magnetic field inside a long current carrying straight solenoid is:[NCERT Exemplar]

(a) more at the ends than at the centre.

(b) minimum in the middle.

(c) uniform at all points.

(d) found to increase from one end to the other.

Ans. (c) uniform at all points.

Explanation :

Inside the solenoid magnetic field lines are straight. This indicates strong magnetic field. Hence, magnetic field is uniform at all points inside the solenoid.

11. Pick out the incorrect statement about magnetic lines of force.

(a) Magnetic lines of forces start from the North Pole and end on the South Pole.

(b) No two magnetic lines of force can intersect each other.

(b) Magnetic lines of force are far away from each other at the poles.

(d) Magnetic lines of force are closed continuous curves.

Ans. (c) Magnetic lines of force are far away from each other at the poles.

Explanation :

Magnetic lines of forces are closed continuous curves. They are nearer to each other at the point where magnetic field is strongest and far from each other where magnetic field is weak. At poles magnetic line of forces are nearest to each other because magnetic field is strongest at the pole.

No two magnetic lines of forces intersect with each other at the point of intersection, the compass needle would point towards two directions, which is not possible.

They are continuous, forming closed loops without beginning or end which start from north pole and end at south pole. Hence, statement (c), *i.e.,* Magnetic lines of force are far away from each other at the poles is the incorrect statement.

12. Strength of the magnetic field at a point in the space surrounding the magnet is measured by:

(a) thickness of the magnet.

(b) number of lines crossing a given point.

(b) resistance of it.

(d) length of the magnet.

Ans. (b) number of lines crossing a given point.

Explanation :

The strength of the magnetic field at a point in the space surrounding the magnet is measured by number of lines crossing a given point.

13. The magnetic field strength of a solenoid can be increased by inserting:

(a) a wooden piece into it.

(b) an iron piece into it.

(b) a glass piece into it.

(d) paper roll into it.

Ans. (b) an iron piece into it.

Explanation :

When a piece of soft iron is inserted inside a solenoid then the strength of the magnetic field increases because the iron gets magnetized due to magnetic induction and this combination of the solenoid and the soft iron core so formed is called an electromagnet.

14. The magnetic field inside the solenoid is:

(a) non-uniform

(b) variable

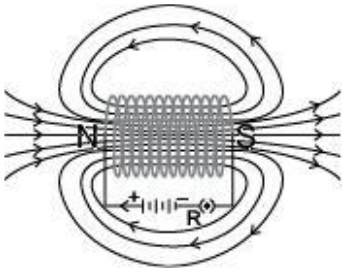
(c) same at all points

(d) zero

Ans. (c) same at all points

Explanation :

The magnetic field inside the solenoid is same at all points. This is because the magnetic field lines inside the solenoid are in the form of parallel straight lines which indicates that the magnetic field is uniform at all points inside the solenoid.



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

15. The magnetic field lines inside a solenoid are in the form of:

(a) Curved line

(b) Circular lines

(c) Zig - zag lines

(d) Parallel straight lines

Ans. (d) Parallel straight lines

Explanation :

The field lines inside the solenoid are in the form of parallel straight lines. This indicates that magnetic field is same at all

point insides the solenoid.

16. Which of the following correctly describes the magnetic field near a long straight wire ?

(a) The field consists of straight lines perpendicular to the wire.

(b) The field consists of straight lines parallel to the wire.

(b) The field consists of radial lines originating from the wire.

(d) The field consists of concentric circles centred on the wire.

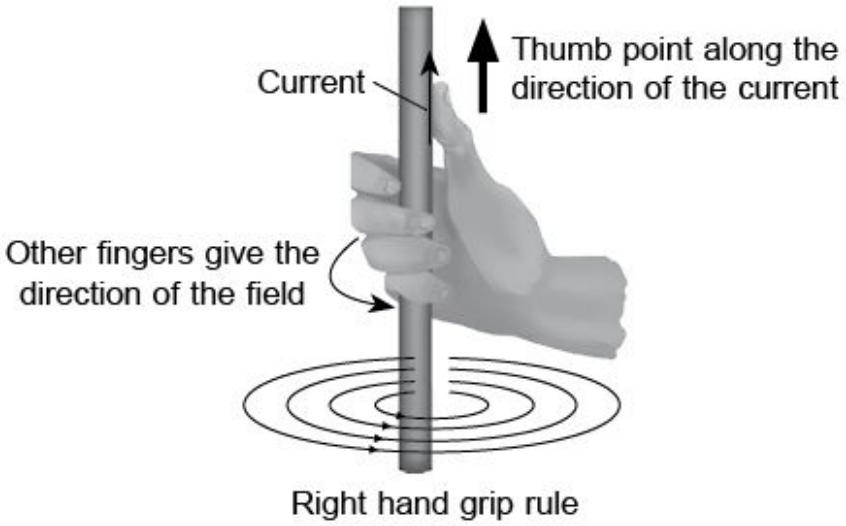
Ans. (d) The field consists of concentric circles centred on the wire.

Explanation :

The magnetic field near a long straight wire are concentric circles and their centres lie on the wire. This can be confirmed by Right-hand Thumb Rule.

According to this rule, if we put the thumb of our right hand in the direction of the current flow through the conductor or straight wire and encircle the wire with your fingers, then the direction of those fingers will correspond to the direction of the magnetic field.

Thus, the magnetic field lines will be in concentric circles around the conductor.



17. Inside the magnet, the field lines move:

(a) from South to North

(b) from North to South

(c) away from North pole

(d) away from South poles

Ans. (a) from South to North

Explanation :

Magnetic field is a vector quantity that has both direction and magnitude. The direction of the magnetic field is taken to be the direction in which a North pole of the compass needle moves inside it. The field lines emerge from North pole and merge in the South pole but inside the magnet the direction of field lines is opposite.

18. An electron moves with a speed ***v*** along positive direction of the *x*-axis. If a magnetic field B acts along the positive ***y***-direction, then the force on the electron will act along:

(a) *x*-axis

(b) *y*-axis

(c) – ve *z*-direction

(d) +ve *y*-direction

Ans. (c) – ve *z*-direction

Explanation :

As electron is moving in positive *x*-direction then, according to the Maxwell's right hand thumb rule, the current is moving in negative *x*-direction and the magnetic field acts on positive *y*-direction. By applying Fleming's left-hand rule, the thumb will be in negative *z*-direction which is the direction of force.

19. The force exerted on a current carrying wire placed in a magnetic field is zero when the angle between wire and the direction of magnetic field is:

(a) 45°

(b) 60°

(c) 90°

(d) 180°

Ans. (d) 180°

Explanation :

The force exerted on a current carrying wire placed in a magnetic field is zero when the angle between wire and the direction of magnetic field is 180°.

A force is experienced by the current carrying wire in the presence of an external magnetic field. This can be expressed as:

$F = BIL \sin \theta$

Where,

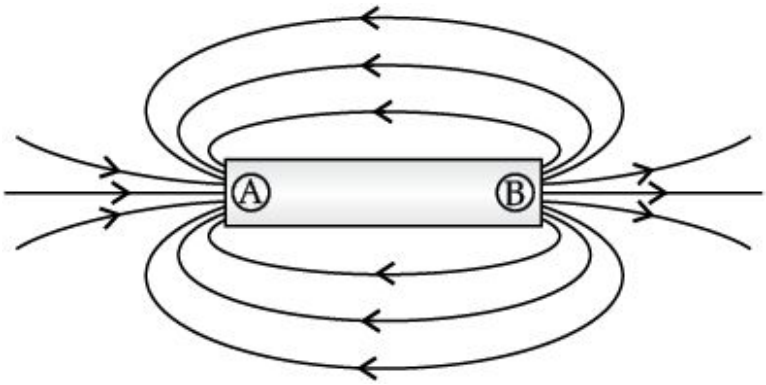
L is the length of the wire.

I is the current, and

θ is the angle between the current and the magnetic field.

We know that sin 180° is 0. Therefore, the force exerted on a current-carrying wire that is placed in a magnetic field is zero when the angle between the wire and the direction of magnetic field is 180°.

20. In the figure shown below, the point A and B are respectively:



(a) North pole, South pole

(b) South pole, North pole

(c) North pole, North pole

(d) South pole, South pole

Ans. (b) South pole, North pole

Explanation :

As magnetic lines of forces start from North pole and terminates at S-pole.

21. The north pole of a long bar magnet was pushed slowly into a short solenoid connected to a galvanometer. The magnet was held stationary for a few seconds with the North pole in the middle of the solenoid and then withdrawn rapidly. The maximum deflection of the galvanometer was observed when the magnet was:

(a) Moving towards the solenoid

(b) Moving into the solenoid

(c) At rest inside the solenoid

(d) Moving out of the solenoid

Ans. (d) Moving out of the solenoid

Explanation :

As due to electromagnetic induction.

22. A rectangular coil of copper wires is rotated in a magnetic field. The direction of the induced current changes once in each:

(a) two revolutions

(b) one revolution

(c) half revolution

(d) one-fourth revolution

Ans. (c) half revolution

Explanation :

A rectangular coil of copper wires is rotated in a magnetic field. The direction of the induced current changes once in each half revolution. This is because when a rectangular coil is rotated in a magnetic field the direction of the induced current varies once every half revolution. As a result, the current in the coil continues to flow in the same direction.

23. The magnetic field of the current was discovered by:

(a) Maxwell

(b) Fleming

(c) Oersted

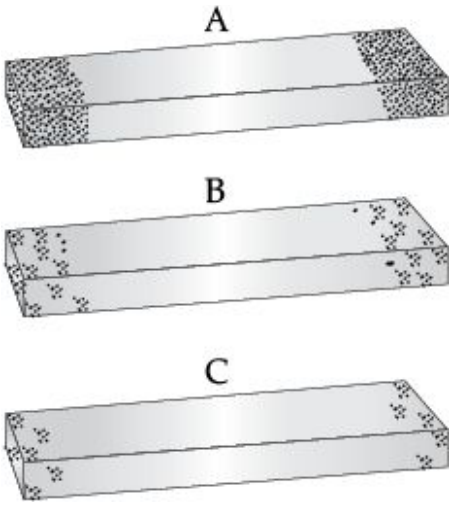
(d) Faraday

Ans. (c) Oersted

Explanation :

Hans Christian oersted discovered that a compass needle got deflected when electric current passed through a metallic wire placed nearby.

24. Three magnets A, B and C wire dipped one by one in a heap of iron filing. It shows the amount of the iron filling stucking to them:



The Strength of these magnets will be:

(a) A > B > C

(b) A < B < C

(c) A = B = C

(d) A < B > C

Ans. (a) A > B > C

Explanation :

As most of the iron fillings got stuck to magnet A. So, it is the most powerful magnet, or it has maximum strength.

25. If we place the magnetic compass near the north pole of the magnet, which pole of the needle will point towards it?

(a) North pole

(b) South pole

(c) Keep deflecting

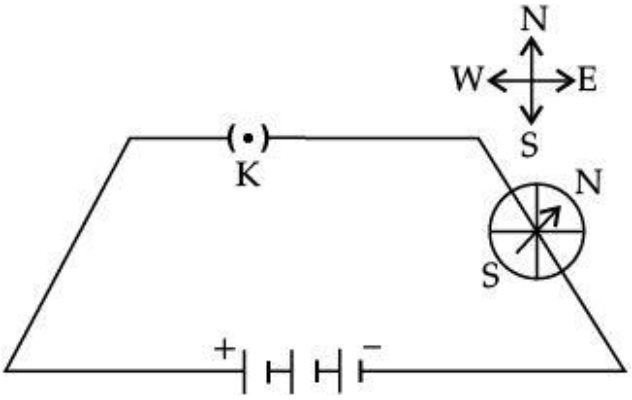
(d) None of these

Ans. (b) South pole

Explanation :

As like poles repel each other and unlike poles attract each other. Therefore when North pole of bar magnet is brought near the compass, it gets defected in south direction.

26. In the circuit shown below, what is direction of the current?



(a) No current flowing

(b) Anti-clock wise

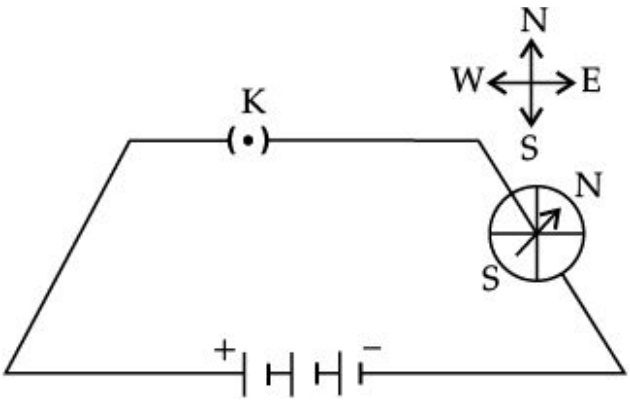
(c) Clock wise

(d) Data insufficient

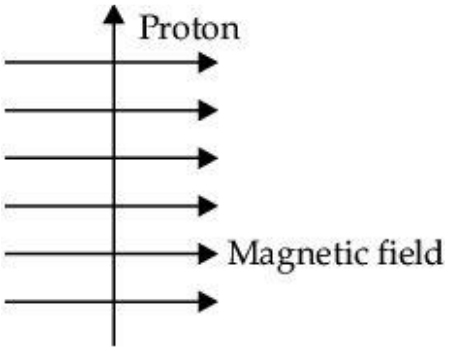
Ans. (c) Clock wise

Explanation :

If the current flows from North to South the compass needle will move towards the last.



27. A proton enters a magnetic field at right angle to it, as shown below. The direction of force acting on the proton will be:



(a) To the right

(b) To the left

(c) Out of the page

(d) Into the page

Ans. (d) Into the page

Explanation :

The proton enters a magnetic field at right-angle to it. Therefore, it will experience a force and the direction of force is calculated using Fleming's Left-Hand Rule.

28. A bar magnet is immersed in a heap of iron fillings and pulled out. The amount of iron filling dinging to the:

(a) North pole is almost equal to the South pole

(b) North pole is much more than the South Pole

(c) North pole is almost less equal than the South pole

(d) Magnet will be same all along its length

Ans. (a) North pole is almost equal to the South pole

Explanation :

As the maximum intensity of magnet is on the poles of the magnet.

29. Rashita and her friends were decorating the class bulletin board. She accidently dropped the box of stainless steel pins by mistake. She tried to collect the pins using a magnet. She could not succeed. Why?

(a) They are not using the magnet in right direction

(b) Steel pins are very heavy and cannot be lifted magnet

(c) Steel pins are very long

(d) Steel is not magnetic in nature

Ans. (d) Steel is not magnetic in nature

Explanation :

As steel is not magnetic in nature So it is not attracted by the magnet.

30. If the current is passing through a straight conductor. then, the magnetic field lines around it forms a particular shape. That shape is:

(a) Straight lines

(b) Concentric circles

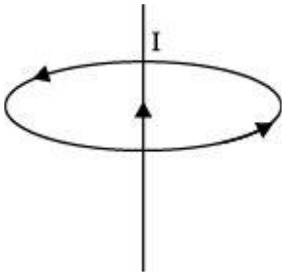
(c) Concentric ellipse

(d) Concentric parabolas

Ans. (b) Concentric circles

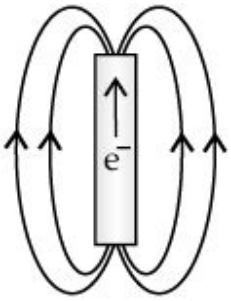
Explanation :

When current passes through a straight conductor, then the magnetic field lines forms concentric circle around it.

