
NDA-CDS 2 2024
GS
LIVE
PHYSICS
CLASS 11
NAVJYOTI SIR
SSBCrack EXAMS

12 July 2024 Live Classes Schedule

9:00AM	12 JULY 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:00AM	COMPLETE PSYCH TEST	ANURADHA MA'AM

NDA 2 2024 LIVE CLASSES

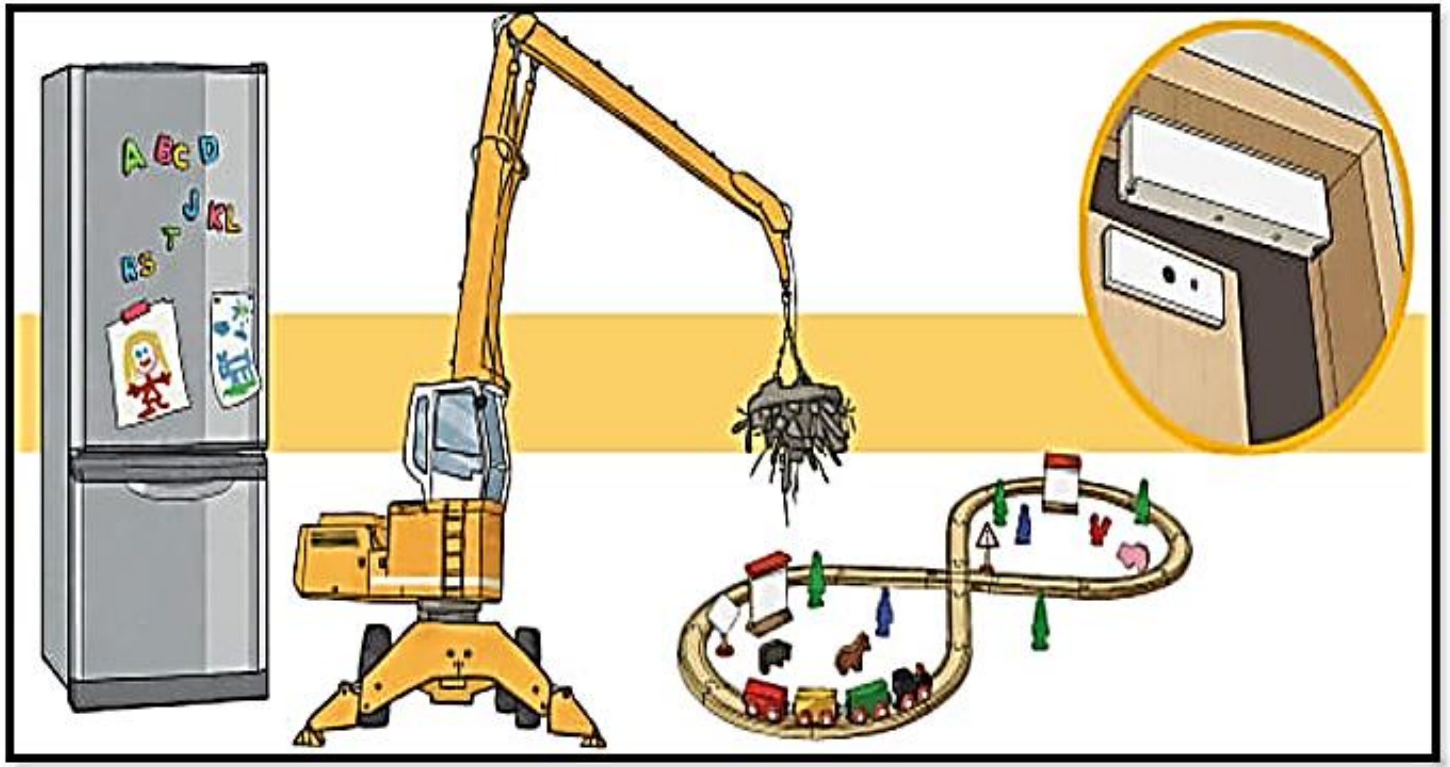
1:00PM	GS - PHYSICS - CLASS 11	NAVJYOTI SIR
5:30PM	ENGLISH - SENTENCE COMPLETION - CLASS 2	ANURADHA MA'AM

CDS 2 2024 LIVE CLASSES

1:00PM	GS - PHYSICS - CLASS 11	NAVJYOTI SIR
5:30PM	ENGLISH - SENTENCE COMPLETION - CLASS 2	ANURADHA MA'AM

SSBCrack EXAMS

MAGNETISM



WHAT WILL WE STUDY ?

- Magnets and Magnetism
- Magnetic Field Lines
- B due to straight current carrying wire
- B due to current through a circular loop
- Solenoid
- Force on a conductor in a Magnetic Field
- Electromagnetic Induction
- Domestic Circuit and Fuse

MAGNETS AND MAGNETISM

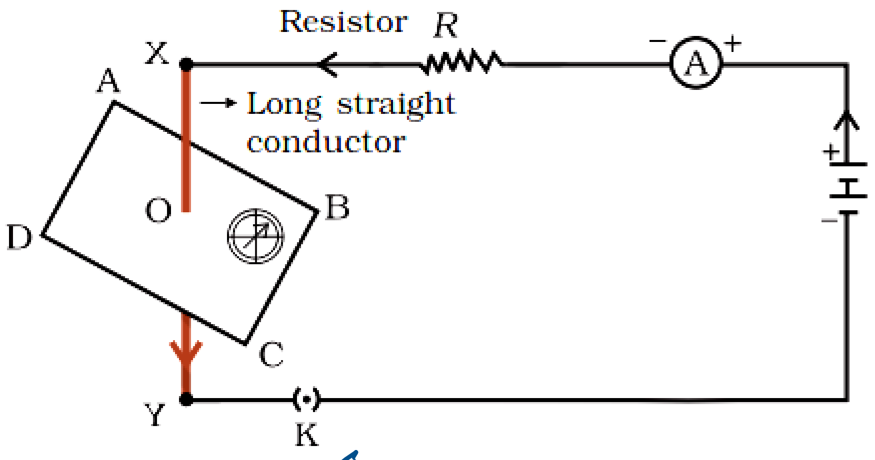
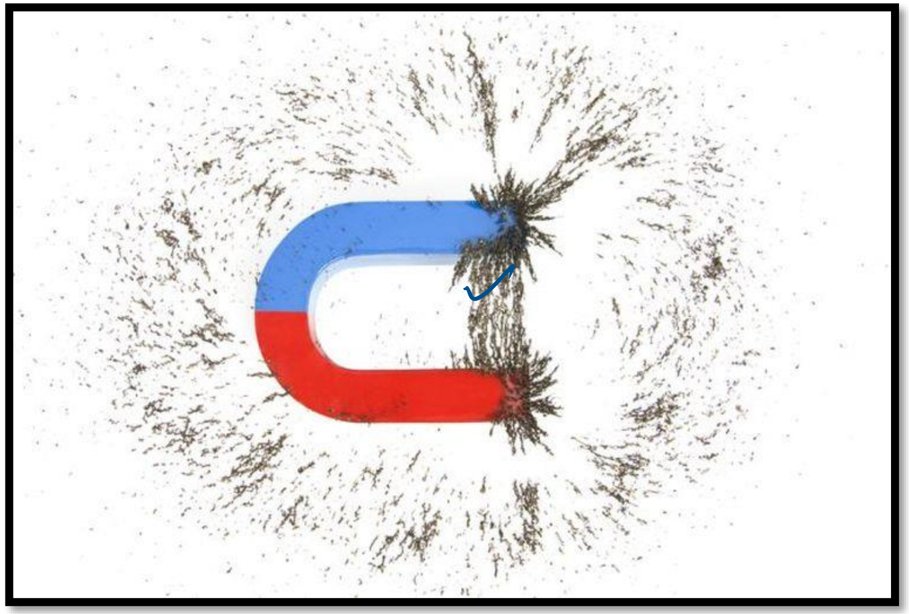


