Magnetic Effect of Current: Exercise Questions

Q.1 Which of the following correctly describes the magnetic field near a long straight wire?
(a) The field consists of straight lines perpendicular to the wire.
(b) The field consists of straight lines parallel to the wire.
(c) The field consists of radial lines originating from the wire.
(d) The field consists of concentric circles centred on the wire.
Sol. (d) The field consists of concentric circles centred on the wire.

Q.2 The phenomenon of electromagnetic induction is
(a) The process of charging a body.
(b) The process of generating magnetic field due to a current passing through a coil.
(c) Producing induced current in a coil due to relative motion between a magnet and the coil.
(d) The process of rotating a coil of an electric motor.
Sol. (c) Producing induced current in a coil due to relative motion between a magnet and the coil.

Q.3 The device used for producing electric current is called a
(a) Generator.
(b) Galvanometer.
(c) Ammeter.
(d) Motor.
Sol. (a) Generator

Q.4 The essential difference between an AC generator and a DC generator is that
(a) AC generator has an electromagnet while a DC generator has permanent magnet.
(b) DC generator will generate a higher voltage.
(c) AC generator will generate a higher voltage.
(d) AC generator has slip rings while the DC generator has a commutator.
Sol. (d) AC generator has slip rings while the DC generator has a commutator.

Q.5 At the time of short circuit, the current in the circuit
(a) Reduces substantially.
(b) Does not change.
(c) Increases heavily.
(d) Vary continuously.
Sol. (c) Increases heavily

Q.6 State whether the following statements are true or false.
(a) An electric motor converts mechanical energy into electrical energy.
(b) An electric generator works on the principle of electromagnetic induction.
(c) The field at the centre of a long circular coil carrying current will be parallel straight lines.
(d) A wire with a green insulation is usually the live wire of an electric supply.
Sol. (a) An electric motor converts mechanical energy into electrical energy: False
(b) An electric generator works on the principle of electromagnetic induction: True
(c) An electric generator works on the principle of electromagnetic induction: True
(d) A wire with a green insulation is usually the live wire of an electric supply: False

Q.7 List three methods of producing magnetic fields.
Sol. The three methods of producing magnetic fields are:
(i) By permanent magnet, magnetic field can be produced.

(ii) By electromagnets, Magnetic field can be produced
(iii) Current carrying conductors produce the magnetic field.

Q.8 How does a solenoid behave like a magnet? Can you determine the north and south poles of a current–carrying solenoid with the help of a bar magnet? Explain.

Sol. A solenoid behaves like a magnet when the electric current starts flow through in it. As we know that any current carrying conductor produces a magnetic field around it. It has the magnetic field very much similar to that of a bar magnet.

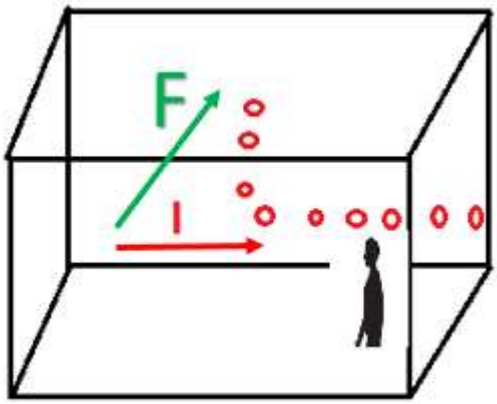
For determining the different poles of a solenoid, we can use a bar magnet. When we bring N-pole of the bar magnet close to one end of the solenoid. If there is repulsion, then it is confirm that end of the solenoid has north polarity and other end has south polarity. If there is an attraction, then it is confirm that end of the solenoid has south polarity and other end has north polarity.

Q.9 When is the force experienced by a current–carrying conductor placed in a magnetic field largest?

Sol. When the current carrying conductor are placed in a perpendicular direction to the direction of the magnetic field, then this conductor experiences the largest force.

Q.10 Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?

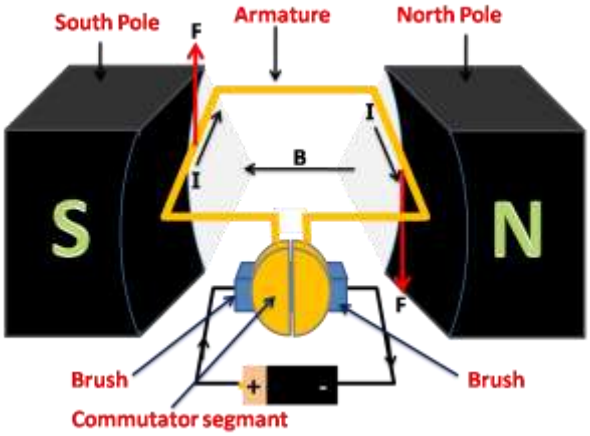
Sol. According to statement, the electron beam is moving from our back wall to the front wall, so the direction of current will be opposite to beam direction i.e. from front wall to back wall or towards us. The direction of deflection (or force) of electron beam is towards our right side as shown in figure.



For finding the direction of magnetic field, we use Fleming left hand rule, Arrange thumb, fore finger and middle finger perpendicular to each other in such a way that thumb should indicate the direction of force and middle finger in the direction of current, then fore finger shows the direction of the magnetic field. Which is downwards.

Q.11 Draw a labelled diagram of an electric motor. Explain its principle and working. What is the function of a split ring in an electric motor?

