

Magnetic Effects of Electric Current

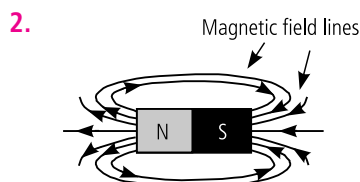
CHAPTER 12



ANSWERS

Topic 1

1. Compass needle gets deflected due to attractive or repulsive interactions between its magnetic field and the magnetic field of the bar magnet.



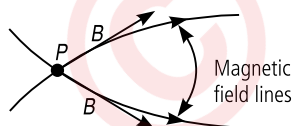
3. The properties of the magnetic field lines are listed below:

(a) Magnetic field lines start at the North pole and end at the South pole.

(b) Magnetic field lines do not intersect each other, because there can not be two directions of the magnetic field at any one point.

(c) The degree of closeness of the field lines depends upon the strength of the magnetic field. Stronger the field, closer are the field lines.

4. The direction of magnetic field (B) at any point is obtained by drawing a tangent to the magnetic field line at that point. In case, two magnetic field lines intersect each other at the point P as shown in figure, magnetic field at P will have two directions, shown by two arrows, one drawn to each magnetic field line at P , which is not possible.

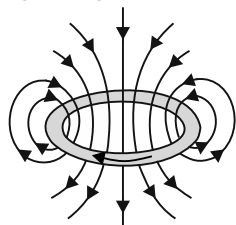


Topic 2

1. (d) : The magnetic field lines around a straight wire carrying current are concentric circles whose centre lie on the wire.

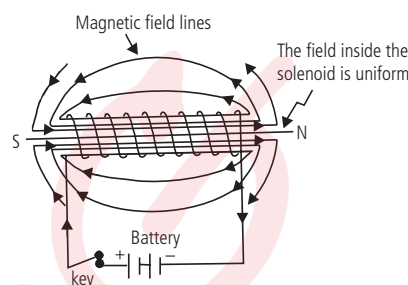
Topic 3

1. The magnetic field inside and outside the current-carrying loop is shown in the given figure.



Topic 4

1. The field lines inside the solenoid are in the form of parallel straight lines. This indicates that the magnetic field inside the solenoid is uniform. This is shown in diagram.



2. (d) : The magnetic field inside a current-carrying solenoid is constant in magnitude and direction, and acts along the axis of the solenoid.

Topic 5

1. (c, d) : Each charged particle moving in a magnetic field experiences a force. The direction of force experienced by a positive charge (*i.e.*, a proton) is given by Fleming's left hand rule. The force acting on the proton would change both velocity and momentum.

2. The displacement of the rod AB

(a) will increase when the current in rod AB is increased.

(b) will increase when a stronger horse-shoe magnet is used.

(c) will increase when length of the rod AB is increased.

3. (d) : Apply Fleming's left-hand rule, we can infer that the direction of magnetic field is upwards.

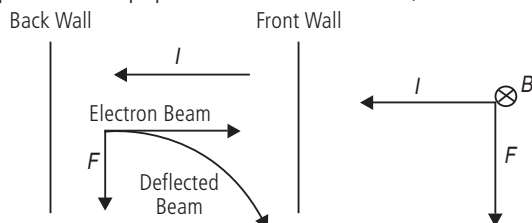
4. Fleming's left-hand rule is as follows:

Stretch out the thumb, the forefinger, and the second (middle) finger of the left hand so that these are at right angles to each other. If the forefinger gives the direction of the magnetic field (N to S), the second (middle) finger gives the direction of current (+ to -), then the thumb gives the direction of the force acting on the conductor.

Since the conductor will move in the direction of the force acting on it hence the thumb gives the direction of motion of the conductor.

5. The force experienced by a current-carrying conductor placed in a magnetic field is the largest when the direction of the current is at right angles to the direction of the magnetic field.

6. The direction of current I is opposite to the direction of electron beam as shown in figure. Since the beam is deflected to the right side, the force, F acting on the beam is as shown. Applying Fleming's left hand rule, it is found that magnetic field, B is acting vertically downwards (*i.e.*, perpendicular to the plane of the paper and directed inwards) as shown by \otimes .



Topic 6

1. The safety devices that are used in electric circuits and appliances are (i) Fuse (ii) Earthing. MCBs are also used as safety device in electrical circuits.

2. Rating of the oven = 2 kW

Line voltage = 220 V

Then, current drawn by the oven = $\frac{\text{Power}}{\text{Voltage}}$

$$= \frac{2 \text{ kW}}{220 \text{ V}} = \frac{2000}{220} \text{ A} = 9.1 \text{ A}$$

Since the domestic circuit is rated for 5 A, and the oven draws a current of 9.1 A, the following might result

(a) The fuse (if there) will blow off.

(b) The wiring may burn out.

3. (a) Do not connect appliances exceeding the total load capacity of the circuit.

(b) Provide fuses/MCBs of proper rating.

4. (c) : Increases heavily.

5. (a) True

(b) False: A wire with a green insulation is usually the Earth wire.

6. Electric short-circuit occurs when the live wire and the neutral wire come in direct contact. This occurs when

(i) the insulation of wires is damaged or

(ii) there is a fault in the electric appliance.

7. Many electric appliances of daily use like electric press, heater, toaster, refrigerator, table fan etc. have a metallic body. If the insulation of any of these appliances melts and makes contact with the metallic casing, the person touching it is likely to receive a severe electric shock. This is due to the reason that the metallic casing will be at the same potential as the applied one. Obviously, the electric current will flow through the body of the person who touches the appliance. To avoid such serious accidents, the metal casing of the electric appliance is earthed. Since the Earth does not offer any resistance, the current flows to the Earth through the Earth wire instead of flowing through the body of the person.