Figure 12.1
Compass needle is deflected on passing an electric current through a metallic conductor

- **A magnetic field is produced due to current carrying conductor which deflects magnetic compass.**

MAGNETIC FIELD

- The space in the surrounding of a magnet or any current carrying conductor in which its magnetic influence can be experienced.



At ends, strength is maximum.

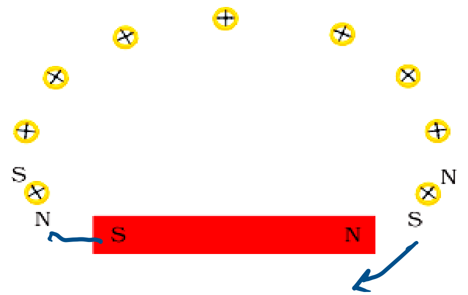


Figure 12.3
Drawing a magnetic field line with the help of a compass needle

bar-magnet

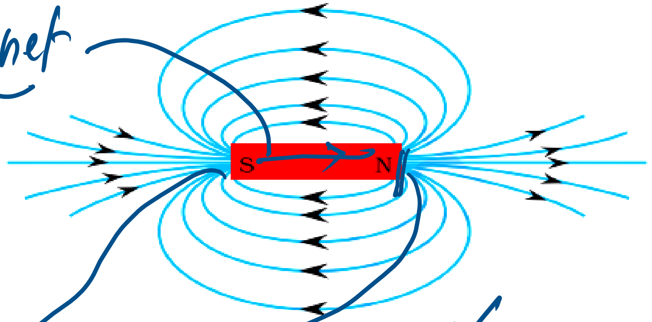
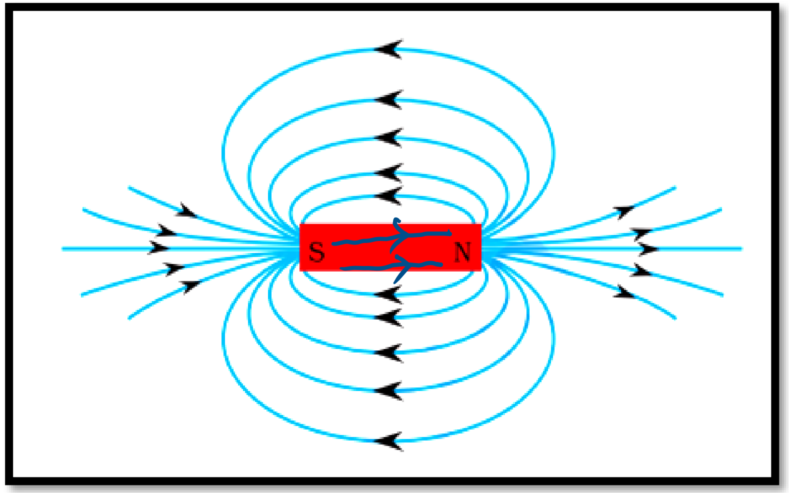


Figure 12.4
Field lines around a bar magnet

FIELD LINES

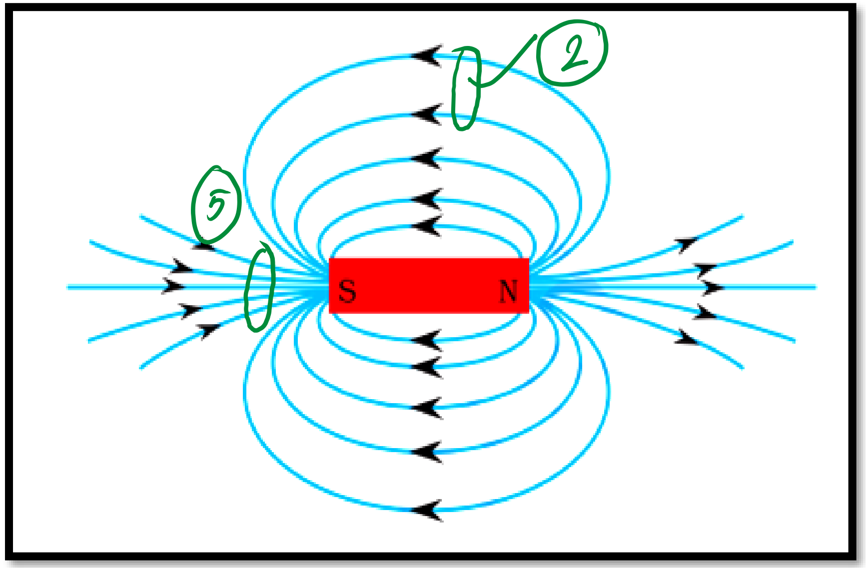
- Magnetic field is a quantity that has both direction and magnitude.
- The direction of the magnetic field is taken to be the direction in which a north pole of the compass needle moves inside it.
- Therefore it is taken by convention that the field lines emerge from north pole and merge at the south pole.
- Inside the magnet, the direction of field lines is from its south pole to its north pole. Thus the magnetic field lines are closed curves.

(complete curve)



FIELD LINES

- The relative strength of the magnetic field is shown by the degree of closeness of the field lines.
- No two field-lines are found to cross each other. If they did, it would mean that at the point of intersection, the compass needle would point towards two directions, which is not possible.



In same area, more no. of field lines entering/moving out means more strength.