Sol. **The diagram of an electric motor**:



Working of Electric Motor: Electric motor converts Electrical energy into mechanical energy.
Examples: Fan, washing machine.
Working Principle: When a current carrying conducting wire is placed in the magnetic field, then wire experiences the force.
Working: A rectangular coil is placed between the two poles of a magnetic field. The battery is connected to the coil with a commutator and carbon brush as shown in figure. Commutator is a device which reverses the direction of electric current in coil.
When electric current is supplied to the coil, it gets deflected because of magnetic field. As it completes the half cycle, the split ring or commutator reverses the direction electric current in the coil. Due to this, the direction of force acting on coil changes. This change in direction of force pushes the coil and it completes the one cycle. Thus, the coil completes one cycle around the axle. This process keeps on again and again in rotation of motor.

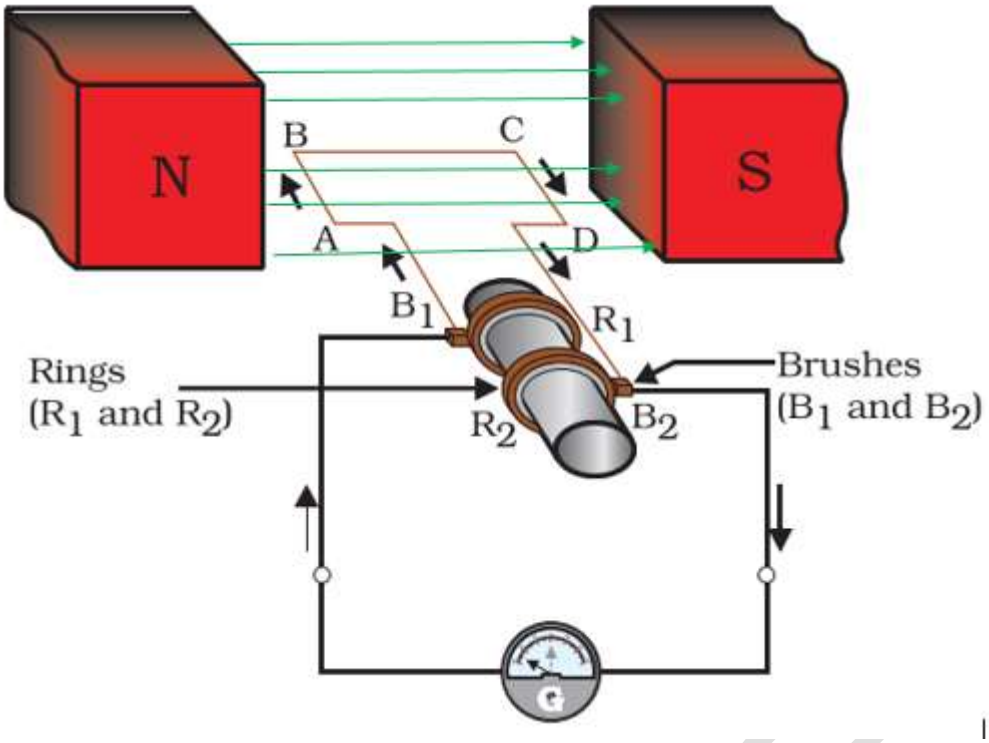
Q.12 Name some devices in which electric motors are used.
Sol. Electric fan, hair dryer, mixer grinder, tape recorder, DVD player, hard disk drive, washing machine, cooler, vacuum cleaner, etc. are some devices in which electric motor is used.

Q.13 A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is (i) pushed into the coil, (ii) withdrawn from inside the coil, (iii) held stationary inside the coil?
Sol. (i) When the bar magnet is pushed into the coil, the needle of galvanometer deflects and shows the production of momentary induced current in the circuit.
(ii) When the bar magnet withdrawn from the coil, the needle of the galvanometer deflects in opposite direction and shows the production of momentary induced current in opposite direction in the circuit.
(iii) When the bar magnet is kept stationary inside the coil, the needle of the galvanometer does not deflect.

Q.14 Two circular coils A and B are placed close to each other. If the current in the coil A is changed, will some current be induced in the coil B? Give reason.
Sol. When two circular coils A and B are placed close to each other. If the current in the coil A is changed, it will create induced current in coil B. This occurs due to change in magnetic field of coil A.

Q.15 State the rule to determine the direction of a (i) magnetic field produced around a straight conductor-carrying current, (ii) force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it, and (iii) current induced in a coil due to its rotation in a magnetic field.
Sol. **State the rules:**
(i) Right hand thumb rule or Maxwell's corkscrew rule
(ii) Fleming's Left Hand Rule
(iii) Fleming's Right Hand Rule

Q.16 Explain the underlying principle and working of an electric generator by drawing a labelled diagram. What is the function of brushes?
Sol.



Working principle: When a conductor is moved in perpendicular direction of magnetic field, then current is induced in it.

Structure of electric generator: In an electric generator, a rectangular armature is placed within the magnetic field. The armature is attached to full rings, brushes and galvanometer as shown in figure. It is placed in such way that it can rotate around an axle. When this armature rotates within the magnetic field, an electric current is induced. When the armature crosses the half cycle of its rotation, then the direction of current changes. Thus, the direction of induced current changes in every rotation. Due to this, the electric generator produces alternate current, i.e. AC. To convert an AC generator into a DC generator, split rings or commutators are used instead of full rings. This helps in producing direct current.

Functions of Brushes: Brushes is used to contact with rings which provide the current for the external use.

Q.17 When does an electric short circuit occur?

Sol. In domestic circuit, when live and neutral wires touch each other, then resistance suddenly decreases and current increases. This creates excessive heat and formation of sparks. This is called short circuit.

Q.18 What is the function of an earth wire? Why is it necessary to earth metallic appliances?

Sol. The earth wire is used to transfers any leakage of electric current to the earth. Otherwise, the leaked current can reach the metallic body of device and we can get the electric shock. Earth wire prevents us from electric shock by transfer the leaked current to the earth.