

CLASS-10TH -CHAPTER -13 MAGNETIC EFFECTS OF ELECTRIC CURRENT

3 marks Qns & ans of Magnetic Effects of Currents

1. Why does a current carrying conductor kept in a magnetic field experience force? On what factors does the direction of this force depend? Name and state the rule used for determination of direction of this force.

Answer: Force on a conductor carrying current in a magnetic field :-

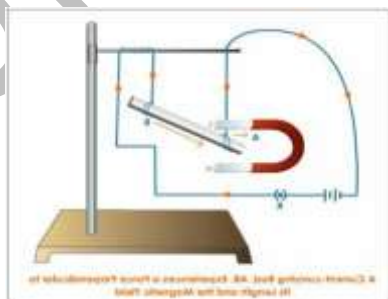
A.M. Ampere suggested that if a current carrying conductor produces a magnetic field and exerts a force on a magnet, then a magnet should also exerts a force on a current carrying conductor.

Eg :- If an aluminum rod is suspended horizontally by a wire between the poles of a horse shoe magnet and current is passed through the wire, then the aluminum rod is displaced. If the direction of current is reversed, the direction of displacement is also reversed. The force exerted is maximum if the conductor is perpendicular to the magnetic field.

Fleming's Left Hand Rule :-

The direction of force (motion) of a current carrying conductor in a magnetic field is given by Fleming's Left Hand Rule.

It states that ' If we hold the thumb, fore finger and middle finger of the left hand perpendicular to each other such that the fore finger points in the direction of magnetic field, the middle finger points in the direction of current, then the thumb shows the direction of force (motion) of the conductor



2. Explain a) Electric fuse b) Overloading c) Short circuit

Answer:

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a) Electric fuse :-

Electric fuse is a safety device used in electric circuits to protect the circuit and appliances from damage due to overloading and short circuit. It is a wire having high resistance and low melting point. If excess current flows through the circuit, the fuse wire melts and breaks the circuit. Fuse wire is made of a metal or an alloy of metals like lead, tin, aluminium and copper. Fuse wire is connected in series with the live wire.

b) Overloading :-

Overloading is caused due to increase in voltage, or if the live wire and neutral wire comes in contact or if too many appliances are connected to a single socket. It results in overheating of the wires and can cause damage to the circuit and appliances.

c) Short circuit :-

Short circuit is caused when the live wire and neutral wire comes in contact and the current suddenly increases in the circuit. It causes spark, fire and damage to the circuit and appliances.

3. Explain Direct and Alternating current

Answer:

a) Direct current (DC) :- A current that always flows in one direction only is called direct current. The current we get from a battery is a direct current.

b) Alternating current (AC) :- A current that reverses its direction periodically is called alternating current. Most power stations in our country produce alternating current. AC changes direction every $1/100$ second and its frequency is 50 Hertz (Hz). One advantage of AC over DC is that it can be transmitted over long distances without much loss of energy

4. Draw the pattern of magnetic field lines of a current carrying solenoid. What does the pattern of fieldlines inside the solenoid indicate? Write one application of magnetic field of current carrying solenoid.

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Figure 13.10 (Page No.229 NCERT Text Book)

Answer: **Pattern of magnetic field lines** It indicates that the magnetic field is the same at all points inside the solenoid

Application-

For making an electromagnet

5 marks Questions & Answers of Magnetic Effects of Electric Currents

1. Explain with an experiment principle of Electromagnetic induction? Which law will give the direction of electric current?

Answer: The motion of a magnet with respect to a coil or a change in the magnetic field induces a potential difference in the coil and produces induced current. This is called electromagnetic induction.

i) Motion of a magnet with respect to a coil produces induced current :-

If a magnet is moved towards or away from a coil of wire connected to a galvanometer, the galvanometer needle shows a deflection. This shows that current is induced in the coil due to the motion of the magnet.

Change in magnetic field produces induced current :-

Take two coils of wires wound around a cylindrical paper roll. Connect one coil to a battery and the other coil to a galvanometer. If current is passed through the first coil, the galvanometer needle shows a deflection in the second coil. If the current is disconnected, the needle moves in the opposite direction. This shows that current is induced due to change in magnetic field.

Fleming's Right Hand Rule :-

The direction of induced current is given by Fleming's Right Hand Rule.

It states that ' If the thumb, fore finger and middle finger of the right hand is held perpendicular to each other such that the thumb points in the direction of motion of the conductor, the fore finger

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points in the direction of the magnetic field, then the middle finger shows the direction of induced current '.

2. Explain Domestic electric circuit?

Answer: Electric power to homes is supplied through the mains. It has two wires. One is a live wire (positive wire) with red insulation and the other is a neutral wire (negative wire) with black insulation. The potential difference between the two wires is 220V. The earth wire with green insulation is connected to a metal plate kept in the ground.

Two separate circuits are used. One is of 15A for appliances with high power rating like gysers, air conditioners etc. The other is of 5A for fans, bulbs etc. The different appliances are connected in parallel so that every appliance gets equal voltage and even if one is switched off the others are not affected.