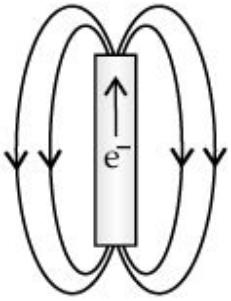


31. The figure given below shows the magnetic field produced by a currents carrying wire. Which of the diagram shows it correctly?

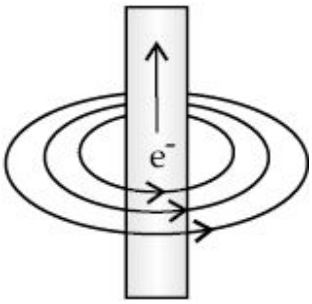
(a)



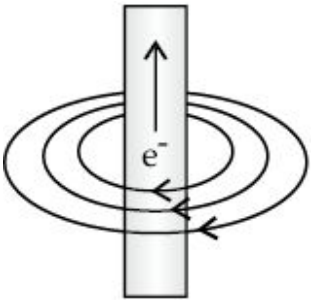
(b)

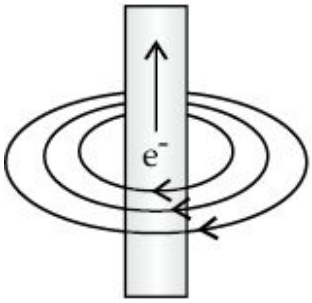


(c)



(d)





Ans. (d)

Explanation :

As when current flows through and current-carrying wire, then direction of magnetic field is calculated by right hand thumb rule.

32. Consider the following statements and choose the correct are:

(a) A magnet is an object which attracts pieces of iron, Nickel and cobalt

(b) Magnetic effect of electric current means that an electric current flowing in a wire produces a magnetic field around it

(c) The end of a freely suspended magnet which points towards the north direction is called the north pole of the magnet

(d) All of the above

Ans. (d) All of the above

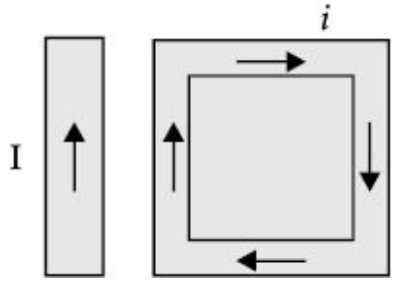
Explanation :

(a) A magnet is an object which attracts pieces of iron, Nickel and cobalt.

(b) Magnetic effect of electric current means that an electric current flowing in a wire produces a magnetic field around it .

(c) The end of a freely suspended magnet which points towards the north direction is called the north pole of the magnet.

33. A rectangular loop carrying a current I is situated near a long straight wire such that the wire is parallel to one of the sides of the loop and is in plane of the loop. If steady current I is created in wire as shown in figure below, then the loop:



(a) Rotate about an axis parallel to the wire

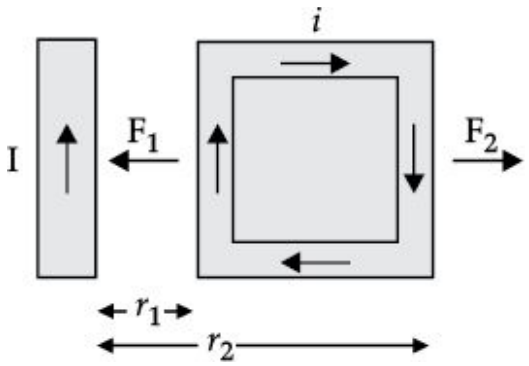
(b) Move towards the wire

(c) Move away from the wire or towards right

(d) Remains stationary

Ans. (b) Move towards the wire

Explanation :



As $r_1 < r_2$

$\therefore F_1 > F_2$

$\therefore F_{net} = F_1 - F_2$

(Directed towards the wire)

34. Which one of the following substances is the magnetic substances?

(a) Mercury

(b) Iron

(c) Gold

(d) Silver

Ans. (b) Iron

Explanation :

Among the given substances, the iron is the only magnetic substances.

35. The magnetic lines of force, inside a current carrying solenoid are:

(a) Along the axis and are parallel to each other

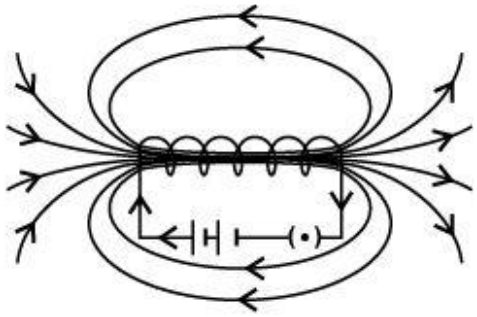
(b) Perpendicular to axis and equidistant from each other

(c) Circular and they do not intersect each other

(d) Circular at the ends but they are parallel to the axis inside the solenoid

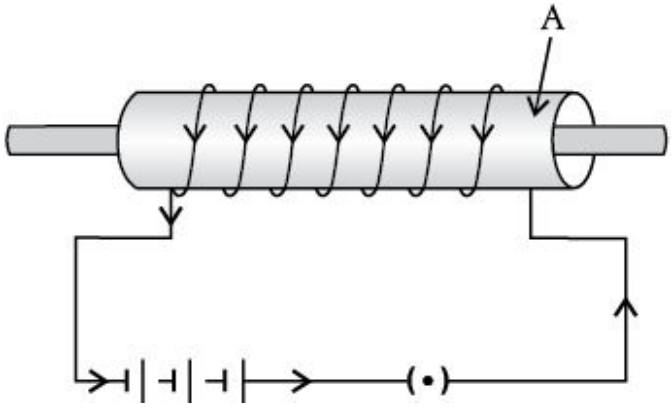
Ans. (a) Along the axis and are parallel to each other

Explanation :



The figure shows the magnetic lines of forces the solenoid.

36. In the diagram shown below, what is the component A:



(a) Solenoid

(b) Glass rod

(c) Magnetic material

(d) None of these

Ans. (c) Magnetic Material

Explanation :

Here, A is a magnetic material on which solenoid as wrapped. As by passing current through it the magnetic material will become an electromagnet.

37. Which of the following determine the direction of magnetic field due to a current carrying conductor?

(a) Faraday's laws of electromagnetic induction

(b) Fleming's left hand rule

(c) Lenz's law

(d) Maxwell's cork screw-rule

Ans. (d) Maxwell's Cork Screw-Rule

Explanation :

According to this rule, if we consider ourselves driving a cork screw in the direction of current, then the direction of the rotation of cork Screw is the direction of the Magnetic field.

38. Which of the following is not an example of the right hand thumb rule ?

(a) D.C. motor

(b) Solenoid

(c) A.C. generator

(d) Cartesian coordinate system

Ans. (c) A.C. generator

Explanation :

Right hand thumb rule is used to find the direction of magnetic field in a coil of wire and the electric current in a straight conductor. A.C. generator is not an example of right hand thumb rule because it works on the principle of electromagnetic induction.

39. Commercial motors do not use:

[NCERT Exemplar]

(a) an electromagnet to rotate the armature

(b) effectively large number of turns of conducting wire in the current carrying coil

(c) a permanent magnet to rotate the armature

(d) a soft iron core on which the coil is wound

Ans. (c) a permanent magnet to rotate the armature

Explanation :

Commercial motors do not use permanent magnets because they are weak and do not produce strong magnetic field in the region.

40. The process of inducing a current in a coil of wire by placing it in a region of changing magnetic field is:

(a) Electrical effect

(b) Heating effect of current

(c) Magnetic effect of current

(d) Electromagnetic induction

Ans. (d) Electromagnetic induction

Explanation :

The process of inducing a current in a coil of wire by placing it in a region of changing magnetic field is electromagnetic induction.

41. The core of electromagnet is made of:

(a) soft iron

(b) steel

(c) magnesium

(d) copper

Ans. (a) soft iron

Explanation :

The core of electromagnet is made of soft iron due to following reasons:

• It can be easily magnetised and demagnetised.

• It has low carbon content.

• It has large susceptibility and small retentivity.

• It does not retain its magnetism when the current is switched off.

• It is less corrosive.

42. Fleming's Right-hand rule gives:

(a) Magnitude of the induced current.

(b) Magnitude of the magnetic field.

(c) Direction of the induced current.

(d) Both, direction and magnitude of the induced current.

Ans. (c) Direction of the induced current.

Explanation :

Fleming's Right hand rule gives the direction of the induced current.

Stretch the thumb, forefinger and middle finger of right hand so that they are perpendicular to each other. If forefinger indicates the direction of the magnetic field, thumb shows the direction of motion of conductor, then the middle finger will show the direction of induced current. We can not find out the magnitude of either the induced current or magnetic field by this law.

43. Which of the following property of a proton can change while it moves freely in a magnetic field?

(a) Mass

(b) Speed

(c) Velocity

(d) Charge

Ans. (c) Velocity

Explanation :

Velocity of a proton can change while it moves freely in a magnetic field because each moving charged particle in a magnetic field experiences a force. The direction of force experienced by a positively charged proton can be studied by

Fleming's Left-hand Rule.

The force acting on the proton would change both velocity and momentum when it moves freely in magnetic field. If a charged particle's velocity is completely parallel to the magnetic field, the magnetic field will not exert any force on the particle, and thus the velocity will remain constant. Whereas, if the force is acting perpendicular to the direction of moving charge, work done will be zero. It means kinetic energy does not change. Hence, we can conclude that the force can change the direction of velocity of the proton but not its speed. Thus, momentum and velocity changes.

44. A positively-charged particle (alpha-particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is:

(a) towards south

(b) towards east

(c) downward

(d) upward

Ans. (d) upward

Explanation :

A positively-charged particle (alpha-particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is upward. This can be explained by Fleming's Left-hand Rule which states that if we stretch our thumb, forefinger and middle figure of our left hand perpendicular to each other in such a way that forefinger points the direction of magnetic field and middle figure points the direction of current then thumb will represent the direction of motion or the force

acting on the conductor. Hence, upward is the correct answer.

45. The phenomenon of electromagnetic induction is:

(a) the process of charging a body.

(b) the process of generating magnetic field due to a current passing through a coil.

(c) producing induced current in a coil due to relative motion between a magnet and the coil.

(d) the process of rotating a coil of an electric motor.

Ans. (c) producing induced current in a coil due to relative motion between a magnet and the coil.

Explanation :

The phenomenon of electromagnetic induction is producing induced current in a coil due to relative motion between a magnet and the coil. When a coil is brought near the magnet, and a relative motion is generated between the two by either moving the magnet or the coil, the magnetic flux links through the coil changes. This change in the magnetic flux produces an emf or voltage and hence, subsequent electric current in the coil.

46. The direction of force acting on a current carrying conductor placed in a magnetic field can be obtained by:[NCERT]

(a) Fleming's left hand rule.

(b) Fleming's right hand rule.

(c) Clock face rule.

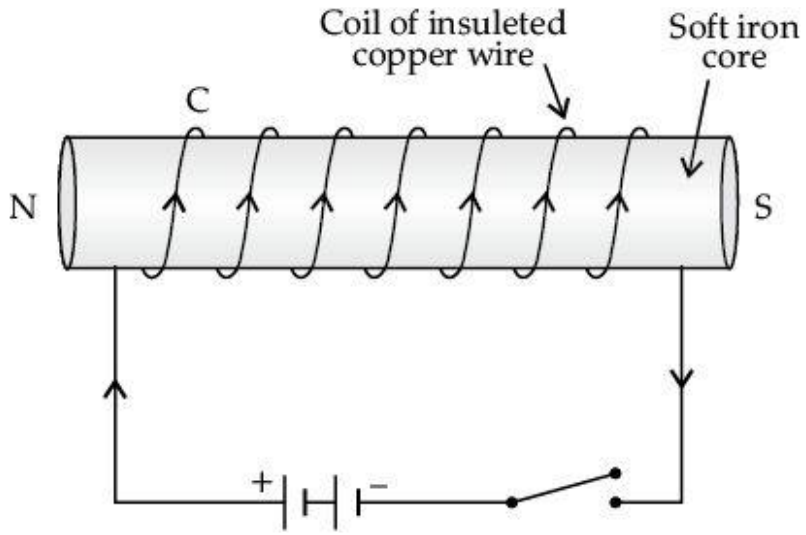
(d) Ampere's swimming rule.

Ans. (a) Fleming's left hand rule.

Explanation :

The direction of force acting on a current carrying conductor placed in a magnetic field can be obtained by Fleming's left hand rule. According to this rule, when a current-carrying conductor is placed in an external magnetic field, the conductor experiences a force perpendicular to both the field and to the direction of the current flow.

47. The process shown in the diagram below is:



(a) Electriomagnetism

(b) Electric generator

(c) Electric Motor

(d) Electric fuse

Ans. (a) Electromagnetism

Explanation :

An electromagnet produces a magnetic field so long as current

flows in its coil.

48. Which of the given options represents the correct pair?

(a)	Right-hand thumb rule	Direction of force
(b)	Galvanometer	Adjust current in circuit
(c)	Earth wire	Red colour
(d)	MRI	Magnetic Resonance Imaging

Ans. (d) MRI → Magnetic Resonance Imaging

Explanation :

MRI is a technique used to obtain the image of different body parts by using magnetic field.

49. The phenomenon of electromagnetic induction is:

(a) The process of charging a body

(b) The process of generating magnetic field due to a current passing through a coil

(c) Producing induced current in a coil to relative motion between a magnet and the coil

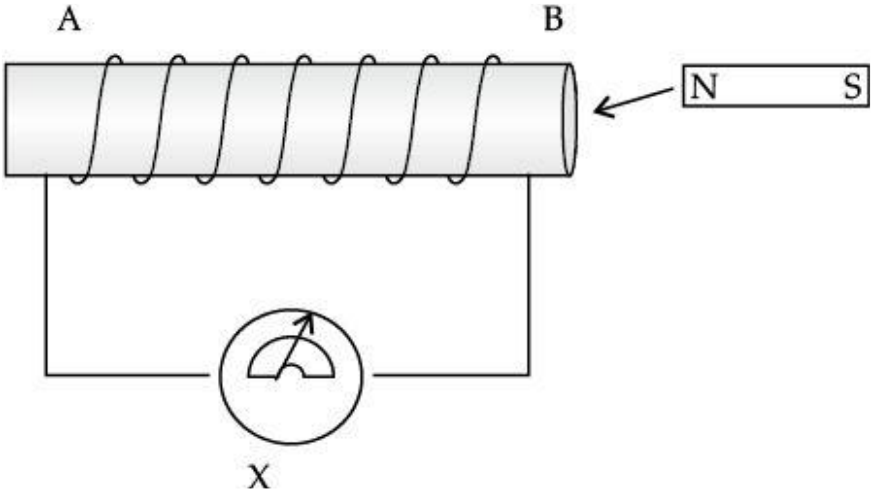
(d) The process of rotating a coil of an electric motor

Ans. (c) Producing induced current in a coil the relative motion between a magnet and the coil

Explanation :

Electromagnetic induction is a process in which current is induced when a current carrying conductor is moved in the magnetic field.

50. In the given electric circuit, the device X is:



(a) Ammeter

(b) Resistance

(c) Galvanometer

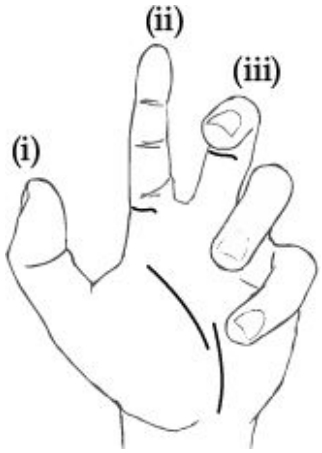
(d) Voltmeter

Ans. (c) Galvanometer

Explanation :

Galvanometer is an instrument that is used to detect the presence of the current in the circuit. And when magnet is moved near the coil, the current is included in the coil.

