CBSE Test Paper-03

Chapter 13 Magnetic Effects of Electric Current

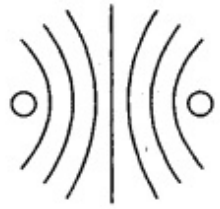
1. The phenomena of electromagnetic induction is **(1)**
   a. the process of generating magnetic field due to a current passing through a coil
   b. the process of charging a body
   c. the process of rotating coil of an electric motor.
   d. producing induced current in a coil by the relative motion between a magnet and the coil
2. The power of an electric motor can be increased by **(1)**
   a. By decreasing the area of cross – section of the coil.
   b. By increasing the number of turns in the coil.
   c. All of these
   d. By decreasing the strength of the magnetic field.
3. Which one of the following correctly describes the magnetic field near a long straight wire? **(1)**
   a. The field consists of straight lines parallel to the wire
   b. The field consists of concentric circles centered on the wire
   c. The field consists of straight lines perpendicular to the wire
   d. The field consists of radial lines originating from the wire
4. Transformer works on the principle of **(1)**
   a. Electro magnetic Induction
   b. Electric field
   c. Electricity
   d. Magnetic field
5. Match the following with correct response. **(1)**

(1) Iron ore	(A) Loadstone
(2) Magnetic flux	(B) Electrical energy into mechanical energy
(3) Electric motor	(C) Number of magnetic lines passing normally through the surface
(4) Permanent	

magnet	(D) Bar magnet

a. 1-A, 2-C, 3-B, 4-D
b. 1-B, 2-D, 3-A, 4-C
c. 1-C, 2-B, 3-D, 4-A
d. 1-D, 2-A, 3-C, 4-B

6. The diagram given below represents the magnetic field caused by a current carrying conductor. Identify the nature of the coil. **(1)**



7. Why are magnetic field lines closed curves? **(1)**

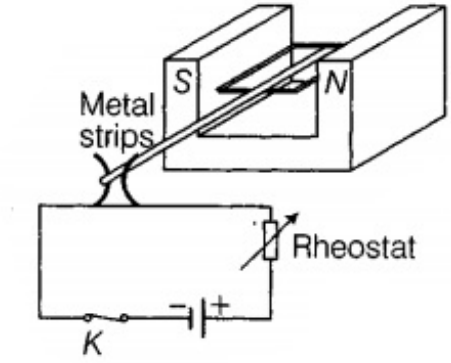
8. What type of field is around stationary charge ? **(1)**

9. How should the electric lamps in a building be connected, so that the switching on or off in a room has no effect on other lamps in the same building? **(1)**

10. An electric oven of 2kW power rating is operated in a domestic electric circuit (220 V) that has a current rating of 5A. What result do you expect ? Explain. **(3)**

11. Draw magnetic lines around a bar magnet. **(3)**

12. The given figure shows a DC motor model used by a student to study electromagnetism. The two ends of the coil are fixed to a pair of curved elastic metal strips. The metal strips are connected to the power supply with a rheostat. **(3)**



i. State the direction of rotation of the coil when viewed from the front.
ii. The student is still testing on the feasibility of using the metal strips in the model. What is he trying to achieve?

13. Mahesh bought an electric iron and connected its wires into the two-pin plug. Obviously, the green wire was not connected anywhere. Few days later, his wife got a severe electric shock while ironing the clothes. The electrician told Mahesh that this situation could be averted, if he had connected the green wire also, using the three-pin plug. Mahesh learnt a lesson for a life-time.
Read the above passage and answer the following questions: **(3)**

    i. Which terminal was to be connected using green wire?
    ii. What qualities does Mahesh need to incorporate in himself to avoid such mistakes?
    iii. If you were the electrician, what else would you do than explaining to Mahesh?

