# Moving Charge and Magnetism

1. **Assertion (A):** Magnetic force between two charge is generally much smaller than the electric force between them.
**Reason (R):** Speeds of charges are much smaller than the free-space speed of light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

2. **Assertion (A):** Pole pieces of the magnet used in a moving coil galvanometer are given a concave shape to achieve a radial magnetic field.
**Reason (R):** A radial magnetic field ensures a better current sensitivity and also makes possible to use a linear scale for current measurement.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

3. **Assertion (A):** Parallel current in wires attracts to each other due to magnetic force.
**Reason (R):** Two electron beams moving paralled to each other repels to each other due to electric force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

4. **Assertion (A):** Two long parallel conductors carrying currents in the same direction experience a force of attraction.
**Reason (R):** The magnetic fields produced in the space between two long parallel current carrying conductors (by each of these conductors) are in the same direction.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

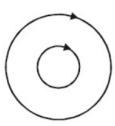
5. **Assertion (A):** Force on a current carrying wire of length $\vec{dl}$ placed in magnetic field $\vec{B}$ is given by $\vec{dF} = i\vec{dl} \times \vec{B}$
**Reason (R):** Net force on a current carrying loop in a non-uniform magnetic field must be non-zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

6. **Assertion (A):** If an observer is moving with drift speed of electrons in direction opposite to current, observer will not experience any magnetic field.
**Reason (R):** In the frame of observer charged particles in conductor are at rest.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

7. **Assertion (A):** The nature of electromagnetic force acting on a moving charged particle in external magnetic field is frame dependent.
**Reason (R):** The force acting on a charged particle always varies with shift of frame.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** When a straight wire carrying current is placed along the axis of a current carrying ring, it starts rotating about the wire.
**Reason (R):** Charged ring will experience a torque when current carrying cable will pass through its axis.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. A small coil lies inside a larger coil as shown in the figure. The two coils are horizontal, concentric and carry currents in the same sense.



