O P JINDAL SCHOOL, SAVITRINAGAR

CLASS TEST & PRACTICE

CLASS X PHYSICS

TOPIC : MAGNETIC EFFECT OF CURRENT AND MAGNATISM

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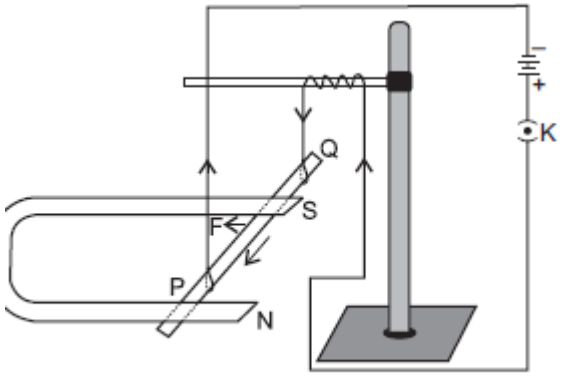
1 (a) Name the material which can be used to make-
(i) Permanent magnet
(ii) Temporary magnet.
(b) State two ways by which the strength of an electromagnet can be increased. 3

ANS: (a) Material which can be used to make
(i) Permanent magnet – steel, alloys (Alnico and Nipermag)
(ii) Temporary magnet – soft iron
(b) Strength of electromagnet can be increased by
(i) increasing the number of turns per unit length of the solenoid and
(ii) increasing the magnitude of the current through the solenoid.

2 With the help of a diagram of experimental set-up describe an activity to show that the force acting on a current carrying conductor placed in a magnetic field increases with increase in field strength. 3

ANS: Aim : To show that force acting on a current carrying conductor placed in a magnetic field increases with increase in the field strength.
Apparatus Required : Aluminium rod, a clamp stand, two horse shoe magnet of different intensity, cell, key and connecting wires.
Procedure : 1. Arrange the experimental set-up as shown in figure.



A current carrying rod, PQ is experiencing force F

2. Plug the key, for the given set-up current will flow through the rod from Q to P and observe the displacement of rod.
3. New unplug the key and remove the first horse shoe magnet and place the second horse shoe magnet of higher magnetic field strength in a similar manner to that of first.
4. Plug the key, the current again flow through the rod from Q to P. Again observe the deflection of rod.
5. Now bring both the magnet is closer together (to ensure greater magnetic field than that of previous case). Again observe the motion of rod.
Observations : In each time, conductor moves faster than that of previous one. It is possible only when conductor gets accelerated more each time which required more force. (F = ma)
Thus, if the magnetic field strength is increased, the rod will experience a greater force and move even faster.

Conclusion: The force acting on a current carrying conductor placed in a magnetic field increases with increase in field strength.

11 What happens to the force acting on current carrying conductor placed in magnetic field when:
(a) Direction of magnetic field is reversed without changing the direction of current.
(b) Direction of the current is reversed without changing the direction of magnetic field.
(c) Direction of both the current and the magnetic field is reversed. 3

ANS: Force acting on a current carrying conductor placed in a magnetic field will
(a) acts in opposite direction to that of previous direction.
(b) acts in opposite direction to that of previous direction.
(c) remains in the same direction.

3 State one main difference between AC and DC. Why AC is preferred over DC for long range transmission of electric power? Name one source each of DC and AC. 3

ANS: Difference between AC and DC: The alternating current (AC) reverses its direction periodically whereas the direct current (DC) always flows in one direction.
AC is preferred over DC because it can be transmitted over long distance without much loss of energy.
DC source : Battery
AC source : AC generator

4 State the consequences that can lead to a short circuit.
Or
One of the major cause of fire in office building is short circuiting. List three factors which may lead to the short circuit. 3

ANS: It occurs as a consequence of
- failure of electrical insulations due to which live wire comes in direct contact with neutral or earth wire.
- presence of external conducting material (such as water) that is introduced accidently into the circuit.
- electrical appliances are forced to operate when its moving parts are jammed.
- connection of current carrying parts of electrical equipment's to one another due to human or natural cause or
- use of less rating wires.

When this happens, there is a flow of an excessive electric current which can damage the circuit and may also cause electrical fires.

5 What is overloading? State the causes of overloading. 3

ANS: Overloading: If the current drawn by the many electrical appliances connected to a single socket exceeds the current rating of the wire, the entire circuit or part of circuit gets heated and can even cause fire. This is known as overloading.
It might be due to
(i) accidental hike in supply voltage or
(ii) connecting too many appliance to a single socket or
(iii) damage in the insulation of wires or
(iv) some fault in the appliances or

(v) direct contact between a live wire and a neutral wire.

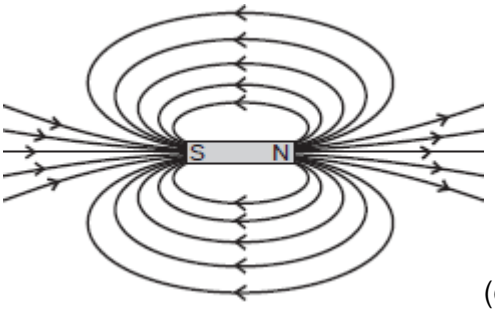
6 Give scientific reasons.
(a) Wires carrying electricity should not be touched when bare-footed.
(b) We must not use many electrical appliances simultaneously.
(c) Electrical switches should not be operated with wet hand. 3

ANS: (a) When we touch the live wire bare-footed, our body is directly in contact with the earth. So, current passes through the body to the earth. As our body is good conductor of electricity, we get a severe shock. Hence, we should not handle live wires bare footed.
(b) When many high power rating appliances are switched on simultaneously, a large amount of current flows through the main circuit and current may exceed the bearing capacity of the connecting wires. This causes overloading, which may cause fire. Hence, we must not use many electrical simultaneously.
(c) Switches should not be operated with wet hand : Water is a good conductor of electricity as it contains salt and impurities. When we touch the switch with wet hand, it is possible that electric current will pass through our body and we get a severe shock.