14. Explain the underlying principle of working of an electric generator by drawing a labelled diagram. What is the function of brushes **(5)**

15. Explain the meanings of words "electromagnetic" and "induction" in the term electromagnetic induction. List three factors on which the value of induced current produced in a circuit depends.
Name and state the rule used to determine the direction of induced current. State one practical application of this phenomenon in everyday life. **(5)**

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Answers

1. d. producing induced current in a coil by the relative motion between a magnet and the coil

   Explanation: When a straight coil and a magnet are moved relative to each other, a current is induced in the coil. This phenomenon is known as electromagnetic induction.

2. b. By increasing the number of turns in the coil.

   Explanation: The power of an electric motor can be increase by one or all of the following means:

   i. By increasing the number of turns in the coil.
   ii. By increasing the area of cross section of the coil.
   iii. By increasing the strength of the radical magnetic field.
   iv. By increasing the magnitude of the current flowing the coil.

3. b. The field consists of concentric circles centered on the wire

   Explanation: The field consists of concentric circles centered on the wire.It originates from the cicumference of the wire and spread out thus creating concentric circles

4. a. Electro magnetic Induction

   Explanation: Transformer works on the principle of mutual induction of two coils or Faraday Law's Of Electromagnetic induction. When current in the primary coil is changed the flux linked to the secondary coil also changes. Consequently an EMF is induced in the secondary coil due to Faraday law's of electromagnetic induction.

5. a. 1-A, 2-C, 3-B, 4-D

   Explanation:

   i. A lodestone is a naturally magnetized piece of the mineral magnetite. Loadstone is iron ore.
   ii. Magnetic flux is the number of magnetic field lines passing through a surface

placed in a magnetic field.

iii. An electric motor converts electrical energy into mechanical energy.

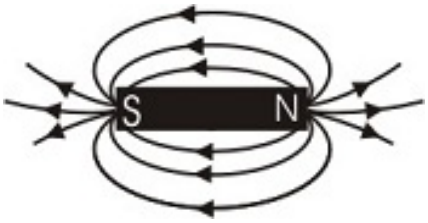
iv. Permanent magnet are usually made of hard materials which are strongly magnetized. A perfect example of permanent magnet is the Bar Magnet. In fact, Permanent magnets are most of the times referred to as Bar Magnets also.

6. The nature of the coil is circular in form of loop.
7. The magnetic field lines are closed curves because magnetic field lines originate from the north pole of a magnet and end at its south pole and inside the magnet, it is directed from south pole to north pole.
8. A stationary charge cannot produce a magnetic field. It produces an electric field. Static charges are the charges at rest.
9. All the lamps should be connected in parallel.
10. Power P = 2kW = 2,000 W, V = 220 volts, I = ?

    P = VI or $I = \frac{P}{V}$

    $I = \frac{2000}{220} = \frac{100}{11} = 9.09\ A$

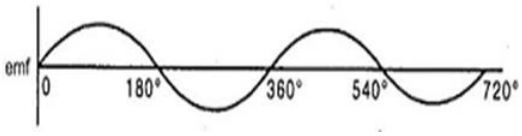
    A current of 9.09 A will flow in the circuit. Since the current rating of circuit is 5A, the fuse (of 5A) rating if inserted in circuit will burn up. If no fuse has been put in the circuit, there may be a fire.
11. Take a small compass and a bar magnet. Place it on a sheet of paper fixed on drawing board by using adhesive tape. Mark the boundary of the magnet. Place compass near north pole of the magnet. South pole of compass will point towards north pole of the magnet. Mark the two points a, b of the needle. Move the needle to a new position such that S of compass is at b [position previously held by N]. Proceed till you reach south pole of the magnet. Joint the marked points on a paper by a smooth line which gives one magnetic line of force. Repeat the procedure taking different starting points.