51. The figure below shows the Fleming's left hand rule. Identify the correct label with the function?



(a) Thumb force

(b) Fore finger field

(c) Middle finger-correct

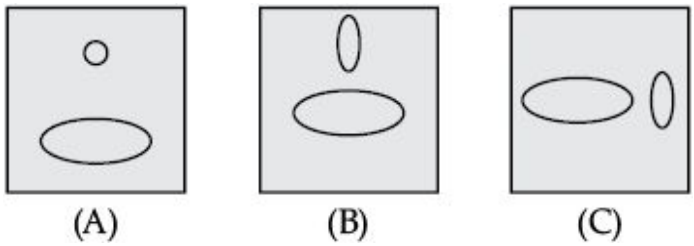
(d) All of these

Ans. (d) All of these

Explanation :

According to Fleming's left hand rule stretch the thumb, fore finger and middle finger of your left hand side that they are mutually perpendicular. If the first finger points in the direction of magnetic field and second finger in the direction of current, then thumb will point in the direction of force.

52. Mutual induction is a process in which current is induced in the neighbouring coil if current flows in a coil. In the figure shown below:



(a) Maximum in situation (A)

(b) Maximum in situation (B)

(c) Maximum in situation (C)

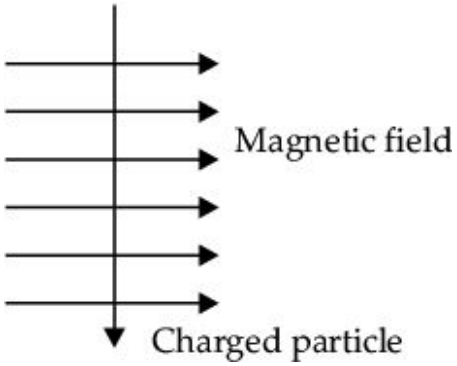
(d) Same in all situation

Ans. (a) Maximum in situation (A)

Explanation :

As both the coils are in the same plane. And induced current is found to be highest when the direction of the coil is at right angle to the magnetic field.

53. A charged particle enters at right angle into a uniform field as shown. What should be the nature of charge on the particle if it begins to move in a direction pointing vertically out of the page due to its interaction with the magnetic field?



(a) Positive

(b) Negative

(c) Natural

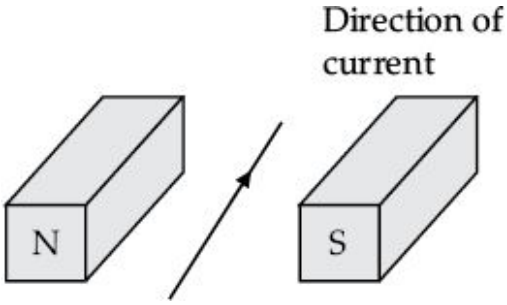
(d) Can't decide

Ans. (a) Positive

Explanation :

Using Fleming's left hand rule, the nature of charged particle is positive.

54. A current flows in a wire, running between the S and N poles of a magnet lying horizontally as shown in the figure below:



The force on the wire due the magnet is directed.

(a) From N to S

(b) From S to N

(c) Vertically downwards

(d) Vertically upwards

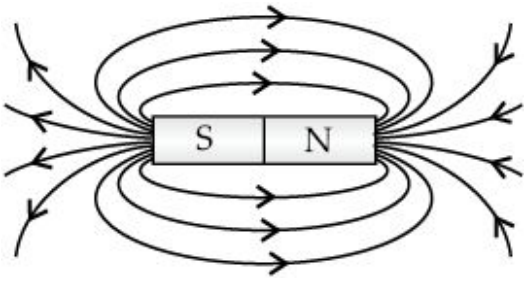
Ans. (c) Vertically downwards

Explanation :

Force on conductor is calculated using Fleming's left hand rule.

55. A student learns that magnetic field strength around a bar magnet is different at every point which diagram shows the correct magnetic field lines around a bar magnet?

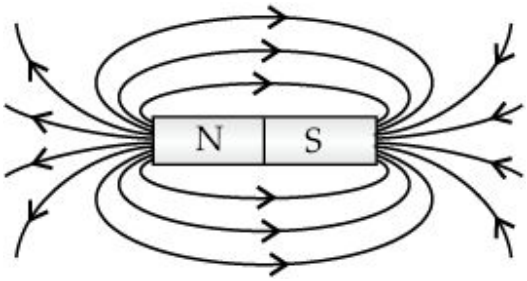
(a)

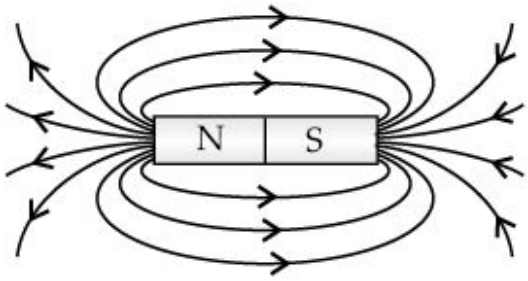


(b)

(c)

(d)



Ans. (d) 

Explanation :

As magnetic lines of forces are continuous curves and originate from N-pole and ends at the S-pole

56. Which of the following is not true?

(a) Induction proceeds attractions

(b) We cannot isolate a single pole

(c) We can magnetic an iron ring

(d) A permanent magnet retains its magnetism even when heated on a flame

Ans. (d) A permanent magnet looses its magnetism when heated on the flame

Explanation :

A permanent magnet does not loose its magnetism even when heated on a flame.

57. Which of the following combination is not correct?

(a) Electric Motor—Fleming's right hand rule

(b) Electric generator—Electromagnetic induction

(c) Earth wire—Green colour

(d) Compass Needle—Small Magnet

Ans. (a) Electric Motor—Fleming's right hand rule

Explanation :

A electric motor works on the principle of Fleming's left hand rule.

58. By removing the inducing magnets, the induced magnetism is:

(a) Finished after sometime

(b) Finished just after

(c) Non-finished for a long time

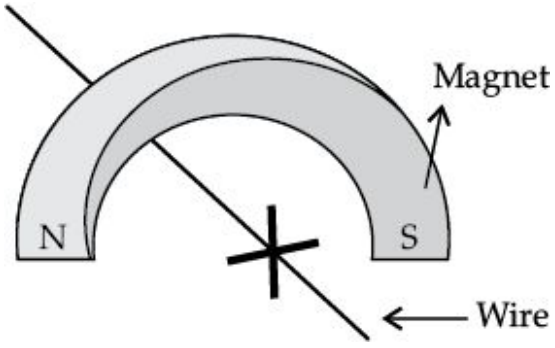
(d) Not Charged

Ans. (b) Finished just after

Explanation :

As induced magnetism takes place, as long as the induced magnet is present.

59. A copper wire is held between the poles of a magnet:



The current in the wire can be reversed. The pole of the magnet can also be changed over. In how many of the four directions shown can the force act on the wire?

(a) 1

(b) 2

(c) 3

(d) 4

Ans. (b) 2

Explanation :

By Fleming's left hand rule, we know that the force on the wire is perpendicular to the current in the wire and the magnetic field.

That it, there are only two possibilities is for the direction of force *i.e.*, upward or downward.

60. Commercial electric motors do not use:

(a) An, electromagnetic to rotate the armature

(b) Effectively large number of conducting wire in the current carrying coil

(c) A permanent magnet to rotate the armature

(d) A soft iron core on which the coil is wound

Ans. (c) A permanent to rotate the armature

Explanation :

Using, electromagnet, the magnetic field strength further increase by, increasing. the current. Hence, it will enhance the power of electric motor.

Assertion and Reasoning Based Questions

61. Assertion: Iron filings are kept near a magnet it gets arranged in a particular fashion.

Reason: Magnetic field is a scalar quantity.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (c) If assertion is true, but reason is false.

Explanation :

Magnetic field is not a scalar quantity rather it is a vector quantity which has both magnitude and direction. So, when iron filings are placed around a magnet, they get arranged in a fashion similar to that of magnetic lines. So, assertion is correct, but reason is false.

62. Assertion: A current carrying rod is suspended between U-shaped magnet, the rod deflects.

Reason: A force is exerted on the rod due to magnetic field.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion.

Explanation :

A force is always exerted due to magnetic field in the same way electric current flowing through any conductor produces magnetic field. And in this case, Fleming's left-hand rule is used to predict directions of the magnetic field, current and displacement. So, assertion and reason both are true and reason is the correct explanation of assertion.

63. Assertion: The energy of charged particle moving in a uniform magnetic field does not change.

Reason: Work done by magnetic field on the charge is zero.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion.

Explanation :

The force on a charged particle moving in a uniform magnetic field always acts in direction perpendicular to the direction of motion of the charge. As work done by magnetic field on the charge is zero, so the energy of the charged particle does not

change. Thus, both assertion and reason are true and reason is the correct explanation of assertion.

64. Assertion: A current carrying conductor experiences a force in a magnetic field.

Reason: The net charge on a current carrying conductor is zero.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation :

When a current carrying conductor having no net charge is placed in a magnetic field, the free electrons of the conductor move towards the positive end of the conductor with same drift velocity, hence a magnetic force acts on them. The positive ions of the conductor being stationary, do not experience any magnetic field. Thus, both assertion and reason are correct but reason is not the correct explanation of the assertion.

65. Assertion: Magnetic field lines do not intersect each other.

Reason: There are two direction of the magnetic field at a point.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (a) Both A & R re true and R is the correct explanation of assertion

Explanation :

Magnetic field lines do not intersect, because it happen so then at that point two direction of magnetic field lines exist, which is not possible.

66. Assertion: The principle of electromagnetic induction was discovered by Micheal Faraday

Reason: The principle is used only in DC generators

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (c) If assertion is true, but reason is false.

Explanation :

Not only DC generators but AC generators also work on the principle of electromagnetic induction.

67. Assertion: Electric Motor converts electric energy into mechanical energy.

Reason: Electric Motor is based on the principle of Fleming's right hand rule.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (c) If assertion is true, but reason is false.

Explanation :

Electric motor is based on the principle of Fleming's left hand rule.

68. Assertion: A compass is kept near a wire carrying current gets deflected.

Reason: Electric current is capable of producing a magnetic effect.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion.

Explanation :

Here while carrying out an experiment if a compass needle is placed near a wire carrying current then due to the effect of magnetism which is produced due to electric current produced in the wire the needle gets deflected. It shows that the magnetism and electricity are interlinked. So, both assertion and reason are true and reason is the correct explanation of assertion.

69. Assertion: Deflection of the iron filings changes when current in the conductor varies.

Reason: Magnitude of the magnetic field does not change with the magnitude of current.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (c) If assertion is true, but reason is false.

Explanation :

Assertion is correct but the reason is wrong. As the current

changes in the conductor, magnitude of the magnetic field produced also varies which is the reason for a change in the deflection of the iron filings.

70. Assertion: A pump operated by electric motor starts pumping liquid.

Reason: Motor converts mechanical energy to electrical energy.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (c) If assertion is true, but reason is false.

Explanation :

An electric motor converts electrical energy to mechanical energy which is used for pumping liquids through the pumps. It produces a rotating force when electricity is given to it. So, assertion is true, but reason is false.

71. Assertion: Galvanometer is used to measure polarity.

Reason: Galvanometer is an instrument which is used to detect current in any circuit.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the

correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation :

Both the statements are correct, but reason is not the correct explanation of assertion. In testing purposes galvanometer is used to measure polarity. There is a torque acting on a current carrying coil suspended in a magnetic field which produces deflection. Deflection is directly proportional to current flowing through the galvanometer coil.

72. Assertion: Current can be induced in a coil by changing the magnetic field around it.

Reason: A Galvanometer connected to a coil can deflect either to the left or right of the zero mark.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

(c) If assertion is true, but reason is false.

(d) If assertion is false, but reason is true.

Ans. (b) If both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation :

Current is induced in a coil due to a changing magnetic field and this process is known as electromagnetic induction. Galvanometer is a device that detects the presence of current by deflecting the needle to one side of the zero mark but this does not explain the current induced in the coil.

Case Based Questions

73. Read the passage carefully and answer the following questions from Q. 73 (i) to Q. 73 (v).

When a small compass is placed near a magnet, it will experience a force due to the magnetic field of the magnet. It is evidently observed due to a deflection in the north pole pointer of the compass. The path traced by the north pole pointer under the influence of a magnetic field is called the magnetic field line. The magnetic field lines are produced from the north pole of the magnet end at the south pole of the magnet. When the compass is moved around the field line, it always sets itself tangential along the curves.

(i) The magnetic field lines:

(a) intersect at right angle to one another.

(b) intersect at an angle of 45 degree.

(c) cross at an angle of 60 degree.

(d) never intersect with each other.

(ii) Magnetic field lines can be used to determine:

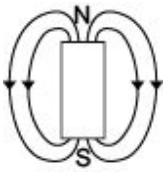
(a) the shape of the magnetic field.

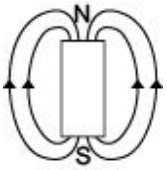
(b) only the direction of the magnetic field.

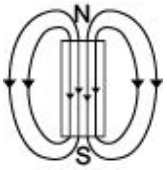
(c) only the relative strength of the magnetic field.

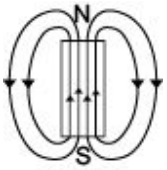
(d) both the direction and the relative strength of the magnetic field.

(iii) The magnetic field lines due to a bar magnet are correctly shown in:

(a) 

(b) 

(c) 

(d) 

(iv) Which of the following is incorrect regarding magnetic field lines?

(a) The field lines are directed N to S inside the magnet.

(b) The Crowdedness of the field lines shows the strength of the magnet.

(c) The field is tangent to the magnetic field line.

(d) Magnetic field lines are closed and continuous curves.

(v) A strong bar magnet placed vertically above a surface. The magnetic field lines will be:

(a) Only in a horizontal plane around the magnet.

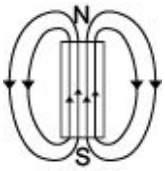
(b) Only in a vertical plane around the magnet.

(c) Both in horizontal and vertical plane around the magnet.

(d) In all the planes around the magnet.

Ans. (i) (d) never intersect with each other.

(ii) (d) both the direction and the relative strength of the magnetic field.

(iii) (d) 

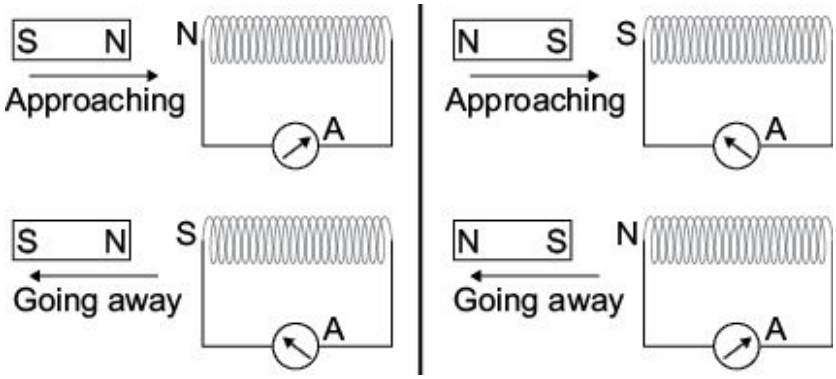
(iv) (a) The field lines are directed N to S inside the magnet.