RIGHT HAND THUMB RULE

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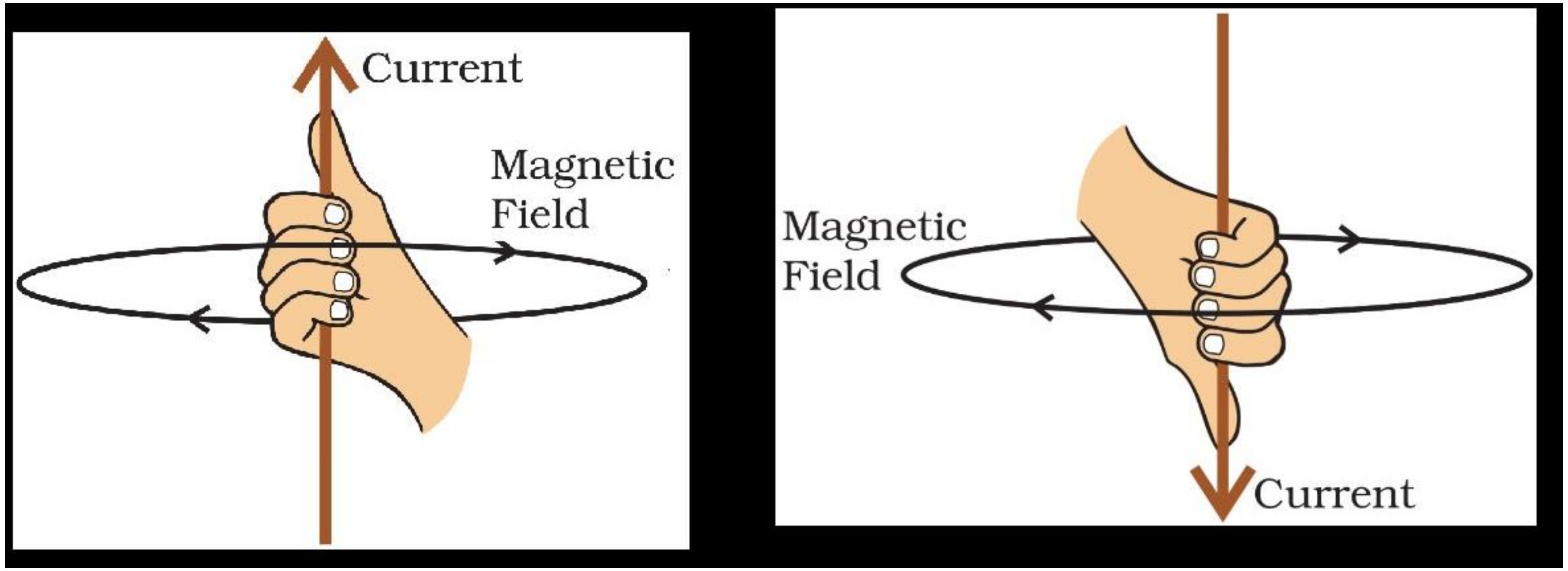

A convenient way of finding the direction of magnetic field associated with a current-carrying conductor.

B DUE TO STRAIGHT CURRENT CARRYING WIRE

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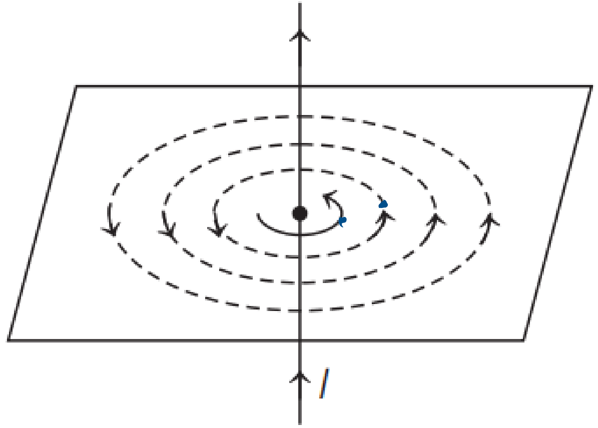
The magnetic field lines due to a straight current carrying conductor are concentric circles having centre at conductor and in a plane perpendicular to the conductor.

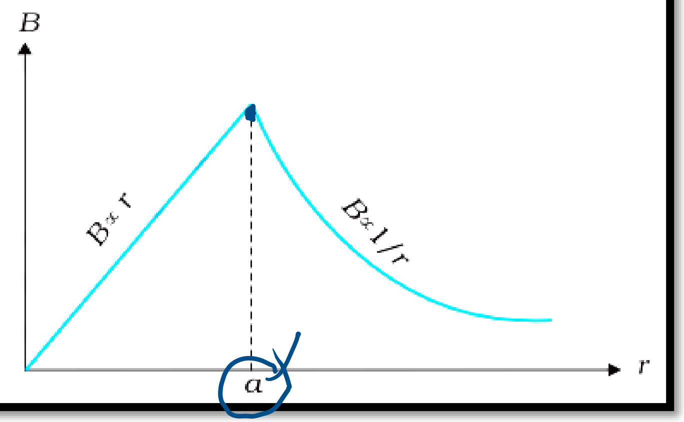


concentric circles

$B = \mu_0 I / (2\pi r)$

constant (permittivity of free space)

distance from wire



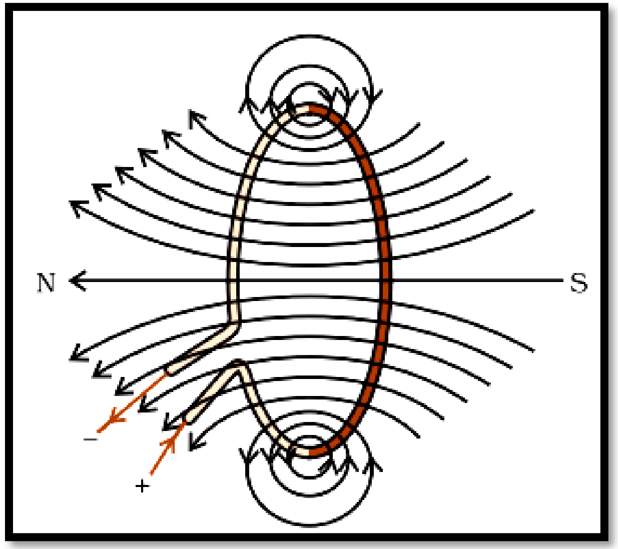
outside wire, $B \propto \frac{1}{r}$

inside wire, $B \propto r$

a – thickness of wire,

B DUE TO CURRENT THROUGH A CIRCULAR LOOP

- At every point of a current-carrying circular loop, the concentric circles representing the magnetic field around it would become larger and larger as we move away from the wire.
- By the time we reach at the centre of the circular loop, the arcs of these big circles would appear as straight lines.
- By applying the right hand rule, it is easy to check that every section of the wire contributes to the magnetic field lines in the same direction within the loop.