**Assertion (A):** The small coil will not experience resultant force.
**Reason (R):** The small coil will experience a torque about a vertical axis.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** A system can not have magnetic moment when its net charge is zero.
**Reason (R):** Magnetic field arises due to charge in motion
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** Magnetic field also represent the lines of force on a moving charged particle at every point.
**Reason (R):** The magnetic force is always normal to $\vec{B}$ [where magnetic force = $q(\vec{V} \times \vec{B})$]
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** When external magnetic field is parallel to plane of current carrying circular loop then its potential energy is maximum.
**Reason (R):** From $U = -MB\cos\theta$ and when
$\theta = 0°$ or $180°$, $|\cos\theta| = 1$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** A planar circular coil of area A and current I is equivalent to magnetic dipole of dipole moment $M = IA$
**Reason (R):** At large distances, magnetic field of circular loop and magnetic dipole is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** A point charge moving with constant velocity may produce radial magnetic field.
**Reason (R):** Rest point charge produces radial electric field.
(1) Both (A) & (R) are true and the (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** The surface integral of magnetic field over any closed surface is always zero.
**Reason (R):** Magnetic poles are always exists in pairs.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** The magnetic field induction due to an infinite long current carrying solid cylindrical conductor of radius R, at a distance R/2 and 2R from its axis is same.
**Reason (R):** An infinite long current carrying solid cylindrical conductor is a source of uniform magnetic field.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** To produce high magnetic moment from a current carrying cable, it should be turned in maximum number of circular loops.
**Reason (R):** Magnetic moment is directly proportional to number of turns of circular loop for a given length of wire.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** If a uniform current carrying loop is placed in uniform magnetic field perpendicular to plane of loop. Tension or compression is created in loop.
**Reason (R):** Net force on any closed loop in uniform magnetic field is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** If a flexible loop (irregular shape) carrying current is located in an external uniform magnetic field then it may be changed to circular shape.
**Reason (R):** A current carrying loop in uniform magnetic field has zero net force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** A solenoid tends to expand, when a current passes through it.
**Reason (R):** Two straight parallel metallic wires carrying current in same direction repel each other.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** If two beams of protons move parallel to each other in same direction then these beams repel each other.
**Reason (R):** Like charges repel while opposite charges attract each other.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** When a magnet is brought near iron nails, only translatory force act on it.
**Reason (R):** The field due to a magnet is generally uniform.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** The Lorentz force is a non-conservative force.
**Reason (R):** The work done by the Lorentz force is always zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** A rectangular current loop is in an arbitrary orientation in an external uniform magnetic field. No work is required to rotate the loop about an axis perpendicular to its plane.
**Reason (R):** All positions represent the same level of energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** In Ampere's law for magnetostatics $\oint \vec{B}.d\vec{\ell} = \mu\Sigma i$, the current outside the amperian loop is not included on the right side.
**Reason (R):** Magnetic field calculated using Ampere's law is due to inside as well outside the current of closed loop.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** If an electron is not deflected while passing through a certain region of space, then only possibility is that there is no magnetic region.
**Reason (R):** Force is directly proportional to the magnetic field applied.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** A charged particle is moving in a circle with constant speed in uniform magnetic field. If we increase the speed of particle to twice, its acceleration will become four times.
**Reason (R):** A charge particle in circular path with constant speed in magnetic field, acceleration is given by centripetal acceleration. If speed is doubled centripetal acceleration will become four times.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** Work done by magnetic force on any moving charge is zero.
**Reason (R):** Magnetic force is perpendicular to velocity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** When a charged particle is projected in a uniform magnetic field with certain angle to it, during its motion in helical path it will never move parallel or perpendicular to field.
**Reason (R):** When the charged particle is projected at a certain angle to the magnetic field, the force experienced by the charged particle is neither in the direction of field nor in the perpendicular direction of the field.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** If a proton and an $\alpha$-particle enter a uniform magnetic field perpendicularly, with the same speed, then the time period of revolution of the $\alpha$-particle is double than that of proton.
**Reason (R):** In a magnetic field, the time period of revolution of a charged particle is directly proportional to mass.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** The direction of magnetic moment and orbital angular momentum are opposite to each other for electron.
**Reason (R):** Electron is negatively charged.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** A charged particle moves perpendicular to magnetic field. Its kinetic energy will remain constant but momentum changes.
**Reason (R):** Magnetic force acts perpendicular to velocity of particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** A charged particle moving in a magnetic field in general, experiences a force but its kinetic energy remains constant.
**Reason (R):** Work done by magnetic force is always zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** Electric force between two like charged particles is repulsive but magnetic force between them could be attractive or repulsive or absent depending on the features of their motion.
**Reason (R):** Magnetic field does not interact with static charges.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** An electron and a proton enter a uniform magnetic field at right angles to the field with equal velocities, then, deviation of both from the original path will be the same.
**Reason (R):** In the situation described above, electron and proton will experience magnetic forces of different magnitude.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** A charged particle enters a uniform magnetic field with a velocity inclined to the field direction at 60°. The particle will move along a circular path inside the magnetic field.
**Reason (R):** Magnetic force on a charge inside a magnetic field provides centripetal force for the circular motion of the charge.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** A current-carrying coil placed in a uniform magnetic field experiences a force which depends on the orientation of plane of the coil relative to the field direction.
**Reason (R):** A current-carrying conductor placed in a magnetic field experiences a force $F = iIB \sin \theta$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

| ANSWER KEY | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Que.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **Ans.** | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 1 | 4 | 1 | 3 | 4 | 2 | 2 | 4 |
| **Que.** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | **33** | **34** | **35** | **36** | **37** | | | |
| **Ans.** | 2 | 4 | 3 | 1 | 2 | 4 | 4 | 1 | 3 | 2 | 3 | 1 | 1 | 2 | 4 | 4 | 4 | | | |