(v) (d) In all the planes around the magnet

74. Read the passage carefully and answer the following questions from Q. 74 (i) to Q. 74 (v).

A current-carrying wire produces a magnetic field around it. The phenomena in which an electromotive force and current are induced by changing magnetic field through it is called induced current. It can be concluded that the induced current flows in a conductor as long as the magnetic force changes within the conductor. For the motion of the coil with respect to the magnet or vice versa, the direction of the current flowing in the conductor is determined by the direction of the relative motion of the conductor

with respect to the magnetic field. The induced emf or current is directly proportional to the rate of change in the magnetic field.



(i) What is the condition of electromagnetic induction?

(a) There must be relative motion between galvanometer and coil of wire.

(b) There must be a relative motion between galvanometer and magnet.

(c) There must be a relative motion between galvanometer and electric motor.

(d) There must be a relative motion between the coil of wire and a magnet.

(ii) An induced emf is produced when a magnet is plugged into a coil. The magnitude of induced emf does not depend upon:

(a) The number of turns in the coil.

(b) The speed with which the magnet is moved.

(c) The resistivity of the material of the coil.

(d) The strength of the magnet.

(iii) A bar magnet is pushed steadily into a long solenoid connected

to a meter.

Which of the following would affect the magnitude of the deflection of the meter?

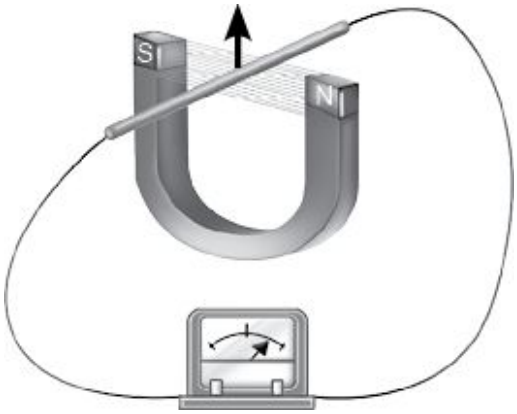
(a) How fast the magnet is pushed into the coil.

(b) Direction in which the coil is wound.

(c) End of the solenoid where the magnet enters.

(d) Pole of the magnet which enters the coil first.

(iv) A conducting rod moves across two magnets as shown in the figure and the needle in the galvanometer deflects momentarily. This physical phenomenon is called:



(a) Induced magnetism

(b) Electromagnetism

(c) Static induction

(d) Electromagnetic induction

(v) Magnetic lines of force inside current-carrying solenoid are:

(a) perpendicular to axis.

(b) along the axis and are parallel to each other.

(c) parallel inside the solenoid and circular at the ends.

(d) circular.

Ans. (i) (d) There must be a relative motion between the coil of wire and a magnet.

(ii) (c) The resistivity of the material of the coil

(iii) (a) How fast the magnet is pushed into the coil

(iv) (d) Electromagnetic induction

(v) (b) along the axis and are parallel to each other

75. Read the passage carefully and answer any four questions from Q. 75 (i) to Q. 75 (v).

Hans christian Oersted, one of the leading scientists of the 19th century, play a crucial role in understanding electromagnetism. In 1820, he accidentally discovered that a compass needle got defected when an electric current passed through a metallic wire placed nearly. Through this observation Oersted showed that electricity and magnetic were related phenomenon. This research later created technologies such as radio, television and fibre optics. The unit of magnetic field was named as Oersted in his honour. Electromagnetism is the study of electromagnetic force. It is a type of interface that happens between electrically charged particles. The electromagnetic force generally exhibits electromagnetic fields like magnetic fields, electric fields and light, and is one of the four essential interactions commonly known as forces in nature. The other 3 important interactions are the strong interaction, gravitation and the weak.

(i) Oersted experiment is used to explain which effect of current ?

(a) Electric field

(b) Magnetic field

(c) Both (a) and (b)

(d) None of these

(ii) Which instrument helps to detect the presence of magnetic field at a point?

(a) Strong magnet

(b) Solenoid

(c) Compass needle

(d) Current carrying line

(iii) In the diagram below, the direction of magnetic field is:

(a) Clockwise

(b) Anti clockwise

(c) Not any fixed direction

(d) None of these

(iv) On reversing the direction of the current in a wire, the magnetic fixed produced by it:

(a) Gets reversed in direction

(b) Increase in strength

(c) Decreases in strength

(d) Remains unchanged in strength and direction

Ans

. (i) (b) Magnetic field

Explanation :

He make to understand that current carrying wire has magnetic field around it.

(ii) (c) Compass needle

Explanation :

Compass needle is a small bar magnet, whose ends are approximately towards the north and south direction.

(iii) (a) Clockwise

Explanation :

It is evaluated by using Right Hand Thum Rule.

(iv) (a) Gets reversed in direction

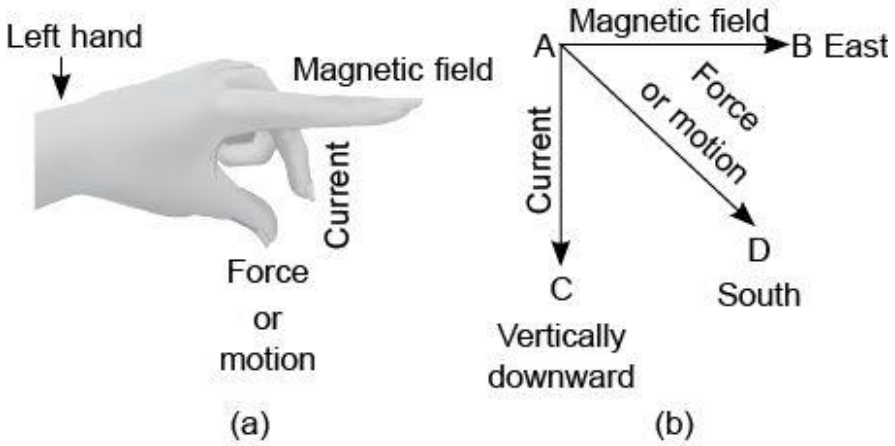
Explanation :

When direction of current change, then direction of magnetic field produced changes accordingly.

76. Read the passage carefully and answer the following questions from Q. 76 (i) to Q. 76 (v).

A magnet must exert an equal and opposite force on a current-carrying conductor. We know that current is due to the charge in

motion. Thus, it is evident that a charge moving in a magnetic field experiences a force. If the direction of motion is perpendicular to the direction of the magnetic field, the magnitude of force experienced depends upon the charge, velocity, and strength of the magnetic field. Fleming's left-hand rule gives the direction of the magnetic force.



(i) If a charged particle is moving along a magnetic field line, the magnetic force on the particle is:

(a) along with its velocity.

(b) opposite to its velocity.

(c) perpendicular to its velocity.

(d) zero.

(ii) An electron is travelling horizontally towards the east. A magnetic field in the vertically downward direction will exert a force in:

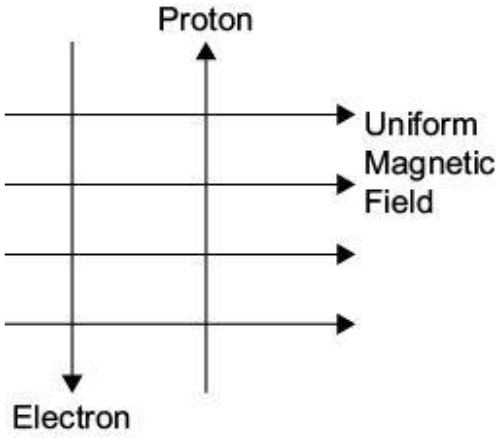
(a) East

(b) West

(c) North

(d) South

(iii) A uniform magnetic field exists from left to right on a surface. An electron and proton moving in the directions as shown in the figure will experience:



(a) Forces both pointing into the plane of the surface.

(b) Forces both pointing out of the plane of the surface.

(c) The electron will experience into the plane and proton out of the plane.

(d) The electron will experience opposite to and proton along the direction of the uniform magnetic field.

(iv) Magnetic field exerts no force on:

(a) a stationary electric charge.

(b) a magnet.

(c) an electric charge moving perpendicular to its direction.

(d) an unmagnetized iron bar.

(v) In Fleming's left-hand rule, the thumb's direction shows the:

(a) current

(b) field

(c) motion

(d) charge

Ans. (i) (d) zero

(ii) (d) South

(iii) (a) Forces both pointing into the plane of the surface

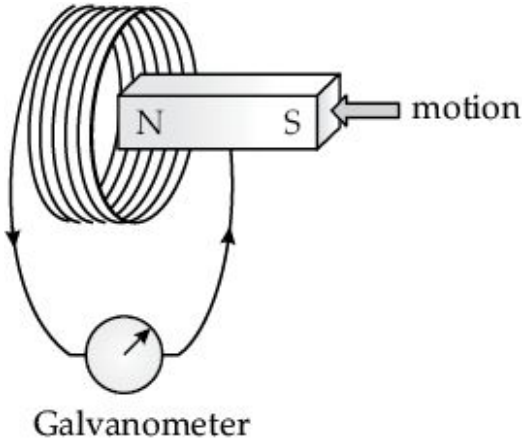
(iv) (a) a stationary electric charge

(v) (c) motion

77. Read the passage carefully and answer the following questions from Q. 77 (i) to Q. 77 (v).

The space surrounding a magnet in which magnetic force is exerted, is called a magnetic field. The direction of magnetic field lines at a place can be determined by using a compass needle. A compass needle placed near a magnet gets deflected due to the magnetic force exerted by the magnet.

The north end of the needle of the compass indicates the direction of magnetic field at the point where it is placed. When the magnet shown in the diagram below is moving towards the coil, the galvanometer gives a reading to the right.



(i) The direction of induced current is given by:

(a) Right hand thumb rule

(b) Fleming's right hand rule

(c) Fleming's left hand rule

(d) Maxwell's rule

(ii) What is the condition of electromagnetic induction?

(a) There must be a relative motion between the coil of wire and galvanometer.

(b) There must be a relative motion between the galvanometer and a magnet.

(c) There must be a relative motion between galvanometer and generator.

(d) There must be a relative motion between the coil of wire and a magnet.

(iii) A student writes a few statements after studying the principles of electromagnetism and working of electric motor:

(I) Fleming's left hand rule is used to make electromagnet.

(II) Fleming's left hand rule is used in electric motor.

(III) Fleming's right hand rule is used in electric motor.

(IV) Right hand thumb rule is used in electric motor.

Choose the correct statement(s) from the following:

(a) Only (I)

(b) Only (II)

(c) (I) and (III)

(d) (II), (III) and (IV)

(iv) When the magnet is moved away from the coil, it is observed that:

(a) the galvanometer needle deflects to the left

(b) the galvanometer needle deflects to the right

(c) the galvanometer needle first deflects to the left and then to the right

(d) the galvanometer needle first deflects to the right and then to the left.

(v) The induced current is highest when:

(a) direction of magnetic field is parallel to the direction of motion of coil.

(b) direction of magnetic field is opposite to the direction of motion of coil.

(c) direction of magnetic field is perpendicular to the direction of motion of coil.

(d) direction of magnetic field is in straight line to the direction of motion of coil.

Ans. (i) (b) Fleming's right hand rule

(ii) (d) There must be a relative motion between the coil of wire and a magnet.

(iii) (b) Only (II)

(iv) (a) the galvanometer needle deflects to the left.

(v) (c) direction of magnetic field is perpendicular to the direction of motion of coil.

Definitions

78. Define magnetism.

Ans. The property by virtue of which a magnet attracts certain metals such as iron, cobalt, nickel etc., is termed as magnetism.

79. What do you mean by 'magnetic field' of a magnet?

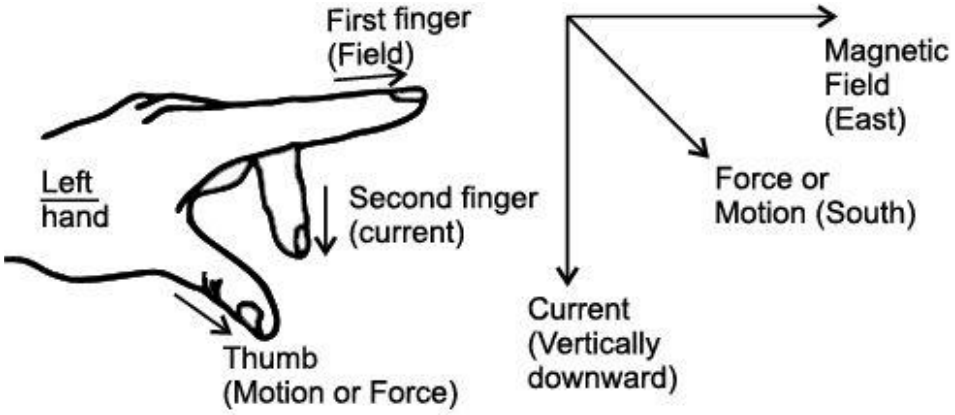
Ans. The space or region around a magnet in which the force of attraction or repulsion due to the magnet can be detected is called the magnetic field.

80. State Ampere's swimming rule.

Ans. If a swimmer swims in the direction of current, facing the magnetic needle, then the north pole of the magnetic needle deflects towards his left hand *i.e.*, west and the south pole towards his right hand *i.e.*, east.

81. State Fleming's Left Hand Rule.[NCERT]

Ans. According to this rule, stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular to each other. If the first finger points in the direction of magnetic field and the second finger in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor.



82. What is an electric motor?

Ans. An electric motor is a device which converts the electrical energy into mechanical energy.

83. What is the principle of an electric motor? [NCERT]

Ans. Electric motor works on the principle that 'when a rectangular coil is placed in a magnetic field and current is passed through it, a force acts on the coil which rotates it continuously. Thus, when the coil rotates, the shaft attached to it also rotates converting the electrical energy supplied to the motor to the mechanical energy of rotation.

84. What is a galvanometer?

Ans. A galvanometer is an instrument which can detect the presence of electric current in a circuit.

85. Define electromagnetic induction.

Ans. The production of electricity from magnetism is called electromagnetic induction.

86. What is a permanent magnet? Give one use of it.

Ans. A permanent magnet is a magnet made from steel such that once magnetized, it does not lose it magnetism easily.

87. Define a compass.

Ans. A compass is a device used to show magnetic field direction at a point. It consists of a tiny pivoted magnet usually in the form of a pointer which can turn freely in the horizontal plane.

Very Short Answer Type Questions

88. How is the strength of the magnetic field at a point near a wire related to the strength of the electric current flowing in the wire ?

Ans. Strength of magnetic field is directly proportional to the strength of current flowing in the wire.

89. State the conclusion that can be drawn from the observation that a current-carrying wire deflects a magnetic needle placed near it.

Ans. A magnetic field is produced around a current-carrying conductor.

90. Why does a current-carrying conductor experience a force when it is placed in a magnetic field ?

Ans. A current-carrying conductor produces a magnetic field around it. This magnetic field interacts with the externally applied magnetic field and as a result the conductor experiences a force.

91. What is the function of a galvanometer in a circuit ?

Ans. Galvanometer is a device that detects the presence of current in a circuit. It is also used for measuring the amount of current in the circuit.

92. Why does a current carrying freely suspended solenoid rest along a particular direction ? State the direction in which it rests.

Ans. A current carrying solenoid behaves like a bar magnet. It rest in geographic north-south direction.

93. At what place of the magnet are the magnetic field lines closer ?*

Ans. Near the poles of the magnet.

94. How is the strength of the magnetic field at a point near a wire related to the strength of the electric current flowing in the wire ?*

Ans. Strength of magnetic field is directly proportional to the strength of current flowing in the wire.