B DUE TO CURRENT IN A SOLENOID

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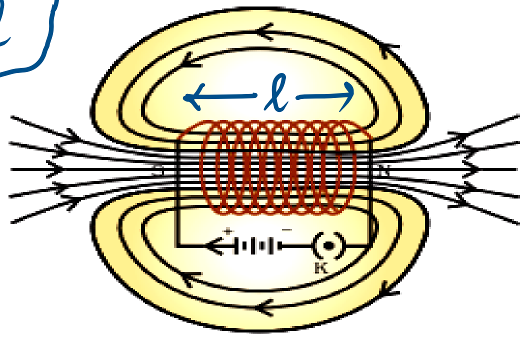


Figure 12.10
Field lines of the magnetic field through and around a current carrying solenoid.

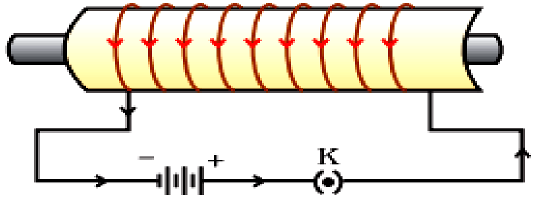


Figure 12.11
A current-carrying solenoid coil is used to magnetise steel rod inside it – an electromagnet.

$$B = \mu_0 n I$$

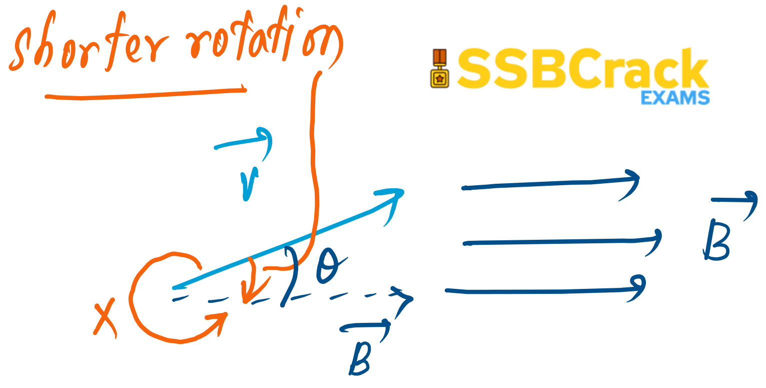
- A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid.

- One end of the solenoid behaves as a magnetic north pole, while the other behaves as the south pole.

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

- A strong magnetic field produced inside a solenoid can be used to magnetise a piece of magnetic material, like soft iron, when placed inside the coil (Fig. 12.11). The magnet so formed is called an electromagnet.

Force in a Magnetic Field



1. On a charged particle ,

$$\mathbf{F} = q\,(\mathbf{v} \times \mathbf{B})$$

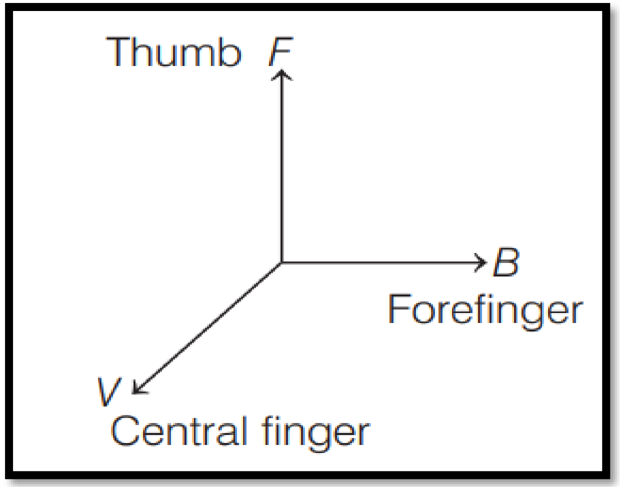
(perpendicular to plane containing $\vec{v}$ and $\vec{B}$)

$F = qvB\sin\theta$

2. On a conductor of length l' ,

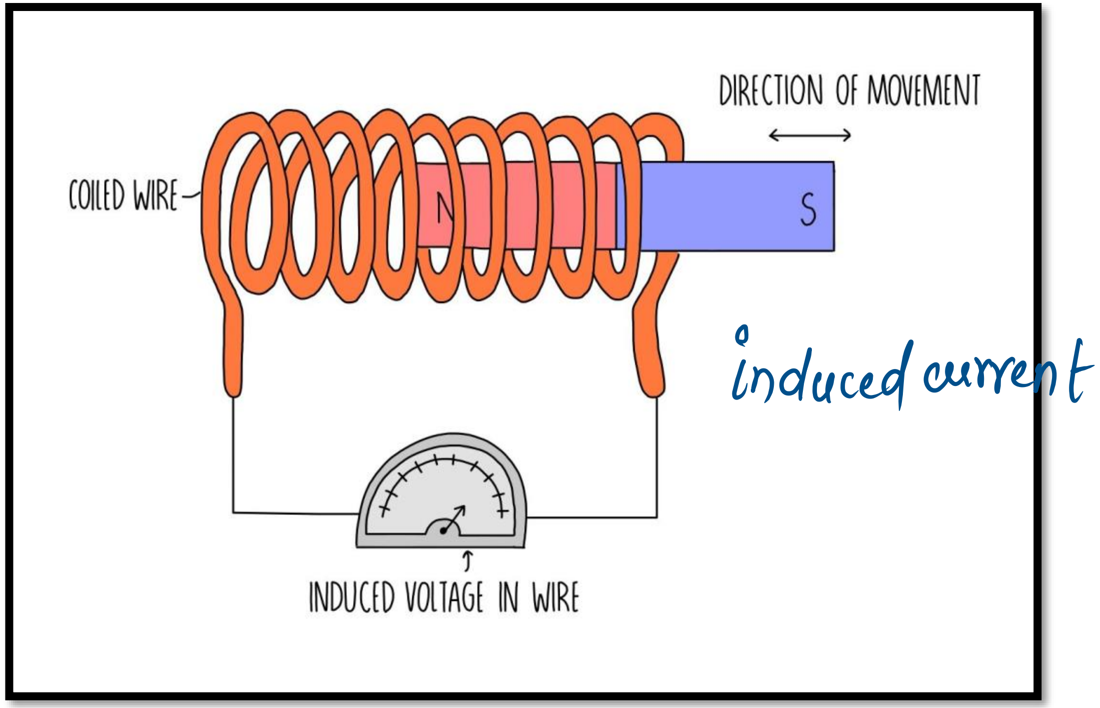
$$\mathbf{F} = I\,(\mathbf{l} \times \mathbf{B})$$

