

Class: 10
Subject: Magnetic effects of electric current
Topic:
No. of Questions: 20

- Q1. A proton enters in a straight line in a uniform magnetic field along the field direction. How will its path and velocity change?
- Sol. As the proton is moving along the field direction, thus no force acts on it and the velocity and the path will not change. It will keep on moving with the same speed along the field direction.
- Q2. A positive charge is moving vertically upwards in magnetic field towards south. In which direction will it be deflected?
- Sol. No deflection because no force acts on a charge particle moving parallel or antiparallel to the magnetic field.
- Q3. Free electrons always keep on moving in the conductor. Even then no magnetic force acts on them in a magnetic field. Why?
- Sol. In the absence of external potential difference the motion of the electrons inside the conductor is totally random. Thus although the electrons are moving their velocity comes out to be zero. Thus, magnetic force which acts on them will always be zero.
- Q4. What is the nature of the magnetic field generated by a current carrying straight conductor?
- Sol. The magnetic field of long straight conductor is in the circular magnetic lines of force. The center of these imaginary lines lies on the wire. The plane of magnetic lines of force is perpendicular to the length of the conductor and is given by right hand thumb rule.
- Q5. An electron and proton enter a uniform magnetic field perpendicular to the direction of the field with same velocity. Will the force on them be same?
- Sol. Yes, the force acting on them is equal in magnitude but the direction of force will be different [opposite]. Also, the radius of the path followed by both will be different as radius is directly proportional to the mass of the charged particle.
- Q6. What is magnetic Lorentz force?
- Sol. The force acting on the charge particle moving inside the magnetic field is called magnetic Lorentz force. $F = qvB \sin \theta$ is the magnitude of the force.

- Q7. Under what conditions electron moving in the uniform magnetic field experiences maximum force?
- Sol. The electron experience maximum force when moving inside the magnetic field if the velocity of the electron is perpendicular to the direction of the magnetic field intensity.
- Q8. Under what condition the force acting on the charge particle in the magnetic field of intensity B minimum?
- Sol. The force will be minimum if the charge particle moves collinear with the direction of magnetic field intensity i.e. either parallel to the field or antiparallel to the magnetic field.
- Q9. An electron is projected with its velocity in the direction of the magnetic field. Will its motion be affected?
- Sol. No the motion of the electron will not be affected by the magnetic field as the charge particle moves parallel to the direction of the magnetic field the force acting on the charge particle is zero.
- Q10. Why a solenoid tends to contract when current passes through it?
- Sol. When current flows through the solenoid the current in the adjacent turns is parallel to each other. Since parallel currents attract each other they tend to come closer. Thus, solenoids tends to contract when current flows through it.
- Q11. A magnetic compass needle is placed in the plane of paper near point A as shown in Figure. In which plane should a straight current carrying conductor be placed so that it passes through A and there is no change in the deflection of the compass? Under what condition is the deflection maximum and why?



- Sol. We know that when the magnetic field and the direction of current are in the same plane, no deflection takes place. So, the current carrying conductor needs to be placed in the same plane as the magnetic compass to attain no deflection. The deflection is maximum when the conductor through A is perpendicular to the plane of paper and the field due to it is maximum in the plane of the paper.

Q12. A magnetic compass shows a deflection when placed near a current carrying wire. How will the deflection of the compass get affected if the current in the wire is increased? Support your answer with a reason.

Sol. The deflection increases. The strength of magnetic field is directly proportional to the magnitude of current passing through the straight conductor.

Q13. Meena draws magnetic field lines of field close to the axis of a current carrying circular loop. As she moves away from the centre of the circular loop she observes that the lines keep on diverging. How will you explain her observation?

Sol. Strength of the magnetic field falls as distance increases. This is indicated by the decrease in degree of closeness of the lines of field.

Q14. Name four appliances wherein an electric motor, a rotating device that converts electrical energy to mechanical energy, is used as an important component. In what respect motors are different from generators?

Sol. Electric fans, mixers, washing machines, computer drives, etc. Motors convert electrical energy into mechanical energy whereas generators convert mechanical energy into electrical energy

Q15. What is the difference between a direct current and an alternating current? How many times does AC used in India change direction in one second?

Sol. Direct current always flows in one direction but the alternating current reverses its direction periodically. The frequency of AC in India is 50 Hz and in each cycle it alters direction twice. Therefore AC changes direction $2 \times 50 = 100$ times in one second.

Q16. If a region has a strong magnetic field, the magnetic field lines will be closely or widely spaced?

Sol. Closely spaced because the distance between any two magnetic field lines is an indication of the strength of the field. The magnetic field lines are closely spaced if a region has a strong magnetic field.

Q17. 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.

Sol. 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.

Q18. When we pass a current through _____, the magnetic field produced is similar to a bar magnet.

Sol. Solenoid.

Q19. Explain Direct and Alternating current

Soln: 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

Q20. State the principle of the working of an electric motor.

Soln: 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 to bring rotational motion.