95. State the observation made by Oersted on the basis of his experiment with current-carrying conductors ?*

Ans. Every current-carrying conductor has a magnetic field around it.

96. What is the shape of a current-carrying conductor whose magnetic field pattern resembles that of a bar magnet ?*

Ans. A solenoid

97. Name the two factors that completely define a magnetic field at a point.*

Ans. The strength and the direction of magnetic field at the given point.

98. A stationary charge is placed in a magnetic field. Will it experience a force ? Give reason to justify your answer.

Ans. No, a magnetic field exerts a force only on a moving charge.

99. Where will be the value of magnetic field maximum due to current-carrying circular conductor?*

Ans. At the centre of current-carrying circular loop.

100. State the conclusion that can be drawn from the observation that a current-carrying wire deflects a magnetic needle placed near it.*

Ans. A magnetic field is produced around a current-carrying conductor.

101. Why does a current-carrying conductor experience a force when it is placed in a magnetic field?*

Ans. A current-carrying conductor produces a magnetic field around it. This magnetic field interacts with the externally applied magnetic field and as a result the conductor experiences a force.

102. Why steel is not used for making electromagnets ?

Ans. The steel does not lose all its magnetism when the current is stopped and becomes a permanent magnet. That's why it is not used for making electromagnets.

103. What happens to the magnetic field lines due to a current-

carrying conductor when the current is reversed ?*

Ans. The direction of magnetic field (and magnetic field lines) gets reversed on changing the direction of flow of current in a straight conductor.

104. Name five main parts of a D.C. motor.

Ans. An electric motor is a device which converts the electrical energy into mechanical energy.

The five main parts of a D.C. motor are:

(a) Strong field magnet,

(b) Armature coil,

(c) Split ring or commutator,

(d) Carbon brushes, and

(e) Battery.

105. What is the role of a split ring in an electric motor? [NCERT]

Ans. In an electric motor, after every half rotation the direction of coil gets reversed due to change in orientation of the magnetic field. To ensure a continuous rotation; a split ring is attached to the coil so that the polarity of the coil changes after every half rotation. This changes the direction of current and thus the armature keeps on rotating continuously.

Reasoning Based Questions

106

. Why does a compass needle get deflected when brought near a bar magnet?[NCERT]

Ans. When a compass needle is brought near a bar magnet, the compass needle experiences a deflection due to the interaction of magnetic fields of the compass needle and the bar magnet.

107

. Why don't two magnetic lines of force intersect each other?

Ans. The tangent drawn at any point on the magnetic field line gives the direction of magnetic field at that point. Hence, if two magnetic field lines would intersect each other, it would result in two tangents at one point which in turn would result in two directions at one point which is impossible. That is why two magnetic field lines never intersect each other.

108

. Why does a magnetic needle show a deflection when brought close to a current carrying conductor?

Ans. A current carrying conductor produces a magnetic field around it and the magnetic needle in this magnetic field experiences a torque due to which it deflects to align itself in the direction of magnetic field.

109

. Why steel is not used for making electromagnets?

Ans. The steel does not lose all its magnetism when the current is stopped and becomes a permanent magnet. That's why it is not used for making electromagnets

110 . Why is soft iron generally used as the core of the

electromagnet?

Ans. Soft iron is generally used for making electromagnets because it can easily gain magnetic properties when current is passed around the core and quickly loses when current is stopped.

111. Explain why, an electromagnet is called a temporary magnet?

Ans. An electromagnet is called a temporary magnet because as we keep on passing electric current it will work as magnet, if we stop passing electric current, it will no longer work as magnet.

Short Answer Type Questions

112 . Answer the following questions:

(a) What do you mean by 'magnetic field' of a magnet?

(b) What are magnetic field lines? List two characteristic properties of these lines.**

Ans. **(a)** The space or region around a magnet in which the force of attraction or repulsion due to the magnet can be detected is called the magnetic field.

(b) The lines drawn in a magnetic field along which north magnetic pole moves, are called magnetic field lines.

The characteristic properties of magnetic field lines are :

(i) The magnetic lines originate from north pole and ends at south pole.

(ii) The magnetic lines do not intersect each other.

113. Answer the following questions:

(a) State Ampere's swimming rule.

(b) Name and state the rule to determine the direction of magnetic field produced by a straight wire carrying current.

Ans. (a) If a swimmer swims in the direction of current, facing the magnetic needle, then the north pole of the magnetic needle deflects towards his left hand i.e., west and the south pole towards his right hand *i.e.*, east.

(b) Maxwell's right hand thumb rule is used to determine the direction. According to this rule, when you hold a current carrying conductor in your right hand in such a way that your thumb points in the direction of the current then the direction in which your fingers encircle the conductor will give the direction of magnetic field around it.

114. Answer the following questions:

(a) Name and state the rule to determine the polarity of the two faces of a current carrying circular loop.

(b) State Fleming's Left Hand Rule.**[NCERT]**

Ans. (a) Clock face rule is used to determine the polarity of the two faces of a current carrying circular loop. According to this rule, "If the current around the face of circular wire flows in the clockwise direction, then that face of the circular wire will be south pole (S-Pole) and if the current around the face of circular wire flows in the anticlockwise direction, then that face of the circular wire will be north pole (N-Pole)."

(b) According to this rule, stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular to each other. If the first finger points in the

direction of magnetic field and the second finger in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor.

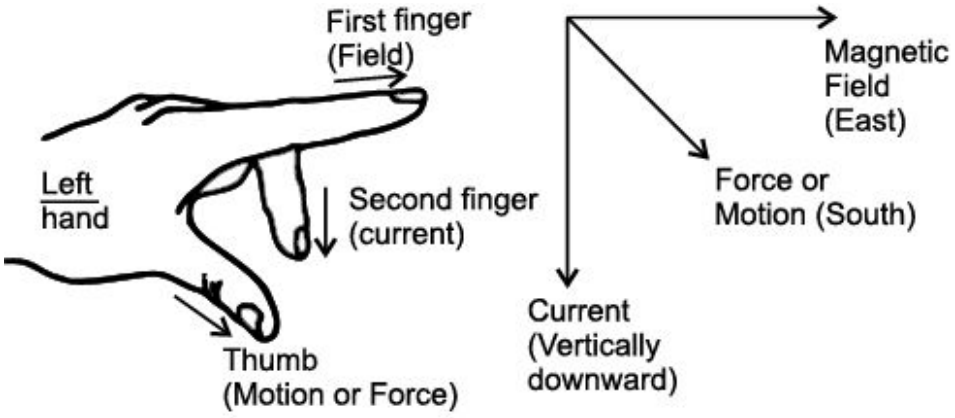


Fig. Fleming's left hand rule

115. Answer the following questions:

(a) What is the principle of an electric motor?

[NCERT]

(b) What is the role of a split ring in an electric motor? **[NCERT]**

(c) Define magnetism.

Ans. (a) Electric motor works on the principle that 'when a rectangular coil is placed in a magnetic field and current is passed through it, a force acts on the coil which rotates it continuously. Thus, when the coil rotates, the shaft attached to it also rotates converting the electrical energy supplied to the motor to the mechanical energy of rotation.

(b) In an electric motor, after every half rotation the direction of coil gets reversed due to change in orientation of the magnetic field. To ensure a continuous rotation; a split ring is attached to the coil so that the polarity of the coil changes after every half rotation. This changes the direction of current

and thus the armature keeps on rotating continuously.

(c) The property by virtue of which a magnet attracts certain metals such as iron, cobalt, nickel etc., is termed as magnetism.

116. State the rule to determine the direction of a :

(a) Magnetic field produced around a straight current carrying conductor.

(b) Force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it.

(c) Current induced in a coil due to its rotation in a magnetic field.

Ans. (a) Right hand thumb rule or Maxwell's Corkscrew rule.

(b) Fleming's left hand rule.

(c) Fleming's right hand rule.

117. Answer the following questions:

(a) What do you mean by Overloading?

(b) Define an electromagnet.

(c) What is a galvanometer?

Ans. (a) Overloading is the process of overheating of a wire due to excess current drawn by all the appliances than the permitted limit for that wire.

(b) An electromagnet is a magnet consisting of a long coil of insulated copper wire wrapped around a soft iron core that is magnetized only when electric current is passed through the

coil.

(c) A galvanometer is an instrument which can detect the presence of electric current in a circuit.

118. Answer the following questions:

(a) Define electromagnetic induction.

(b) What is a permanent magnet? Give one use of it.

(c) Define a compass.

Ans. (a) The production of electricity from magnetism is called electromagnetic induction.

(b) A permanent magnet is a magnet made from steel such that once magnetized, it does not lose its magnetism easily.

(c) A compass is a device used to show magnetic field direction at a point. It consists of a tiny pivoted magnet usually in the form of a pointer which can turn freely in the horizontal plane.

119. State Fleming's right hand rule.

Ans. It states that, "Stretch your right hand in such a way that the first finger, the central finger and the thumb are mutually perpendicular to each other. If the first finger points along the direction of magnetic field and the thumb points along the direction of motion of the conductor, then the direction of induced current is given by the direction of the central finger." This rule is also called dynamo rule.

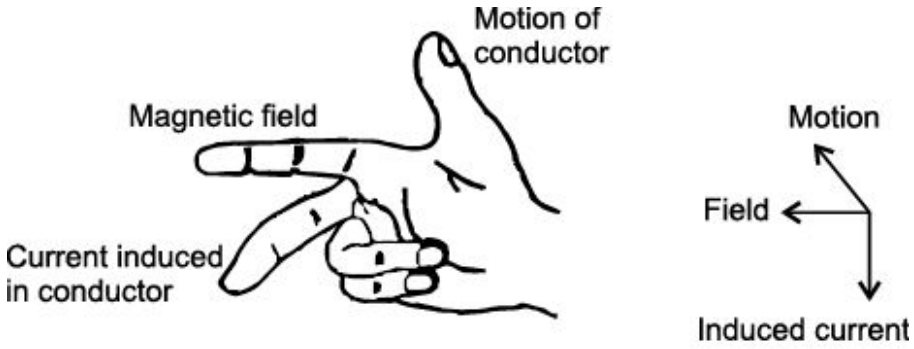


Fig. Fleming's right hand rule.

Differentiate Between

120

. State five differences between an electromagnet and a permanent magnet.

Ans.

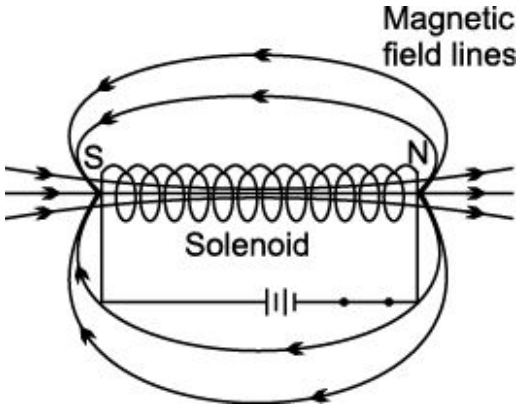
S. No.	Electromagnet	Permanent Magnet
1.	It is made up of soft iron.	It is made up of steel.
2.	The magnetic field strength can be changed.	The magnetic field strength can not be changed.
3.	The magnetic field can be very strong.	The magnetic field is not so strong.
4.	The polarity of an electromagnet can be reversed.	The polarity of a permanent magnet cannot be reversed.
5.	It can be easily demagnetized by switching off the current.	It cannot be easily demagnetized.

Diagram Based Questions

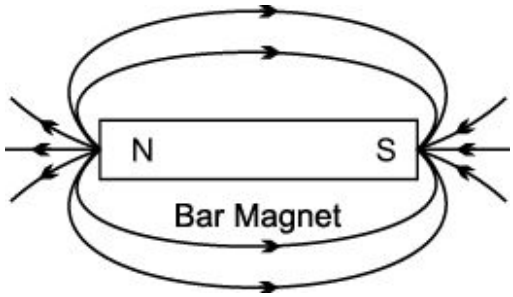
121

. What is a solenoid ? Draw the pattern of magnetic field lines of (i) a current carrying solenoid and (ii) a bar magnet. List two distinguishing features between the two fields.*

Ans. Solenoid is a long cylindrical coil of wire consisting of a large number of turns bound together very tightly.



(i)



(ii)

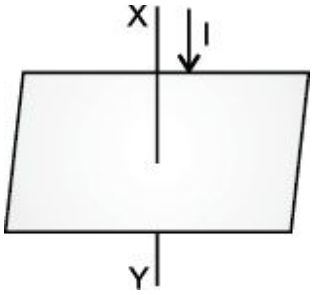
Distinguishing features are as follows :

1. Magnetic field outside the solenoid is negligible as compared to the bar magnet.

2. Magnetic field of solenoid can be varied as per our requirement just by changing current or core of solenoid but in bar magnet it is fixed.

122

. In the diagram XY is a straight conductor carrying current in the direction marked by the arrow. The conductor is held vertically by passing it through a horizontal cardboard sheet. Draw three magnetic lines of force on the board and mark the direction of magnetic field in your diagram. State two factors on which magnitude of magnetic field at a point, depends.

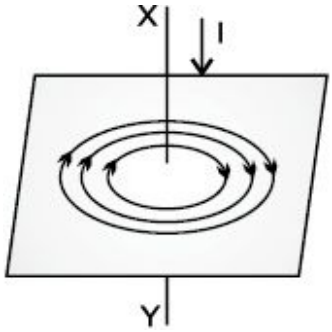


Ans. The magnetic lines of force due to current in the straight conductor XY are shown in figure given alongside. The arrows on the magnetic lines of force show the direction of magnetic field.

The magnitude of magnetic field at a point depends on :

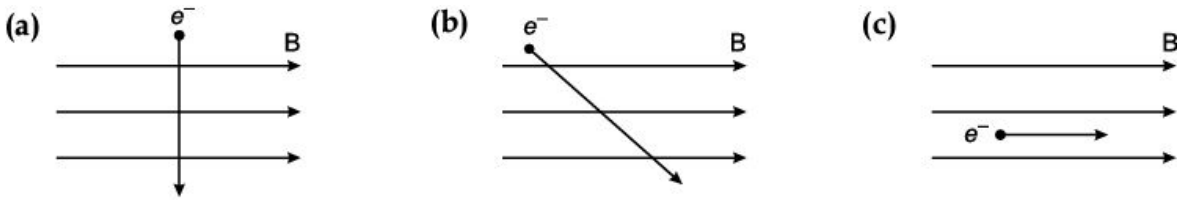
(i) The strength of current in the conductor, and

(ii) The distance of point from the conductor.