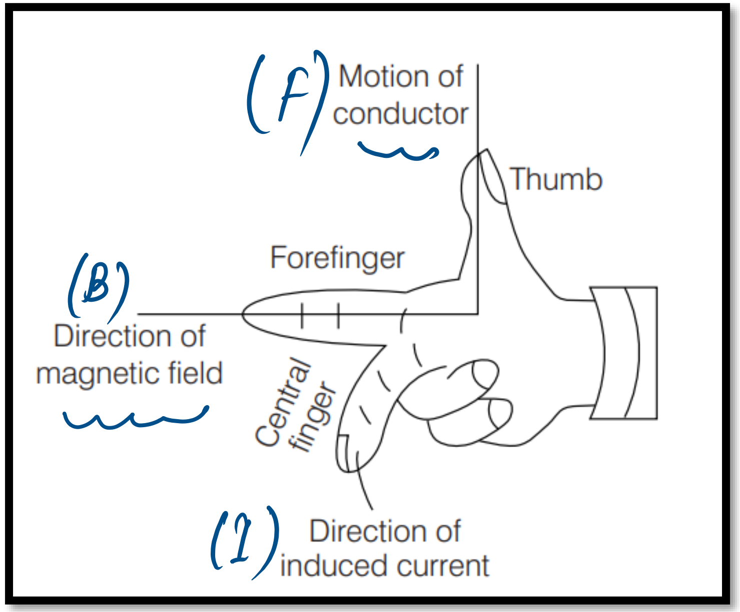
$F = IlB\sin\theta$



ELECTROMAGNETIC INDUCTION

Whenever the magnetic flux linked with an electric circuit changes, an emf is induced in the circuit. This phenomenon is called electromagnetic induction.





AC AND DC GENERATOR

generating current (electromagnetic induction)

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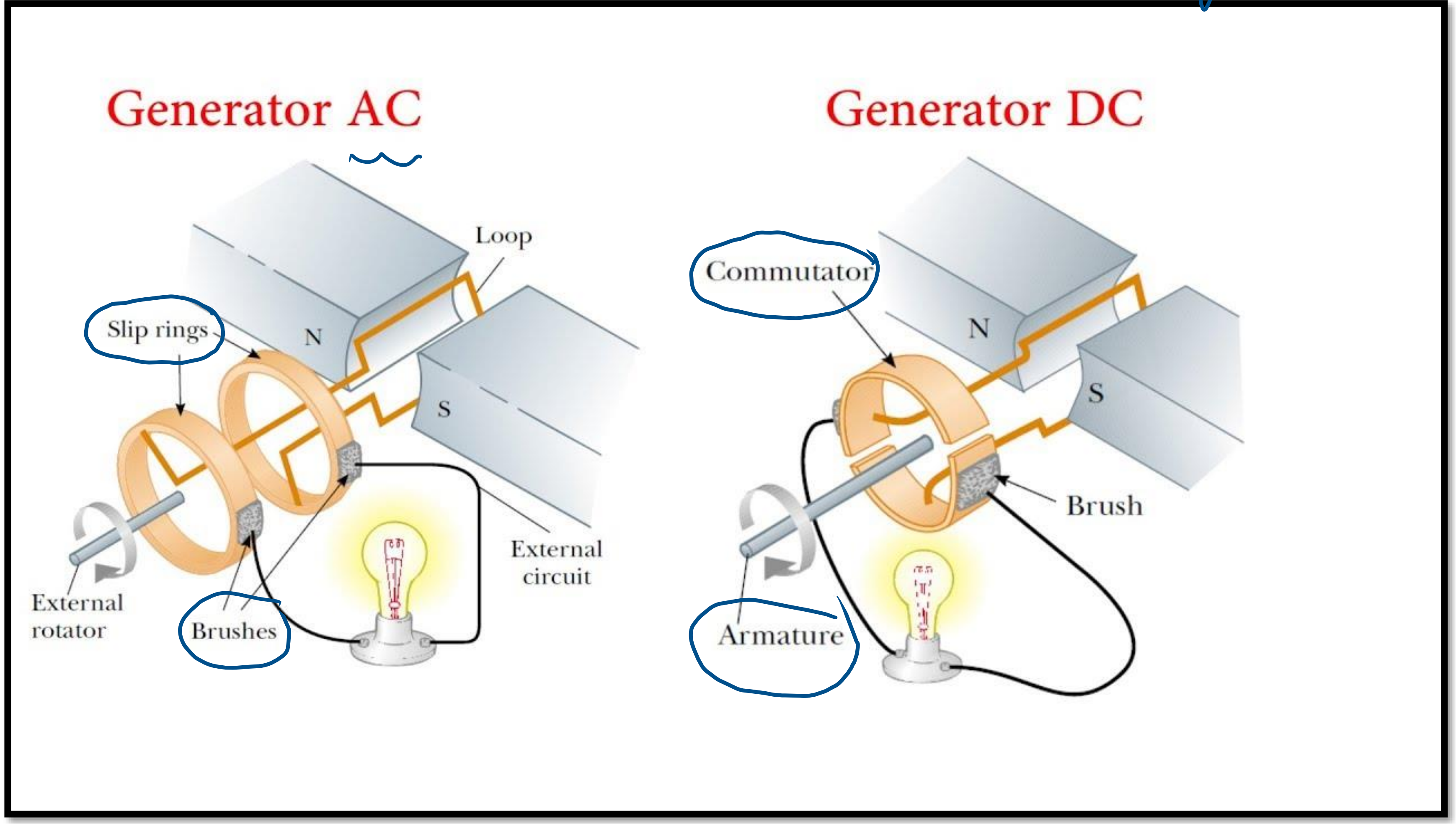
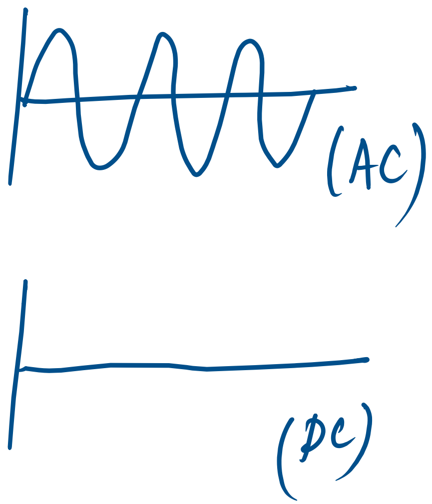
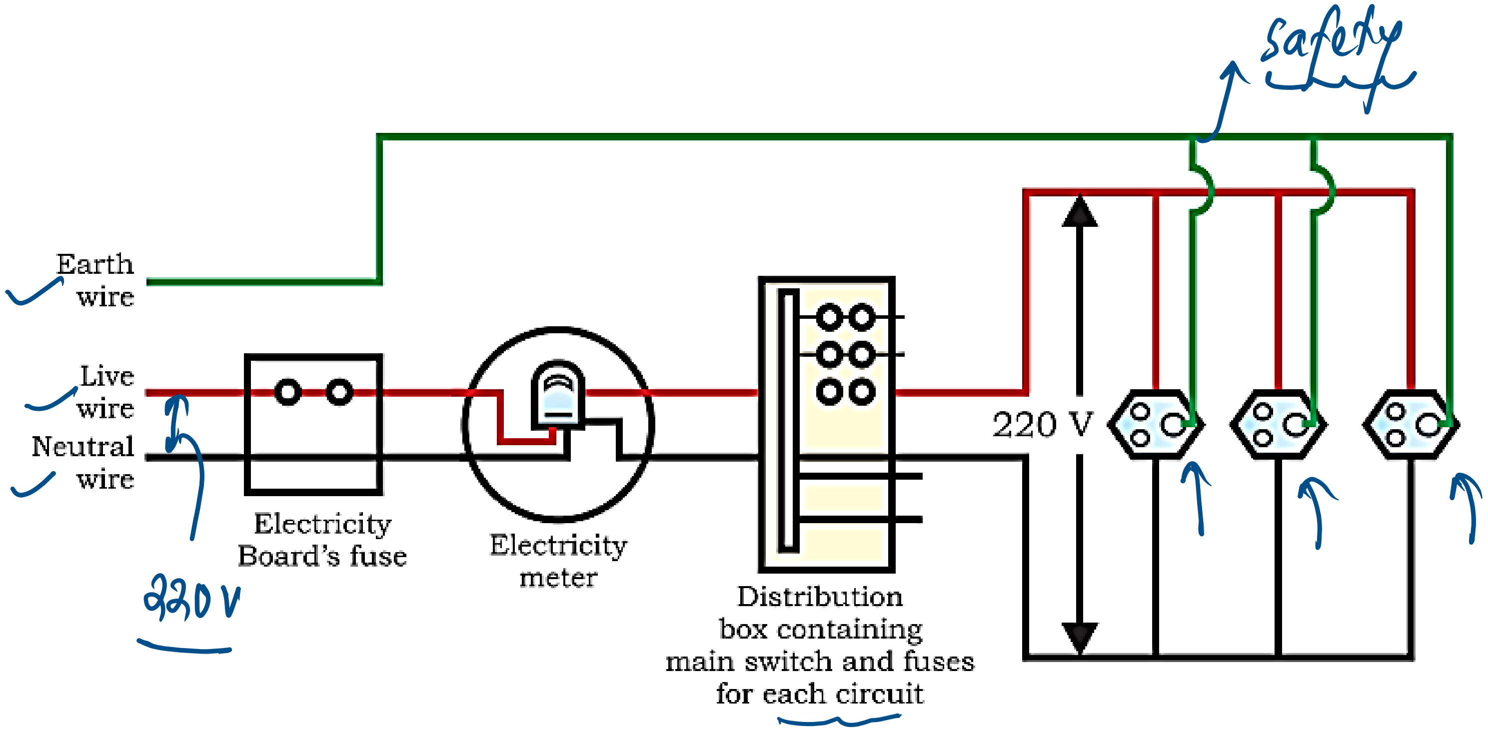




