Q No 1: (Page 5/6) A compass needle is deflected when a charged plastic rod is held near it because;

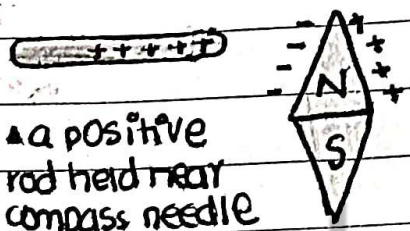
→EXPLANATION:

Origin of deflection: Origin of deflection is electric force.

Electrostatic induction: When a charged plastic rod is held stationary near neutral metallic compass needle. then opposite charges will induced on the side of metallic compass needle near the charged plastic rod.

Deflection of needle: The compass needle is deflected due to electrostatic force of attraction between charged plastic rod and induced opposite charges on near side of metallic compass needle.

Diagram:



▲a positive rod held near compass needle

Q No2: PERMITTIVITY || PERMEABILITY

(i) Related to

PERMITTIVITY	PERMEABILITY
→This property is related to Electric field which measures opposition offered against the formation of electric field.	→This property is related to Magnetic field which measures support provided by material to pass the magnetic flux when an external magnetic field is applied.

(ii) Principle involved

PERMITTIVITY	PERMEABILITY
Polarization of electric charges	→Magnetization.

(iii) Representation and unit

PERMITTIVITY	PERMEABILITY
→Represented by ε, unit $\frac{\text{farad}}{\text{meter}}$.	→Symbol: μ, Unit: Henry per metre

(iv) Referred as

PERMITTIVITY	PERMEABILITY
→Electric constant.	→Magnetic constact.

(v) Application

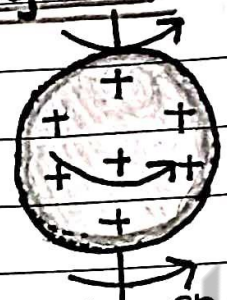
PERMITTIVITY	PERMEABILITY
→Capacitors	→Electromagnetic equipment.

Q NO3 (Page 4/6) A highly charged metallic object in rotational motion may create magnetic field.

→EXPLANATION:

Rotation of charged sphere: When a charged metallic sphere is rotated then every charged particle on it will move in a circle so there is infact a current and that current will generate a magnetic field.

Diagram:



A rotating charged metallic sphere

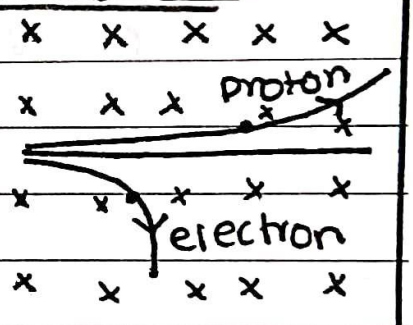
Revolution of electron: When electron revolves around the nucleus it produces magnetic field due to its orbital motion and also due to its spin motion about its own axis.

QNO4: Electron will suffer greater deflection.

→REASON:

Force acting: When charged particles enter magnetic field at 90° then maximum force acts on them causing them to deflect from their path. **Mathemanically:** $F=qVB$

Diagram:



Deflection of e and proton in magnetic field

Radius of path: Radius of deflected path depends upon mass, velocity, electric charge and magnetic field. The only factor electron and proton have different is their mass. Since mass of proton is greater than mass of electron, electron will suffer greater deflection as **radius is directly proportional to mass of particle.**

Mathematically: $r=\frac{mv}{qB}$ $\frac{me}{mp}=\frac{1}{1836}$ me < mp thus re < rp

→CONCLUSION: Thus mass effects the radius of deflection.

Q No 5 (Page 1/6) Magnetic field may or may not be zero.

→ **EXPLANATION:** Force experienced by a charged particle is given by $\vec{F}=q(\vec{V}\times\vec{B})$

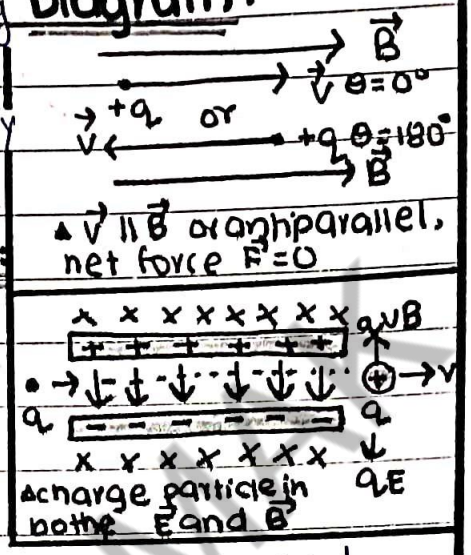
- **Absence of magnetic field:** Force may be zero due to $\vec{B}=0$ Thus $\vec{F}=0$
- **Motion parallel or antiparallel to $\vec{B}$:** Force can be zero if $\theta=0°$ or $180°$