7 A student fixes a sheet of white paper on a drawing board. He place a bar magnet at the centre of it. He sprinkles some iron filings uniformly around the bar magnet. Then he taps the board gently and observes that the iron filings arrange themselves in a particular pattern.
(a) Why do the iron filings arrange in a pattern?
(b) What is indicated by the crowding of iron filings at the end of the magnet?
(c) What do the lines along which the iron filings align represent?
(d) Draw a neat diagram to show the magnetic field lines around a bar magnet.
(e) Write any two properties of magnetic field lines. 5

ANS: (a) When iron filings are placed in a magnetic field around a bar magnet they behaves likes a tiny magnet (by induction). The magnetic force experienced by these tiny magnets make them to rotate and align themselves along the direction of magnetic field lines. Thus, iron filling arrange themselves in a particular pattern.
(b) The crowding of iron filings at the end of the magnet indicates strong magnetic field at the ends of magnet.
(c) It represents the magnetic field lines around a bar magnet.

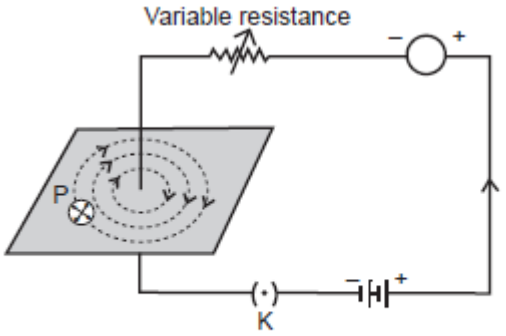
(d)



(e) (i) The magnetic field lines never intersect each other.
(ii) Magnetic field lines are closed curve.

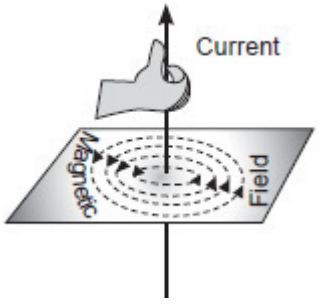
8 (a) Describe an activity to demonstrate the pattern of magnetic field lines around a straight conductor carrying current.
(b) State the rule to find the direction of magnetic field associated with a current carrying conductor. 5
(c) What is the shape of a current carrying conductor whose magnetic field pattern resembles that of a bar-magnet?

ANS: (a) Aim : To study the magnetic field due to a straight current carrying conductor.
Apparatus Required : A thick conducting wire, battery, rheostat, magnetic needle, ammeter (0-5A), key, a cardboard, a stand to hold the wire, iron filings and sprinkler of iron filings.
Procedure :
1. Attach and pass the thick wire through a hole at the middle of the cardboard and clamp it in a stand.
2. Attach the ends of the wire through a key, variable resistor and an ammeter on either side of a battery and hold it vertically and perpendicularly to the board as shown in figure below.



Magnetic field around a straight conducting wire.
Concentric circles indicate the field lines

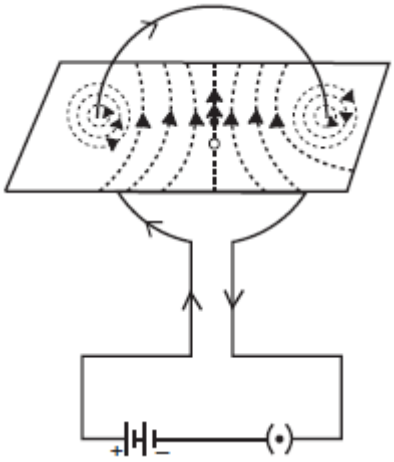
3. Spread the iron filings uniformly on the cardboard and place the magnetic needle on the board.
4. Close the key and tap the cardboard slightly and observe the orientation of iron filings.
Observation :
1. Just on closing the key, the iron filings are aligned in the pattern of concentric circles around the wire.
Conclusion :
1. Current carrying conductor is a source of magnetic field.
2. The magnetic field is in the form of concentric circles whose centre lies on the wire. (b) Right-Hand Thumb Rule. This rule is used to find the direction of magnetic field due to a straight current carrying wire.
It states that if we hold the current carrying conductor in the right hand in such a way that the thumb is stretched along the direction of current, then the curly finger around the conductor represent the direction of magnetic field produced by it. This is known as right-hand thumb rule. Direction of Field Lines due to current carrying straight conductor as shown in figure.



(c) Solenoid .

9 Draw the pattern of magnetic field lines through and around a current carrying loop of wire.
Mark the direction of
(i) electric current in the loop
(ii) magnetic field lines. How would the strength of magnetic field due to current, carrying loop be affected if- 5
(a) radius of the loop is reduced to half its original value?
(b) strength of current through the loop is doubled?

ANS: The direction of electric current in the loop and magnetic field lines is shown in figure given below.



(a) Magnetic field strength (B) produced is inversely proportional to the radius of current carrying loop of wire, i.e.

$$B \propto \frac{1}{r} \Rightarrow B_1 = \frac{1}{r_1}$$

$$B_2 = \frac{1}{r_2}$$

given, $r_2 = \frac{1}{2} r_1$

$$\therefore \quad \frac{B_2}{B_1} = \frac{r_1}{r_2} = \frac{r_1}{\frac{1}{2} r_1} = 2 \Rightarrow B_2 = 2B_1$$

Hence, strength of magnetic field double if the radius of loop is reduced to half its original value. (b) Strength of magnetic field increases to twice its original value as B ∝ I.