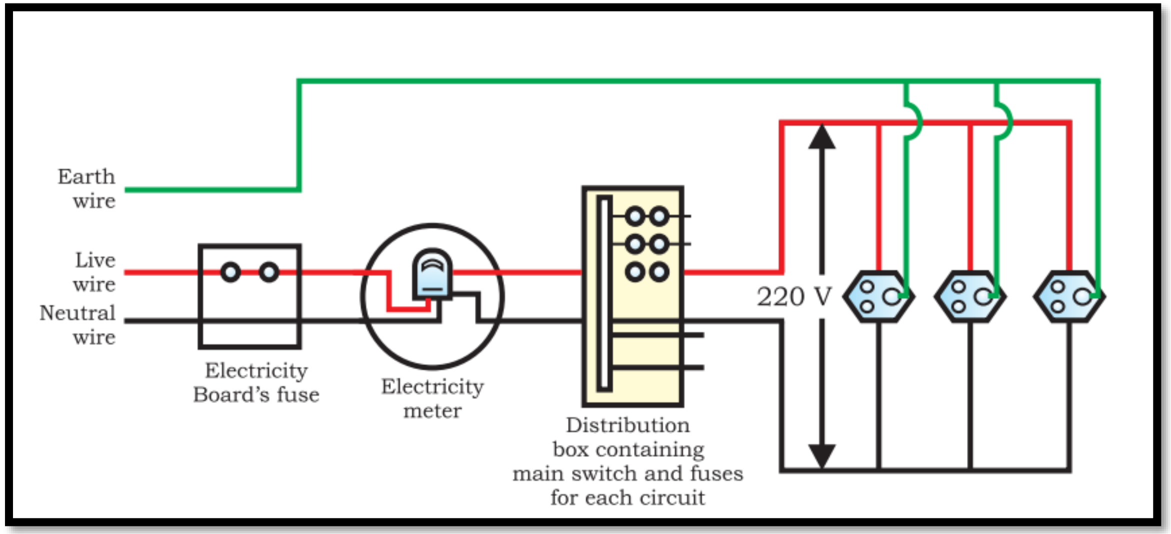
DOMESTIC ELECTRIC CIRCUITS



- One of the wires in this supply, usually with red insulation cover, is called live wire (or positive). Another wire, with black insulation, is called Neutral wire (or negative). The potential difference between the two is 220 V.

DOMESTIC ELECTRIC CIRCUITS

SSBCrack EXAMS



- The Earth wire, which has insulation of green colour, is usually connected to a metal plate deep in the earth near the house. This is used as a safety measure, especially for those appliances that have a metallic body, for example, electric press, toaster, table fan, refrigerator, etc.
- The metallic body is connected to the earth wire, which provides a low-resistance conducting path for the current. Thus, it ensures that any leakage of current to the metallic body of the appliance keeps its potential to that of the earth, and the user may not get a severe electric shock.

FUSE

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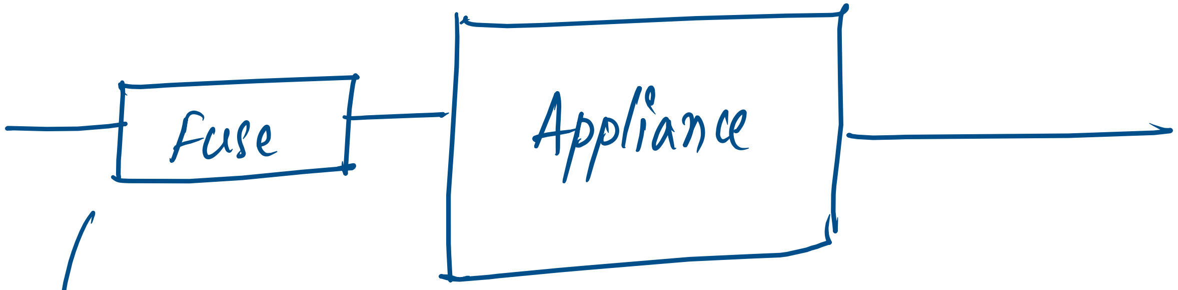
- A fuse in a circuit prevents damage to the appliances and the circuit due to overloading. Overloading can occur when the live wire and the neutral wire come into direct contact. (This occurs when the insulation of wires is damaged or there is a fault in the appliance). Overloading can also occur due to an accidental hike in the supply voltage. Sometimes, overloading is caused by connecting too many appliances to a single socket.
- In such a situation, the current in the circuit abruptly increases. This is called short-circuiting.