Mathematically: $F=qVB\sin\theta$, $F=0$

- **Perpendicular electrical and magnetic fields:** Charged particle moving perpendicularly into a region where electric and magnetic fields are also perpendicular will pass undeflected as net force on charge = 0 **Mathematically:** $\vec{F_E}=\vec{F_B}$, $F_{net}=0$

→ **CONCLUSION:** In all these cases charge particle won't be deflected

Diagram:



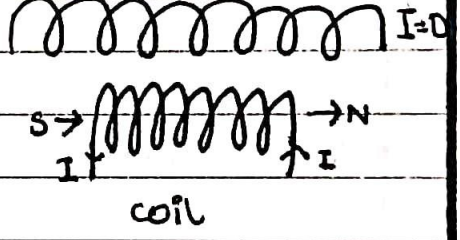
Q no 6: When current is passed through an unstretched spring, it will contract.

→ **EXPLANATION:**

Let us consider the spring as a coil. In absence of current, loops are spaced apart.

- **Applied current:** Current passes through all loops in the same direction, one end of coil becomes North and other becomes South pole.
- **Attraction between loops:** As two parallel wires carrying current in same direction attract each other, the loops of coil attract one another causing the spring to contract.

Diagram:



▲ current through a coil.

Q No7: (Page 2/6) Neutrons cannot be accelerated by means of a cyclotron.

→EXPLANATION:

- **Cyclotron:** Charged particles are accelerated using magnetic field of high frequency alternating voltage in the device.
- **Charge on neutron:** Neutron is neutral bearing no charge.
- **Magnetic force on neutron:** As charge = 0 on neutron thus no magnetic force acts on neutron.

Mathematically: $F = qVB\sin\theta$

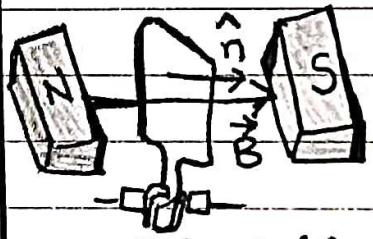
$F = (0)VB\sin\theta$ $q = 0$ for neutron

$F = 0$ Thus neutron can't be accelerated.

Qno8: Plane of loop should be perpendicular to magnetic field to maintain the equilibrium state in which no torque acts on loop. $\tau = 0$

→EXPLANATION: When a current carrying coil is placed in a magnetic field it will experience a torque. When vector area of coil is parallel to magnetic field torque will be zero

Diagram:



▲ a coil in equilibrium in a magnetic field

Mathematically: $\tau = NIAB\sin\theta$. where $N = 1$ and $\theta = 0°$ for equilibrium state. $\tau = (1)IAB\sin 0°$, $\tau = 0$

→CONCLUSION:

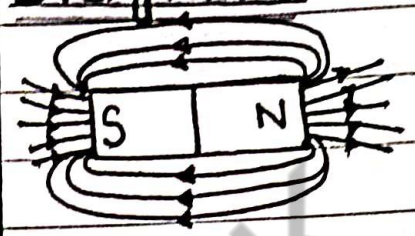
As no net torque acts on the loop so loop will be in equilibrium.

Q No 9 (six) A current carrying coil behaves like a tiny bar magnet.

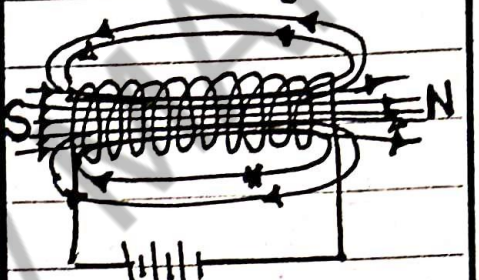
→ **EXPLANATION:**

When current passes through a coil it produces a magnetic field that resembles the magnetic field of bar magnet.

Diagram:



▲a bar magnet.



▲current carrying coil.

- **Origin and termination of field lines:** Magnetic field lines originate from one face of coil and terminate at the other face.
- **Magnetic field inside:** Inside the coil magnetic field is strong and uniform like bar magnet.
- **Right Hand Rule for finding direction:** This rule can be used to find direction of magnetic field. Hold the coil in such a way that curling fingers are in direction of current then thumb will be North-pole and opposite to thumb will be South pole.