The appliances having metallic body like electric iron, refrigerators etc., their metallic body is connected to the earth wire so that if there is leakage of current, it passes to the earth and prevents electric shock

3. Explain the meaning of the word 'electromagnetic' and 'induction' in the term electromagnetic induction. On what factors does the value of induced current produced in a circuit depend? Name and state the rule used for determination of direction of induced current. State one practical application of this phenomenon in every day life.

Ans)

i) Meaning of the terms (1)

(ii) Rate of change of magnetic flux (1)

(iii) Fleming's Right Hand Rule (1)

(iv) Statement of the rule (1)

(v) Electric Generator (1)

(v) Power can be transmitted over long distances without much loss of energy. 1

HOTS Questions with Answers

Magnetic Effects of Electric Currents

Q1. On what factors does the magnetic field intensity at the centre of the circular coil carrying current depend?

Answer: The magnetic field intensity at the centre of the circular coil is directly proportional to current and inversely proportional to radius of the coil. So, in both the cases, that is, twice the current as well as half in radius, the magnetic field intensity gets doubled.

Q2. State the principle used to determine the force experienced by a conductor carrying current in uniform magnetic field?

Answer: Fleming's Left Hand Rule - Stretch the first three fingers of the left hand mutually perpendicular to each other such that the fore finger points in the direction of magnetic field, the middle finger points in the direction of current, then the thumb will indicate the direction of force experienced by the conductor.

Q3. On what factors does the force experienced by a conductor carrying current in uniform magnetic field depend?

Answer: Force experienced by a conductor depends on

- (a) Current and
- (b) The perpendicular distance between that point and the conductor.
- (c) Magnetic field strength

Q4. On what factors does the strength of a magnetic field at a point due to a straight conductor carrying current depend?

Answer: (a) Magnitude of electric current and

(b) perpendicular distance between that point and the conductor.

Q5. Differentiate between direct current and alternating current.

Answer: DIRECT ALTERNATING

CURRENT CURRENT

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(a) It has constant

a) It varies in magnitude.

(b) It has constant

b) It changes its direction

alternatively

(c) It is less dangerous in terms of shock.

c) It is more dangerous in electric shock.

Q6. A switch is always connected in

(a) earth wire

(b) neutral wire

(c) live wire

Answer: . It is always connected with live wire.

Q7. What type of connection is used in household circuits?

Answer: . In household circuits all electrical appliances are connected in parallel.

Q8. State the principle of the working of an electric motor.

Answer: . An electric motor works on the principle of force experienced by a current carrying conductor in a magnetic field. The two forces acting are equal and opposite. Since they act in different lines they bring rotational motion.

Q9. State the principle of a D.C generator.

Answer: . It is based on the principle of electromagnetic induction.

Q10. State the characteristics of magnetic field lines.

Answer: (i) The direction of magnetic field is indicated by the arrow in the line at any point (tangent).

(ii) The field lines come out of the north pole and emerge into the south pole (closed loops are formed). (iii) No two field lines will ever intersect each other.

Q11. State Right Hand Thumb Rule.

Answer: . Hold the wire carrying current in your hand, such that the thumb points in the direction of current, the direction of the curled fingers will indicate the direction of magnetic field.

Q12. Define the phenomenon overloading.

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Answer: .If the total current drawn by all the appliances at a particular time exceeds the bearing capacity of that wire, the wires of the domestic wiring get heated.This Phenomenon is called overloading.

Q.13. How can it be shown that magnetic field exist around a wire carrying current?

Answer: By using magnetic compass which, shows deflection.

A current-carrying straight conductor is placed in the east-west direction. What

Q.14 Will be the direction of the force experienced by this conductor due to earth's magnetic field?

How will this force get affected on? (a) reversing the direction of flow of current (b) doubling the magnitude of current.

The direction of earth's magnetic field is from G-south to G-north.

Answer: Let current is from west to east. Therefore force is vertically upwards.

(a) By reversing the direction of current, the direction of will be reversed i.e. vertically downwards.

(b) The magnitude of the force is doubled.

Q.15. A wire carrying current passes through the middle of the plane A perpendicular to it. If a magnetic needle is placed in the plane parallel to the wire. What will be the direction of the needle?

Answer: (i) along the tangent to a circle going anti-clockwise to an out coming current(to plane A).

Q.16.A wire carrying current passes through the middle of the plane A perpendicular to it. If a magnetic needle is placed in the plane perpendicular to the plane A, what will be the direction of the needle? Answer: .Any direction, as the needle is not influenced by a perpendicular field.

Q.17.If a magnetic needle is placed at the north pole in a horizontal plane, in what direction it will indicate? Why?

Answer: They will show random orientation as the magnetic field at the poles are along the vertical line and not on the horizontal plane.

Q.18.If a magnetic needle is placed at the north pole in a vertical plane, what will be its direction?

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Answer: .They will stand vertically.

Q.19. Is a circular coil carrying current similar to magnet?

Answer: Yes

Q.20. What is the role of soft iron in the core of a solenoid?

Answer: It acts as an electromagnet.

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