FUSE

- The use of an electric fuse prevents the electric circuit and the appliance from a possible damage by <u>stopping the flow of unduly high electric current</u>.
- <u>The Joule heating</u> that takes place in the fuse melts it to break the electric circuit.

$H = I^2Rt$



(melting and breaking the circuit when current exceeds a certain value)

SUMMARY

- Magnets and Magnetism
- Magnetic Field Lines
- B due to straight current carrying wire
- B due to current through a circular loop
- Solenoid
- Force on a conductor in a Magnetic Field
- Electromagnetic Induction
- Domestic Circuit and Fuse

NDA & CDS 2 2024 PHYSICS - CLASS 12

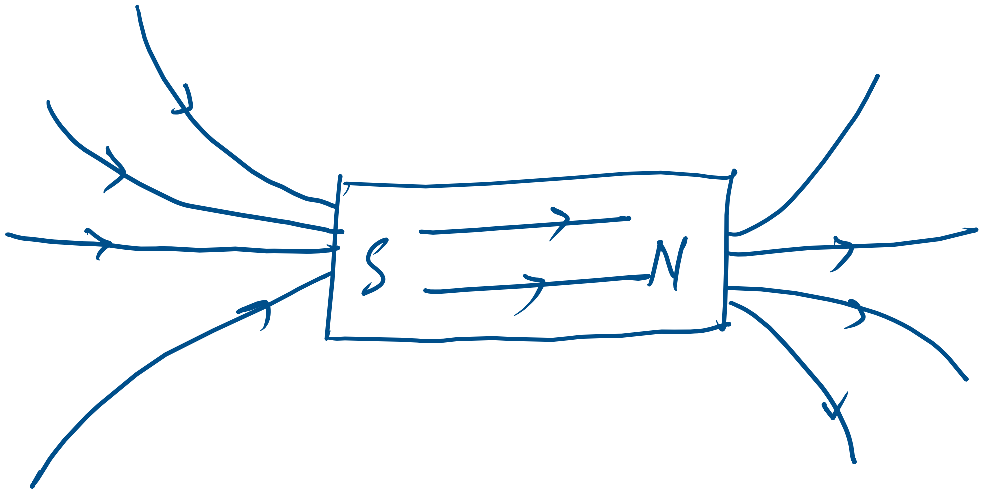
1. Which one of the following statements about magnetic field lines is NOT correct ?

(a) They can emanate from a point

(b) They do not cross each other

(c) Field lines between two poles cannot be precisely straight lines at the ends

(d) There are no field lines within a bar magnet



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(a) They can emanate from a point

(b) They do not cross each other

(c) Field lines between two poles cannot be precisely straight lines at the ends

(d) There are no field lines within a bar magnet

Answer: (D)

2. The magnetic field strength of a current-carrying wire at a particular distance from the axis of the wire

(a) depends upon the current in the wire

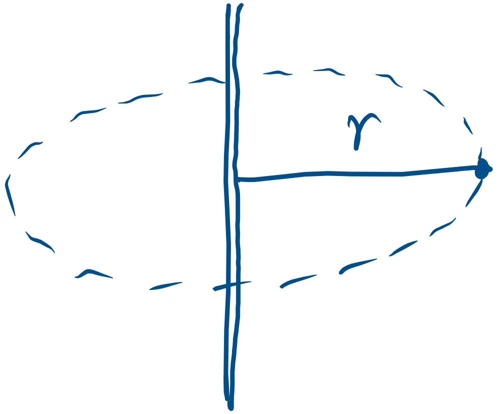
(b) depends upon the radius of the wire

(c) depends upon the temperature of the surroundings

(d) None of the above

$$B = \frac{\mu_0 I}{2\pi r}$$

$$B \propto I$$



2. The magnetic field strength of a current-carrying wire at a particular distance from the axis of the wire

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(b) depends upon the radius of the wire

(c) depends upon the temperature of the surroundings

(d) None of the above

Answer: (A)

3. Consider the following statements about a solenoid :

1. The magnetic field strength in a solenoid depends upon the number of turns per unit length in the solenoid
2. The magnetic field strength in a solenoid depends upon the current flowing in the wire of the solenoid
3. The magnetic field strength in a solenoid depends upon the diameter of the solenoid

Which of the statements given above are correct ?

(a) 1, 2 and 3

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1 and 2 only

$B = \mu_0 n I$

current

no. of turns per unit length,

(no reference of diameter)

SSBCrack EXAMS

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1. The magnetic field strength in a solenoid depends upon the number of turns per unit length in the solenoid
2. The magnetic field strength in a solenoid depends upon the current flowing in the wire of the solenoid
3. The magnetic field strength in a solenoid depends upon the diameter of the solenoid

Which of the statements given above are correct ?

(a) 1, 2 and 3

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1 and 2 only

Answer: (D)

4. Which one of the following statements regarding magnetic field is NOT correct ?

(a) Magnetic field is a quantity that has direction and magnitude

(b) Magnetic field lines are closed curves

(c) Magnetic field lines are open curves

(d) No two magnetic field lines are found to cross each other

4. Which one of the following statements regarding magnetic field is NOT correct ?

(a) Magnetic field is a quantity that has direction and magnitude

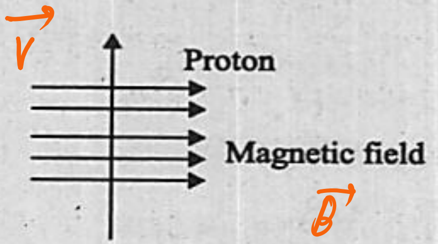
(b) Magnetic field lines are closed curves

(c) Magnetic field lines are open curves

(d) No two magnetic field lines are found to cross each other

Answer: (C)

5. Consider the following image :



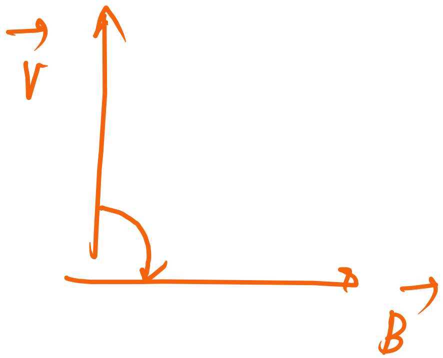
A proton enters a magnetic field at right angles to it, as shown above. The direction of force acting on the proton will be