123

. Given below are three diagrams showing entry of an electron in a magnetic field. Identify the case in which the force on electron will be maximum and minimum respectively. Give reason for your answer. Find the direction of maximum force acting on electron.*



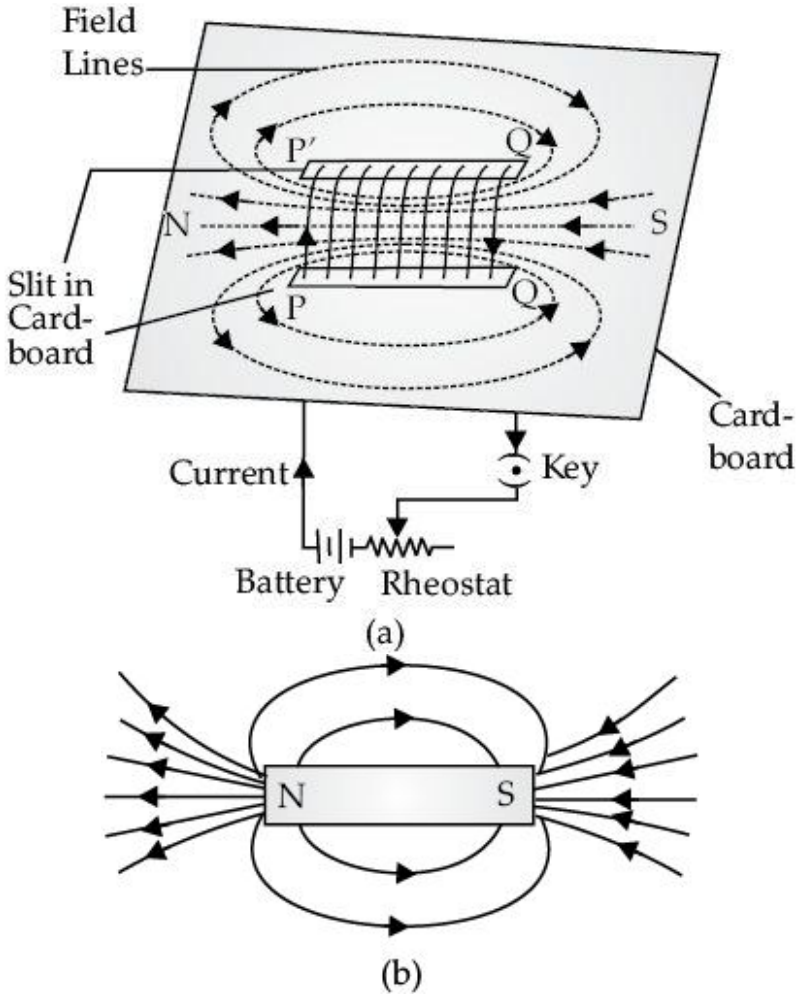
Ans. Force on electron is maximum in fig. (a) because here direction

of motion of electron is at right angles to that of magnetic field ‘B’. The force is minimum (or zero) in fig. (c) because here electron is moving along the direction of magnetic field B. The direction of maximum force acting on electron is perpendicular to the plane of paper and directed into it.

124

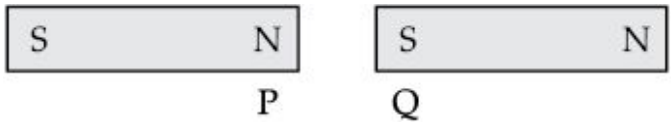
. Sketch the lines of force of the magnetic field of a solenoid. How does its field compare with that of a bar magnet ?

Ans. The magnetic field of a solenoid is very similar to that of a bar magnet. this is shown in figure (a) and (b) respectively, which shows the lines of force of the magnetic field of a current carrying solenoid and a bar magnet.

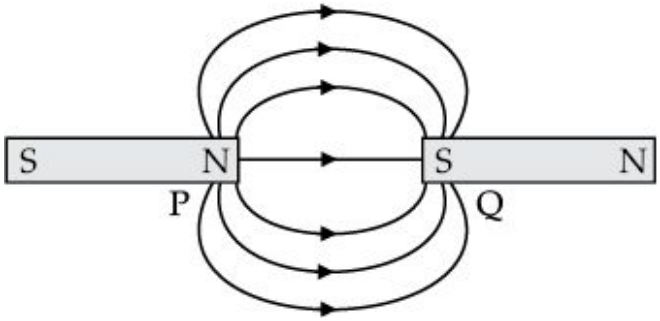


125

. Two magnets are lying side by side as shown below. Draw magnetic field lines between poles P and Q.

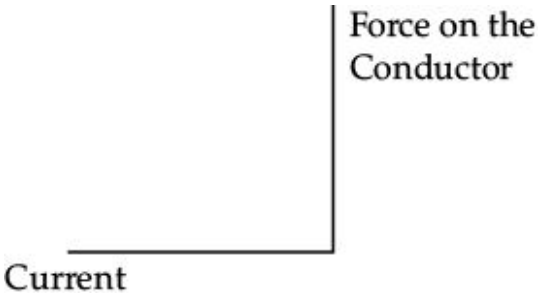


Ans. Magnetic field lines are shown below:



126

. State the direction of magnetic field in the following diagram.



Ans. As per Fleming's left hand rule, the magnetic field is directed out of the paper.

127

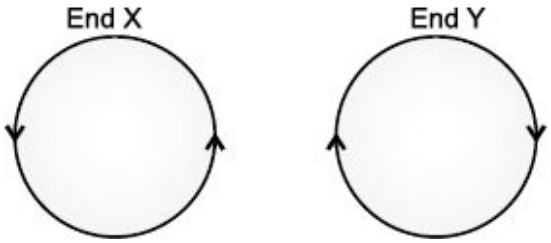
. The directions of current flowing in the coil of an electromagnet at its two ends X and Y are as shown in given figure.

(a) What is the polarity of end X ?

(b) What is the polarity of end Y ?

(c) Name the rule which you have used to determine the

polarities.



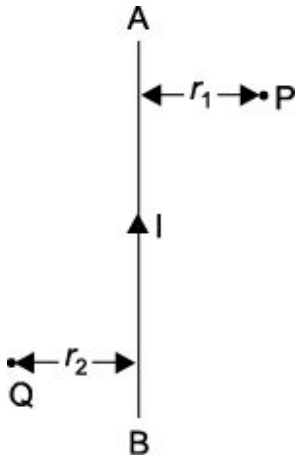
Ans. (a) Since current at end X is anticlockwise, the polarity at that end is North pole.

(b) Current at end Y is clockwise, hence polarity at that end is South pole.

(c) Clock-face rule is used to determine the polarities of the two faces of a current carrying circular loop.

128

. AB is a current carrying conductor in the plane of the paper as shown in figure. What are the directions of magnetic fields produced by it at points P and Q ? Given $r_1 > r_2$, where **will the strength of the magnetic field be larger?**



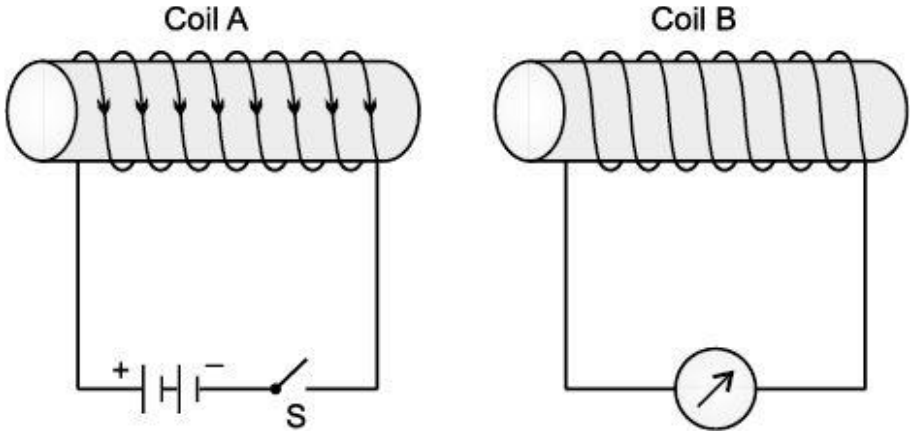
Ans. Since the direction of the current in the current carrying conductor AB is upwards, the direction of the magnetic field would be anti-clockwise as deduced by applying right hand

thumb rule. Consequently, the magnetic field at point P would be towards the plane and, at point Q, the direction of the magnetic field would be away from the plane.

Since the strength of the magnetic field is inversely proportional to the distance (r), the field at P would be weaker as compared to Q [$\because r_1 > r_2$].

129

. Two coils A and B are placed close to each other. If the current in coil A is changed, will some current be induced in the coil B ? Given reason.[NCERT]

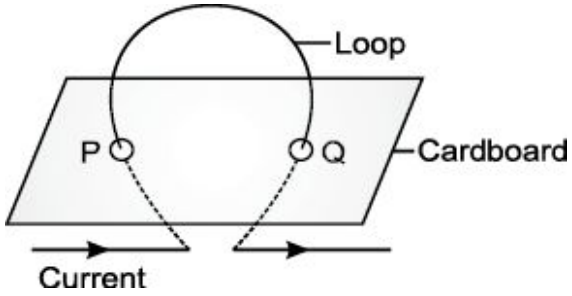


Ans. When we switch on current in coil A, it becomes an electromagnet and produces a magnetic field around coil B. So, an induced current flows in coil B for a moment. When the current in coil A becomes steady, its magnetic field also becomes steady and the current in coil B stops. When we switch off the current in coil A, then the magnetic field in coil B stops quickly and in this case an induced current flows in coil B in the opposite direction.

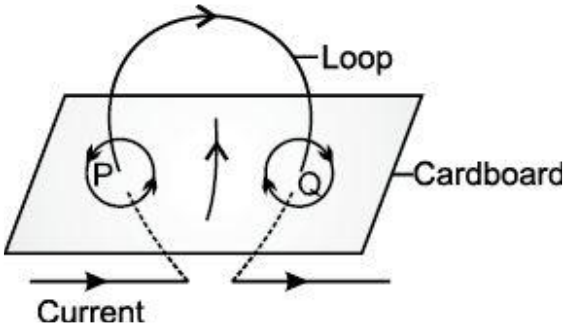
130

. The diagram shows a current carrying coil passing through a cardboard sheet. Draw three magnetic lines of force on the

board. State two factors on which magnitude of magnetic field at the centre depends.



Ans. Figure shows the magnetic lines of force due to current carrying coil.

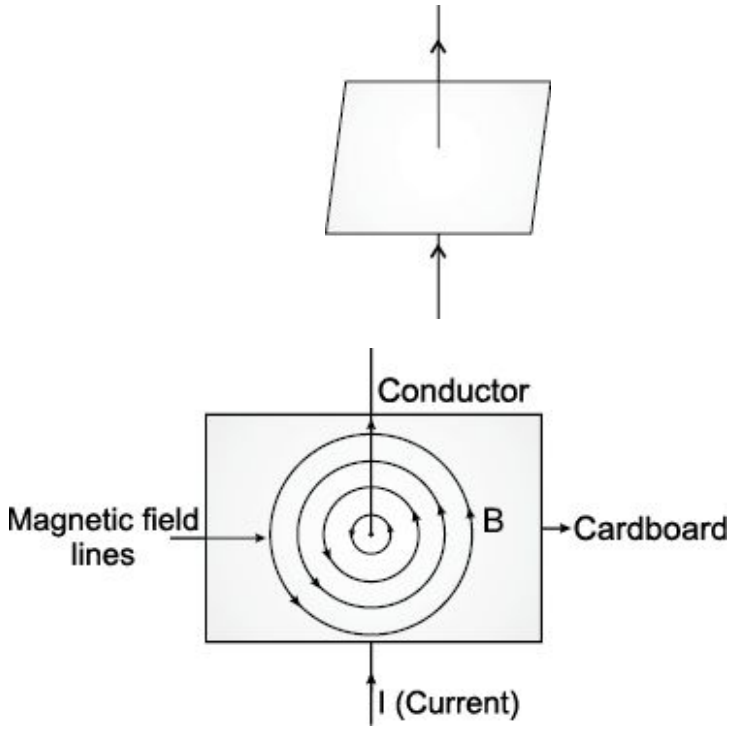


The magnitude of magnetic field at the centre of coil depends on : (a) the strength of current in the coil, and (b) the number of turns in the coil.

131. Answer the following question:

(a) A straight wire conductor passes vertically through a piece of cardboard sprinkled with iron filings. Copy the diagram and show the setting of iron filings when a current is passed through the wire in the upward direction and the cardboard is tapped gently. Draw arrows to represent the direction of the magnetic field lines.

(b) Name the law which helped you to find the direction of the magnetic field lines.



Ans. (a)

(b) Right hand thumb rule.

Analysis and Evaluation Based Questions

132. . Answer the following question:

(a) What type of magnetic field is produced due to a straight current carrying conductor?

(b) The magnetic field lines produced by a straight solenoid resemble the magnetic field lines produced by another object. Identify that object.

Ans. (a) Magnetic field lines are concentric circular loops in a plane perpendicular to the straight conductor. The centres of the circular lines lie on the conductor.

(b) The magnetic field produced due to a straight solenoid is

similar to that produced by a bar magnet.

133

. Why does it become more difficult to move a magnet towards a coil when the number of turns in a coil have been increased?

Ans. It becomes more difficult to move a magnet towards a coil when the number of turns in the coil is increased because the induced current in the coil due to electromagnetic induction increases and the induced current opposes the motion of the magnet towards the coil.

134

. When is the force experienced by a current-carrying conductor placed in a magnetic field largest?

[NCERT]

Ans. The force experienced by a current-carrying conductor placed in a magnetic field is largest when the current-carrying conductor is placed perpendicular to the direction of magnetic field.

135

. State the condition in each case of the magnitude of force on a current carrying conductor placed in a magnetic field to be (a) zero and (b) maximum.

Ans. (a) The magnitude of force acting on a current carrying conductor placed in a magnetic field will be zero, when the current carrying conductor is in the direction of magnetic field.

(b) The magnitude of force acting on a current carrying conductor placed in a magnetic field will be maximum, when the current carrying conductor is normal (perpendicular) to the magnetic

field.

136

. When an iron bar is placed inside a solenoid carrying current, it becomes a magnet as long as current flows through the solenoid. Such a magnet is known as electromagnet. In fact, the magnetic field inside the solenoid magnetises the soft iron bar placed in it, which acts as an electromagnet.

(a) What type of core is used to make an electromagnet?

(b) State two ways by which the strength of an electromagnet can be increased.

(c) State one use of electromagnet.

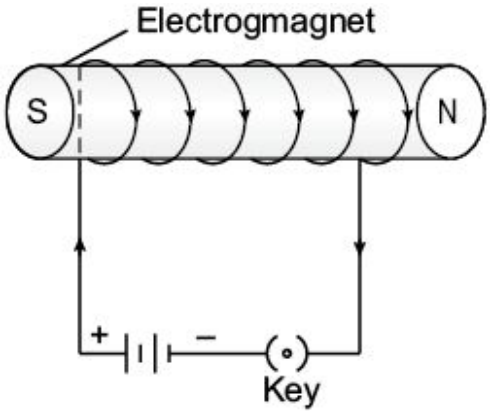
(d) Basically electromagnet is a :

(i) Magnet

(ii) Solenoid

(iii) Wire

(iv) Coil



Ans. (a) Soft iron core.

(b) 1. By increasing the number of turns in the winding on the

soft iron core.

2. By increasing the strength of the current through the winding.

(c) Electromagnet are used to lift heavy iron pieces.

(d) (ii) Solenoid

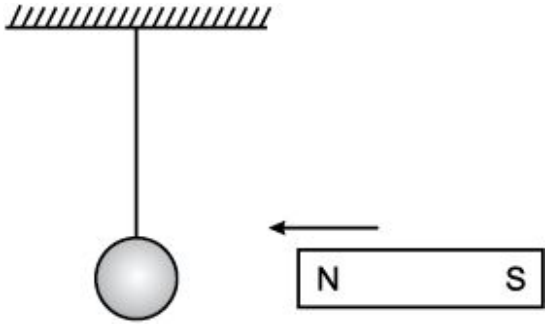
137

. How will you decide whether the magnetic field at a point is due to some current carrying conductor or due to earth?

Ans. Place a compass needle at the given point. If it stays in the north-south direction, then the magnetic field is due to earth. If the needle points along any direction other than north-south direction, then the field is due to some current carrying conductor.

138

. A metallic wire loop is suspended freely and a bar magnet is brought near it as shown in the diagram. What will be the direction of induced current in the wire loop when the magnet is moved towards it?