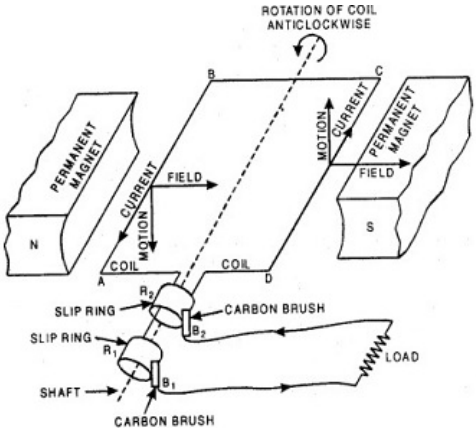
Magnetic field around a bar magnet

It will be found that no two magnetic lines of force intersect each other. Relative strength of magnetic field is shown by the degree of closers of the field lines. It is more when field is crowded and weak when field lines are at distance.

12. i. The direction of rotation of the coil is anti-clockwise when viewed from the front.
    ii. He is trying to achieve the rotation of the coil in one direction. As the current in the coil reverses for every half turn, the coil rotates in one direction.
13. i. The terminal to be connected by green wire is the earthing terminal.
    ii. Mahesh needs to be more careful, concerned about safety measures and be less ignorant about simple safety practices.
    iii. I would have checked all other devices to ensure the further safety.
14. Principle: Alternators are based on the principle that an induced current is produced in a conductor whenever there is change in magnetic lines of force linked with it. The direction on induced current is given by Fleming's right hand rule stated below.
    Fleming's right hand rule. If the thumb, forefinger and central finger of right hand are stretched out mutually at right angles to each other such that forefinger points along the direction of magnetic field and thumb along the direction of motion of the conductor, then the central finger indicates the direction of the current produced in the coil.
    Construction: A simple A.C. generator consists of the following important parts :
    Working : Let the coil initially be in horizontal position as shown in fig. Let the coil be rotated in anticlockwise direction between the pole pieces N and S of a horseshoe magnet.
    At an instant, let AB move down and CD move up as shown in the fig. The coil AB cut the magnetic lines of force near N-pole of the magnet, side CD cut the lines near S pole of the magnet. Due to the change in the magnetic field cutting the coil, an induced current is produced in AB and DC. Using Fleming's right hand rule to side AB and DC of the coil, we observe that the current flows in the direction B and A and D and C. Effective current flows along DCBA.
    After half rotation, side AB and DC of the coil will interchange their positions. AB will come towards right and DC towards left. Now AB starts moving up and DC downwards. The direction of induced current in each side is reversed after half a revolution. Due to the change in the direction of induced current in the coil is reversed after half revolution, hence positive or negative polarity of the two ends is also changed.
    In India, we produce 50 Hz A.C. Hence coil is to be rotated 50 times per second. In a single rotation, the current changes its direction twice i.e. each termed is positive for only $\frac{1}{2\times\ 50} = \frac{1}{100}$ = 0.01s and negative for 0.01s. Since the current alternates its direction every 0.01 s. the current produced is called alternating current or A.C.



i. Armature: It consists of coil ABCD having a large number of insulated copper wires wound over a soft iron core. The coil is called armature. The armature is mounted on an axle which can be rotated by force exerted by falling water, wind or stream.



ii. Field magnets : The coil is held between the pole pieces of a strong magnet called the field magnet. In small dynamos, the magnetic field is provided by permanent magnet. in large dynamos, the magnetic field is provided by electromagnets.

iii. Split Rings : These consist of two hollow metallic ring R_1 and R_2 mounted on the axle of the coil. The ends of the limbs AB and CD of the coil are connected to the rings R_1 and R_2 respectively. These rings rotate along with the rotation of The armature.

iv. Current from B_1, B_2 is taken out to load connected across two brushes.

15. The word "electromagnetic" is related to the interrelation between electric current I and magnetic field B. While "Induction" is the process of giving rise to something. So the process of generation of an electric current I from magnetic effects B is called electro - magnetic induction.

Three factors which affects the electro-magnetic induction are:

Fleming's right-hand rule used to determine the direction of induced current.

Electric generator is based on the principle of electromagnetic induction.

i. The number of turns in a coil

ii. The strength of magnet used and

iii. The speed by which magnet is pushed into the coil.