(a) to the right

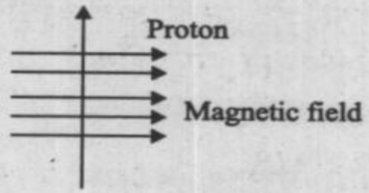
(b) to the left

(c) out of the page

(d) into the page



5. Consider the following image :



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(a) to the right

(b) to the left

(c) out of the page

(d) into the page

Answer: (D)

SSBCrack EXAMS

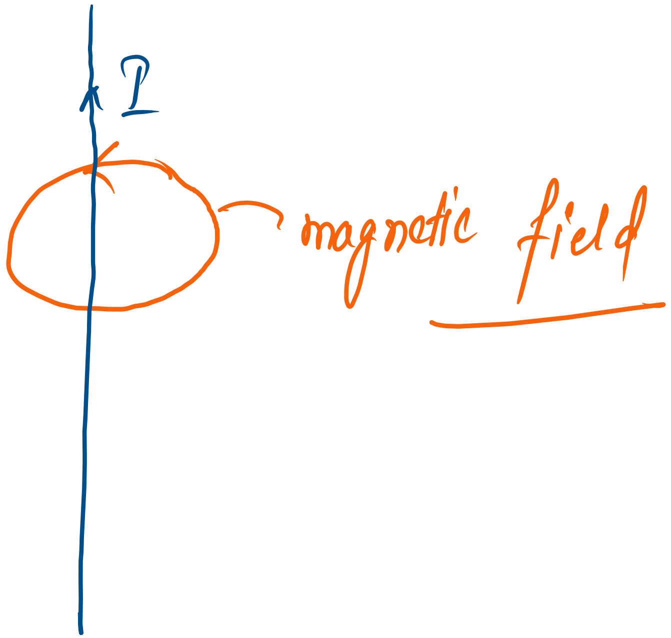
6. Imagine a current-carrying straight conductor with magnetic field of lines in anti-clockwise direction. Then the direction of current is determined by

(a) the Right-Hand Thumb rule and it would be in the downward direction.

(b) the Left-Hand Thumb rule and it would be in the downward direction.

(c) the Right-Hand Thumb rule and it would be in the upward direction.

(d) the Left-Hand Thumb rule and it would be in the upward direction.



6. Imagine a current-carrying straight conductor with magnetic field of lines in anti-clockwise direction. Then the direction of current is determined by

(a) the Right-Hand Thumb rule and it would be in the downward direction.

(b) the Left-Hand Thumb rule and it would be in the downward direction.

(c) the Right-Hand Thumb rule and it would be in the upward direction.

(d) the Left-Hand Thumb rule and it would be in the upward direction.

Answer: (C)

7. The magnetic field produced by a current-carrying straight wire at a point outside the wire depends

(a) inversely on the distance from it

(b) directly on the distance from it

(c) inversely at short distances and directly at large distances from it

(d) directly on the distance (at short distances) and inversely on the distance (at long distances) from it

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(d) directly on the distance (at short distances) and inversely on the distance (at long distances) from it

Answer: (D)

8. According to Fleming's right-hand rule, if the forefinger indicates the direction of magnetic field and thumb shows the direction of motion of conductor, then the stretched middle finger will predict the direction of

(a) force acting on the conductor

(b) electric field

(c) induced current

(d) current

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(b) electric field

(c) induced current

(d) current

Answer: (D)

9. A DC generator works on the principle of

(a) Ohm's law

(b) Joule's law of heating

(c) Faraday's laws of electromagnetic induction

(d) None of the above

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(a) Ohm's law

(b) Joule's law of heating

(c) Faraday's laws of electromagnetic induction

(d) None of the above

Answer: (C)

10. The presence of magnetic field can be determined using which one of the following instruments?

(a) Ammeter

(b) Voltmeter

(c) Magnetic needle

(d) Motor

•

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(a) Ammeter

(b) Voltmeter

(c) Magnetic needle

(d) Motor

Answer: (C)

11. A positive charge is moving towards south in a space where magnetic field is pointing in the north direction. The moving charge will experience :

(a) a deflecting force towards north direction.

(b) a deflecting force towards east direction.

(c) a deflecting force towards west direction.

(d) no deflecting force.

11. A positive charge is moving towards south in a space where magnetic field is pointing in the north direction. The moving charge will experience :

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(b) a deflecting force towards east direction.

(c) a deflecting force towards west direction.

(d) no deflecting force.

Answer: (D)

12. Choose the incorrect statement from the following regarding magnetic lines of field

A. The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points

B. Magnetic field lines are closed curves

C. If magnetic field lines are parallel and equidistant, they represent zero field strength

D. Relative strength of magnetic field is shown by the degree of closeness of the field lines

12. Choose the incorrect statement from the following regarding magnetic lines of field

A. The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points

B. Magnetic field lines are closed curves

C. If magnetic field lines are parallel and equidistant, they represent zero field strength

D. Relative strength of magnetic field is shown by the degree of closeness of the field lines

13. For a current in a long straight solenoid N and S poles are created at the two ends. Among the following statements, the incorrect statement is

(a) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid

(b) The strong magnetic field produced inside the solenoid can be used to magnetize a piece of magnetic material like soft iron, when placed inside the coil

(c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet

(d) The N- and S-poles exchange position when the direction of current through the solenoid is reversed.

13. For a current in a long straight solenoid N and S poles are created at the two ends. Among the following statements, the incorrect statement is

(a) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid

(b) The strong magnetic field produced inside the solenoid can be used to magnetize a piece of magnetic material like soft iron, when placed inside the coil

(c) **The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet**

(d) The N- and S-poles exchange position when the direction of current through the solenoid is reversed.

14. A constant current flows in a horizontal wire in the plane of the paper from east to west as shown in Figure 13.5. The direction of magnetic field at a point will be North to South

(a) directly above the wire

(b) directly below the wire

(c) at a point located in the plane of the paper, on the north side of the wire

(d) at a point located in the plane of the paper, on the south side of the wire

14. A constant current flows in a horizontal wire in the plane of the paper from east to west as shown in Figure 13.5. The direction of magnetic field at a point will be North to South

(a) directly above the wire

(b) directly below the wire

(c) at a point located in the plane of the paper, on the north side of the wire

(d) at a point located in the plane of the paper, on the south side of the wire

15. The strength of magnetic field inside a long current carrying straight solenoid is

(a) more at the ends than at the centre

(b) minimum in the middle

(c) same at all points

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

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(a) more at the ends than at the centre

(b) minimum in the middle

(c) same at all points

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

16. To convert an AC generator into DC generator

(a) split-ring type commutator must be used

(b) slip rings and brushes must be used

(c) a stronger magnetic field has to be used

(d) a rectangular wire loop has to be used

16. To convert an AC generator into DC generator

(a) split-ring type commutator must be used

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