Ans. Anticlockwise from the side of a magnet. As when magnet is brought near it the magnetic flux increases so the induced current will flow in the direction so as to oppose the current. So, current will be anticlockwise.

139

. The wire in the figure below is being moved downwards through the magnetic field, so as to produce induced current.

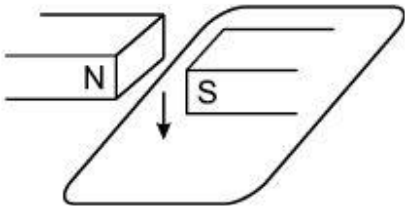
What would be the effect of :

(a) moving the wire at a higher speed?

(b) moving the wire upwards rather than downwards?

(c) using a stronger magnet?

(d) holding the wire still in the magnetic field?



Ans. (a) The induced current increases at a higher speed.

(b) The induced current is reversed.

(b) The induced current increases.

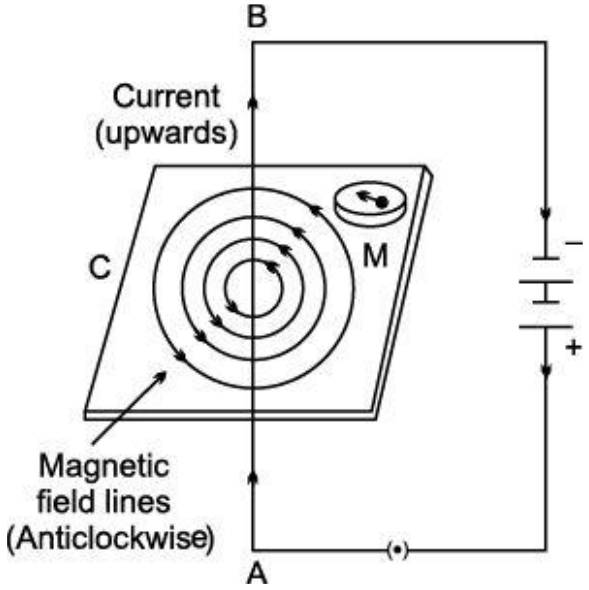
(d) The induced current is zero.

140

. Draw the pattern of magnetic field lines produced around a current carrying straight conductor passing perpendicularly through a horizontal cardboard. State and apply right-hand thumb rule to mark the direction of the field lines. How will the strength of the magnetic field change when the point where magnetic field is to be determined is moved away from the straight conductor? Give reason to justify your answer.*

Ans. Maxwell's Right Hand Thumb rule states that if current carrying wire is imagined to be held in the right hand so that thumb

points in the direction of current, then the direction in which fingers encircle the wire will give the direction of magnetic field lines around the wire. If we hold the current carrying straight wire so that thumbs in upward direction points the direction of current, the direction of magnetic field lines will be anticlockwise. The strength of magnetic field is inversely proportional to the distance of the point of observation from the wire. So, as we move away from the wire the strength of magnet decreases.



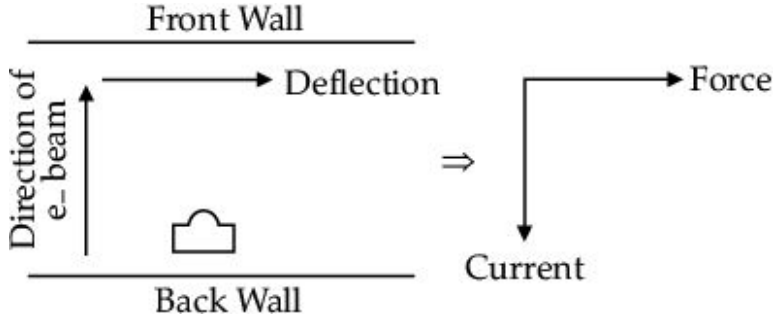
Magnetic field pattern due to a straight current-carrying wire

141

. Imagine that you are setting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field ?

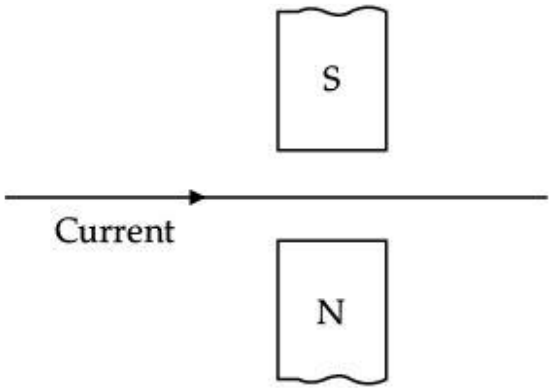
Ans. As the electron beam moves from back wall towards the front wall, it implies that the current is travelling from front to back wall. Deflection towards right side indicate the direction of the force. Thus by using Fleming's left hand rule, the direction of the magnetic field would be from of the room towards the floor,

i.e., from top to bottom or downwards.



142

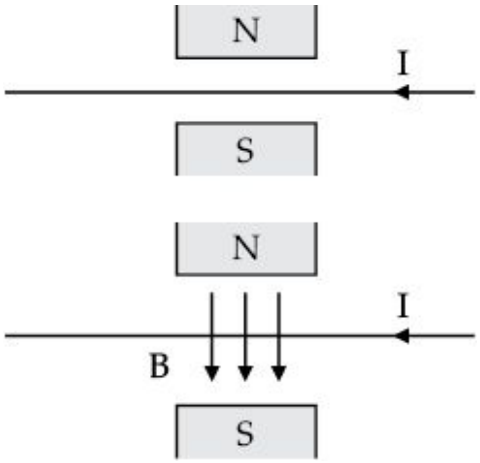
. Which way does the wire carrying current in the given figure tend to move ?



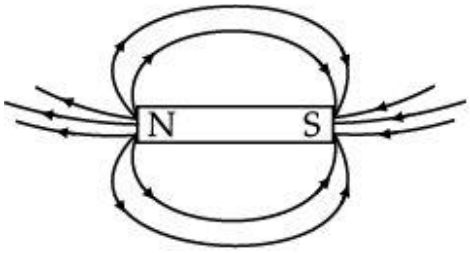
Ans. Applying Fleming's left hand rule, the wire carrying current tends to move upwards (out of the page).

143

. A wire is placed between N and S poles of a magnet as shown in figure. If current flows in the wire as shown, in which direction does the wire tend to move?



Ans. The direction of magnetic field is from N-pole to S-pole; on applying Fleming's left-hand rule, the wire tends to move perpendicular to plane of paper upward.



Practical Based Questions

144

. A student wound an insulated copper wire around a soft iron rod. He then connected one end to the rheostat and the other free end to the battery via a key. He closed the key and observes the deflection in the magnetic needle placed nearby. Now he altered the current using by reversing the connections of the battery and again noted the change in the deflection of the needle.

(a) Why do the student perform this activity ?

(b) What did the student observe ?

(c) Comment on the statement “a material in the middle of a

current carrying coil gets magnetised".

Ans. (a) The student conducted this activity to make an electromagnet.

(b) The electrical current flowing through a coil will create a uniform magnetic field. This magnetic field causes the needle to turn. Reversing, the connections to the battery, reverses the direction of the current flow and the needle will point in the opposite direction.

(c) When an iron rod is placed along the axis of a current carrying coil, it gets magnetised under the influence of the magnetic field produced by the coil through induction. But this magnetism lasts as long as the current supply is not withdrawn.

145

. Answer the following question:

(a) A coil of insulated wire is connected to a galvanometer. What would be seen if a bar magnet with its south pole towards one face of the coil is :*****

(i) moved quickly towards it

(ii) moved quickly away from it

(iii) placed near its one face ?

These activities are then repeated with north pole of the magnet. What will be the observations ?

(b) Name and define the phenomenon involved in above activities.

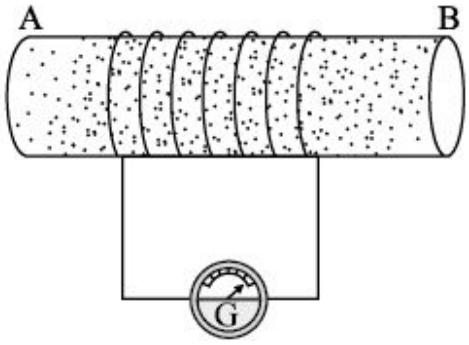
(c) Name the rule which can determine the direction of current in each case.

Ans. (a) A coil of insulated wire is connected to a galvanometer and if a bar magnet with its south pole towards one face of the coil is

(i) Moved quickly towards it, the galvanometer is deflected towards the left.

(ii) Moved quickly away from it, the galvanometer is deflected towards the right.

(iii) If the magnet is held stationary inside the coil, the deflection of the galvanometer is zero as no change in flux.



If this activity is repeated with north pole of the magnet :

(i) If the magnet is pushed into the coil, the galvanometer is deflected towards the right.

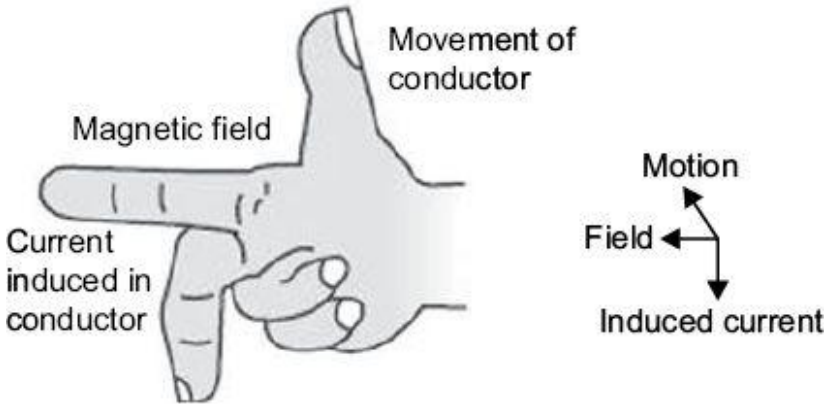
(ii) If the magnet is withdrawn from the coil, the galvanometer is deflected towards the left.

(iii) If the magnet is held stationary inside the coil, the deflection of the galvanometer is zero.

(b) The phenomenon involved in this activity is electromagnetic induction. The production of electric current by moving a magnet

inside a fixed coil of wire is called electromagnetic induction.

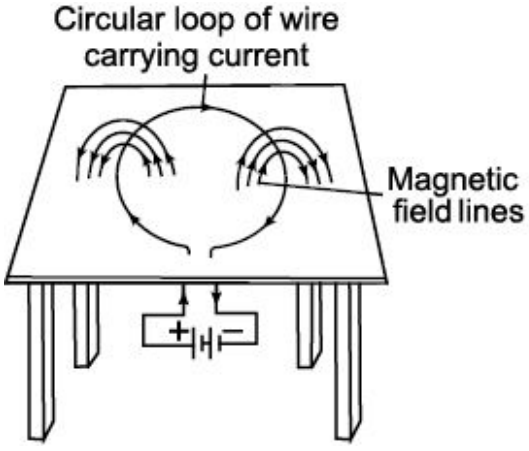
(c) The direction of induced current is determined by 'Fleming's right hand rule'.



146

. Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clock-wise. Apply the right hand rule to find out the direction of the magnetic field inside and outside the loop.**[NCERT]**

Ans. Since, the current is flowing clockwise through a circular loop. The direction of magnetic field around the conductor can be found by using the right hand thumb rule. As the figure shows, the magnetic field would be towards the plane of the paper when it is inside the loop. On the other hand, the magnetic field would be away from the paper when it is outside the loop.



147

. A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is :

(a) pushed into the coil ?

(b) held stationary inside the coil ?

(c) withdrawn from the coil ?**[NCERT]**

Ans. (a) When a bar magnet is pushed into the coil, a momentary deflection is observed in the galvanometer.

(b) When the bar magnet is held stationary inside the coil, there is no deflection in the galvanometer.

(c) When the bar magnet is withdrawn from the coil, the deflection in the galvanometer is in the opposite direction.

Creating Based Questions

148

. Using the following informations form a pathway that defines the working of the electric motor. And also include informations that are not mentioned below to complete it.

Battery, Horse-shoe magnet, vertical position, Commutator, rectangle coil, Magnetic force, horizontal position.

Ans. Rectangle coil is placed between horse-shoe magnet $\longrightarrow$ **Coil is connected to the battery** through brush and commutator $\longrightarrow$ The **current flow through the coil which is placed between magnetic field** $\longrightarrow$ **Rectangle coil rotates** from the horizontal position $\longrightarrow$ The **current stops flowing when the coil attains vertical position** because the brush and the

commutator ring will not be in connection ⟶ Though the coil keeps **rotating because of the momentum** from the earlier rotation ⟶ Now the coil attains horizontal position ⟶ Coil again starts to rotate ⟶ With the help of **Fleming's left-hand rule**, the direction of the rotation of the coil is determined.

149

. Using the following informations form an instruction to draw magnetic lines. And also include informations that are not mentioned below to complete it.

Magnetic compass, repel, board, Bar magnet, Needle, attract, Merge, Emerge.

Ans. Place a board ⟶ Place a bar magnet in the **middle** ⟶ Mark the boundary of the bar magnet ⟶ Place the magnetic compass near the **North Pole of the bar magnet** ⟶ **North side of the needle points away from the north side of the magnet** ⟶ Same poles repel each other ⟶ different poles attract each other ⟶ Now place the **pin in the direction the needle points** ⟶ Move the compass to **new position where south pole points the previous position of the north pole** ⟶ Repeat the procedure ⟶ Magnetic lines emerge at north pole ⟶ Magnetic lines merge at south pole ⟶ This forms **concentric magnetic lines around bar magnet**.

150

. What would be the inference made by Prashant about the magnetic strength when current passed through a circular coil produces a magnetic field ?

Ans. 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.

151

. Selena measures the magnetic field produced by an infinitely long wire, a rectangular loop, a solenoid of finite length, a circular loop where all the four carries the same amount of current. After her experiment, she tends to notice that the magnetic field produced by certain cases is similar to the magnetic field produced by the bar magnet. Find out the cases in which both the magnetic fields are equal ?

Ans. Solenoid is the only thing which is tightly-packed and wound in terms of close loops. If current is passed inside a solenoid which is of finite length, the closely packed loops inside it produce a magnetic field which resembles the magnetic field of a bar magnet. Other than this, the circular or rectangular loop doesn’t produce much magnetic field as that of a bar magnet.

152

. Blair wants to measure magnetic field. Suggest her a better instrument which would measure magnetic field approximately.

Ans. Blair can use Flux meter to measure the magnetic field since it can be used to predict the flux amount produced in the permanent magnet due to its low controlling torque and its heavy electromagnetic damping. It is better than a ballistic galvanometer since it has high torque and its accuracy is less.

153

. Using the following informations form an instruction to draw magnetic lines. And also include informations that are not

mentioned below to complete it.

Magnetic compass, repel, board, Bar magnet, Needle, attract, Merge, Emerge.

Ans. Place a board ⟶ Place a bar magnet in the middle ⟶ Mark the boundary of the bar magnet ⟶ Place the magnetic compass near the North Pole of the bar magnet ⟶ North side of the needle points away from the north side of the magnet ⟶ Same poles repel each other ⟶ different poles attract each other ⟶ Now place the pin in the direction the needle points ⟶ Move the compass to new position where south pole points the previous position of the north pole ⟶ Repeat the procedure ⟶ Magnetic lines emerge at north pole ⟶ Magnetic lines merge at south pole ⟶ This forms concentric magnetic lines around bar magnet.

154

. What would be the inference made by Prashant about the magnetic strength when current passed through a circular coil produces a magnetic field?

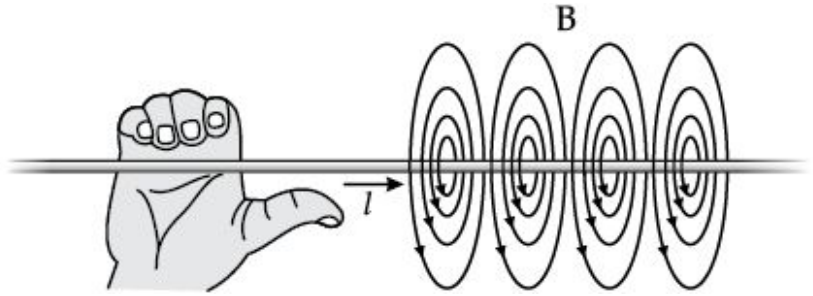
Ans

. 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.

155

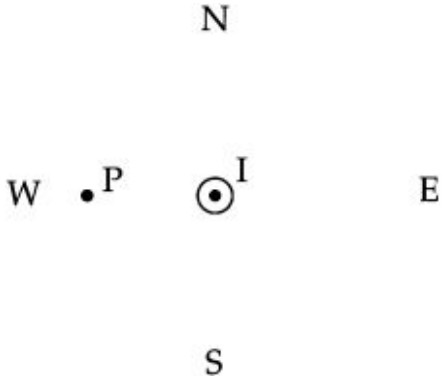
. Read the passage carefully and answer any four questions from Q.155(i) to Q.155(v).

The magnetic field lines of an infinite wire are circular and centered at the wire and they are identical in every plane perpendicular to the wire as shown in the figure.



Since the field decreases with distance from the wire, the spacing of the field lines must increase correspondingly with distance. The direction of this magnetic field may be found with a second form of the right-hand rule. If you hold the wire with your right hand so that your thumb points along the current, then your fingers wrap around the wire in the same sense as B→.

(i) A vertical wire carries an electric current out of the page. What is the direction of the magnetic field at point P located to the west from the wire?



(a) North

(b) South

(c) East

(d) Down

(ii) A student writes the following statements on the characteristics of magnetic field lines:

(I) The magnetic field lines are imaginary lines.

(II) The magnetic field lines has only magnitude.

(III) The magnetic field lines are closed curves.

(IV) The magnetic field lines emerge from the south pole of a magnet.

Choose the correct statement(s) from the following:

(a) Only (I)

(b) Both (I) and (II)

(c) Both (I) and (III)

(d) Both (II) and (IV)

(iii) A current carrying conductor is held in exactly vertical direction. In order to produce a clockwise magnetic field around the conductor, the current should be passed in the conductor:

(a) from top to bottom

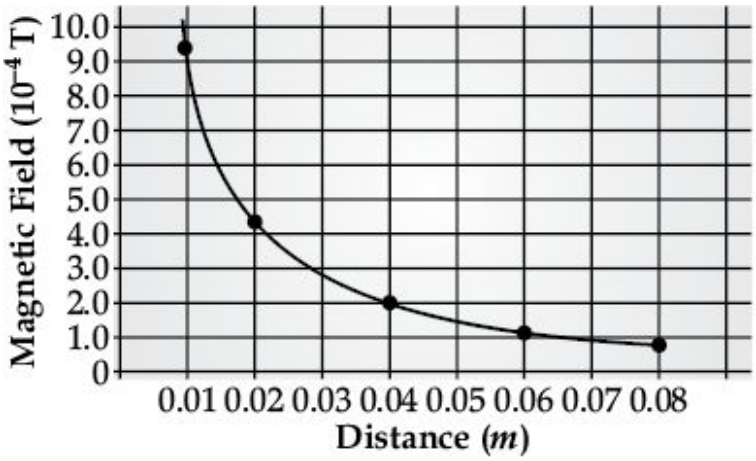
(b) from left to right

(c) from bottom to top

(d) from right to left

(iv) A student plotted the variation of magnetic field around a straight current carrying wire and the distance from the wire where the magnetic field is measured. Study the graph below and answer

the question that follows:



The magnetic field around a current carrying straight wire:

(a) increases linearly with increase in distance.

(b) decreases with increase in distance.

(c) remains constant.

(d) magnetic field at a point does not depend on distance.

(v) A positive charge is moving towards a person. The direction of magnetic field lines will be in:

(a) clockwise direction

(b) anticlockwise direction

(c) vertically upward direction

(d) vertically downward direction

Ans. (i) (b) South

(ii) (c) Both (I) and (III)

(iii) (a) from top to bottom

(iv) (b) decreases with increase in distance

(v) (b) anticlockwise direction

156

. Using the following informations form a pathway to determine the direction of the motor in an electric motor. And also include informations that are not mentioned below to complete it. Motion of the conductor, Direction of current, three fingers, Magnetic field, Index finger, motion of the conductor.

Ans

. Three fingers ⟶ In left-hand ⟶ Index finger ⟶ Middle finger ⟶ Thumb ⟶ At right angle ⟶ Middle finger represents the direction of the current ⟶ Index finger represents the direction of the magnetic field ⟶ Thumb represents the direction of the motion of the conductor ⟶ Used to define the direction of the motion of the conductor in electric motor ⟶ Also known as motor rule.

157

. Using the following informations form a pathway that defines the working of the electric motor. And also include informations that are not mentioned below to complete it. Battery, Horse-shoe magnet, vertical position, Commutator, rectangle coil, Magnetic force, horizontal position.

Ans

. Rectangle coil is placed between horse-shoe magnet ⟶ Coil is connected to the battery through brush and commutator ⟶ The current flows through the coil which is placed between magnetic field ⟶ Rectangle coil rotates from the horizontal position ⟶ The current stops flowing when the coil attains vertical position because the brush and the commutator ring will

not be in connection ⟶ Though the coil keeps rotating because of the momentum from the earlier rotation ⟶ Now the coil attains horizontal position ⟶Coil again starts to rotate ⟶ With the help of Fleming's left-hand rule, the direction of the rotation of the coil is determined.

158

. Using the following informations form a pathway to determine the direction of the motor in an electric motor. And also include informations that are not mentioned below to complete it. Motion of the conductor, Direction of current, Three fingers, Magnetic field, Index finger, motion of the conductor.

Ans. Three fingers ⟶ **In left-hand** ⟶ Index finger ⟶ Middle finger ⟶ Thumb ⟶ **At right angle** ⟶ **Middle finger represents** the direction of the current ⟶ **Index finger represents** the direction of the magnetic field ⟶ **Thumb represents** the direction of the motion of the conductor ⟶ Used to define the direction of the motion of the conductor in electric motor ⟶ Also known as **motor rule**.

159

. For experimenting purpose, Ram made two electromagnets by wrapping a few turns of wire on one nail and doubled the number of turns of wire for the other nail and let the same amount of electric current passed through it. From his inference, which one tends to have larger magnetic strength ?

Ans. The number of turns of the wire wrapped over the two iron nails is in the ratio of 2 : 1. Electromagnetic strength has a direct relationship with the number of turns wrapped over it. The strength of electromagnet increases with increase in a number of turns of the wire wrapped over the nail and the current

passing through them. Hence, the one with more number of turns tends to have more magnetic strength.

160

. Suggest a method by which Simran could determine the direction of the magnetic field in a generator.

Ans. Fleming's right-hand rule is generally used for determining the direction of the current, magnetic field and the motion of the conductor in a generator. Here, one can determine the directions by placing the thumb, forefinger and the middle finger of the right-hand perpendicular to each other. The thumb represents the motion of the conductor, the forefinger and the middle finger represent the direction of the magnetic field and the induced current respectively.

Miscellaneous Questions

161

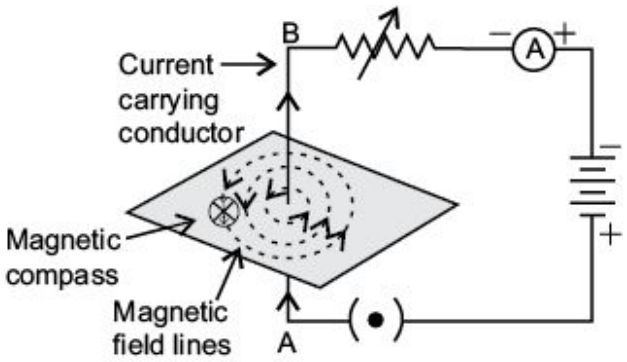
. Draw the pattern of magnetic field lines around a current carrying straight conductor. How does the strength of the magnetic field produce change :******

(a) with the distance from the conductor ?

(b) with an increase in current in a conductor ?

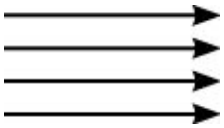
Ans. (a) The strength of a magnetic field is inversely proportional to the square of the distance from the conductor *i.e.,* strength of an electric field decreases with increase in distance.

(b) The strength of the magnetic field is directly proportional to the current passing in the wire *i.e.,* strength of the magnetic field increases with the increase in current.



162

. The magnetic field in a given region is uniform. Draw a diagram to represent it.

Ans. 

163

. How will the direction of force be changed, if the current is reversed in the conductor placed in a magnetic field ?

Ans. The direction of the force will be reversed.

164

. Write the factors on which the strength of magnetic field produced by a current carrying solenoid depends ?

Ans. The strength of magnetic field produced by a current carrying solenoid depends on :

1. The number of turns in the solenoid : Larger the number of turns in the solenoid, greater will be the magnetism produced.

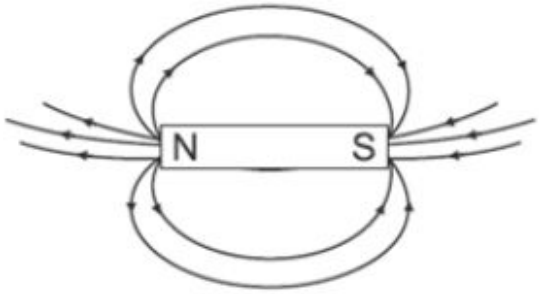
2. The strength of current in the solenoid : Larger the current passed through solenoid, stronger will be the magnetism produced.

3. The nature of core material used in making solenoid : The use of soft iron rod as core in a solenoid produces the stronger magnetism.

165

. Draw magnetic field lines around a bar magnet.

Ans.



166

. List the properties of magnetic lines of force.

Ans. Properties of magnetic field lines:

(a) Magnetic field lines follow the direction from the North Pole to the South Pole.

(b) Magnetic field lines always form closed circular loops.

(c) Magnetic field lines do not cross one another.

(d) Closer the field lines; stronger is the magnetic field and vice-versa.

(e) Magnetic field lines are closer near the poles; which shows greater strength of magnetic field near the poles.

167

. Name some devices in which electric motors are used. [NCERT]

Ans. Electric fan, mixer grinder, tape recorder, CD player, hard disk

drive, washing machine, cooler, toy car, vacuum cleaner, etc., are some devices in which electric motor is used.

168

. List three sources of magnetic fields.

Ans. Three methods of producing magnetic fields are as follows:

(a) By permanent magnet.

(b) By electromagnet

(c) By current carrying conductors.

169

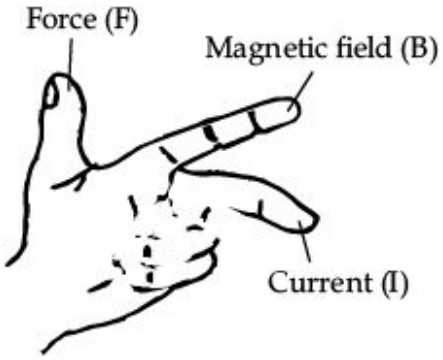
. **(a)** State Fleming's left hand rule.*

(b) Write the principle of working of an electric motor.

(c) Explain the function of following parts of an electric motor:

(d) Armature (ii) Brushes (iii) Split ring.

Ans. (a) According to this rule, stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular. If the first finger points in the direction of magnetic field and the second finger in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor.



(b) Principle of electric motor : When a coil carrying current is placed in a magnetic field, it will experience a force. As a result of this force, the coil begins to rotate.

(c) (i) **Armature:** It creates a magnetic field and the second role is to generate electromotive force.

(ii) Brushes: Carbon brushes are used to make contract with the rotating rings of the commutator and through them to supply current to the coil.

(iii) Split ring: Split rings are used to reverse the direction of current flowing through the coil every time the coil just passes the vertical position during a revolution.

170

. Explain different ways to induce current in a coil.[NCERT]

Ans. The different ways to induce current in a coil are :

1. By moving the coil in a magnetic field.

2. By changing the magnetic field around the coil.

171

. Complete the following sentences :

(a) A current carrying solenoid behaves like a ……

(b) A current or a moving charge produces a …… around it.

Ans

. (a) bar magnet (b) magnetic field.

172

. What are the factors affecting the strength of an electromagnet ?

Ans. Factors affecting the strength of an electromagnet : The strength of an electromagnet depends on :

1. The number of turns in the coil : If we increase the number of turns in the coil, the strength of electromagnet increases.

2. The current flowing in the coil : If the current in the coil is increased, the strength of electromagnet increases.

3. The length of air gap between its poles : If we reduce the length of air gap between the pole of an electromagnet, then its strength increases.

Self-Assessment

173. Answer the following questions:

(a) What are magnetic field lines?

(b) List any two properties of magnetic field lines.

174. Consider a straight conductor passing vertically through a card-board having some iron filings sprinkled on it. A current is passed in the conductor in downward direction and the card-board is gently tapped. Show the setting of iron filings on the card-board and draw arrows to represent the direction of magnetic field lines.

175. A coil of insulated copper wire is connected to a galvanometer. What will happen if the coil is :

(a) pushed towards a bar magnet.

(b) taken away from a bar magnet.

(c) held stationary near a bar magnet.

176

. How can you demonstrate that a momentary current?

177

. The presence of magnetic field at a point can be detected by means of :

(a) a solenoid

(b) a compass needle

(c) a bar magnet

(d) a current carrying wire

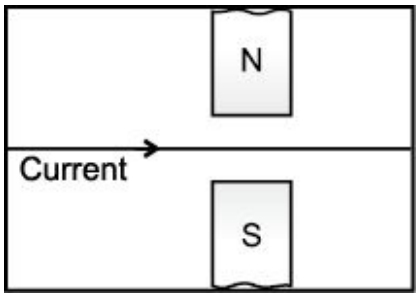
Ans. (b) a compass needle

178

. Name and state the rule through which the polarity at the ends of a current carrying solenoid is determined.

179

. Which way does the wire carrying current in given figure tend to move ?



Ans. Downward (into the page)

180

. The direction of induced current is obtained by :

(a) Right hand thumb rule

(b) Fleming's left hand rule

(c) Fleming's right hand rule

(d) Clock face rule.

Ans. (c) Fleming's right hand rule

181

. State the rule which gives the direction of a magnetic field produced by a straight current carrying conductor.

182

. State the rule which determines the direction of induced current in electromagnetic induction.

183

. Why is soft iron generally used as the core of an electromagnet ?

184

. If you hold a coil of wire next to a magnet, no current, flows in the coil. What else is needed to induce a current ? Explain your answer.

185

. **Assertion :** The force experienced by a current carrying conductor placed in a magnetic field is largest when they both are perpendicular to each other.

Reason : According to Fleming's Right Hand Rule, the magnetic field is largest when both forces are perpendicular to each other.

186

. State Fleming's left hand rule.

187

. Give the principle of electric motor?

188

. What is electromagnetic induction?

189

. What is induced potential difference and induced current?

190

. State Fleming’s Right hand rule.

191

. Give the difference between Fleming’s left and right hand rule.

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