Q. No. 1 (xv) Electric field may or may not be zero:

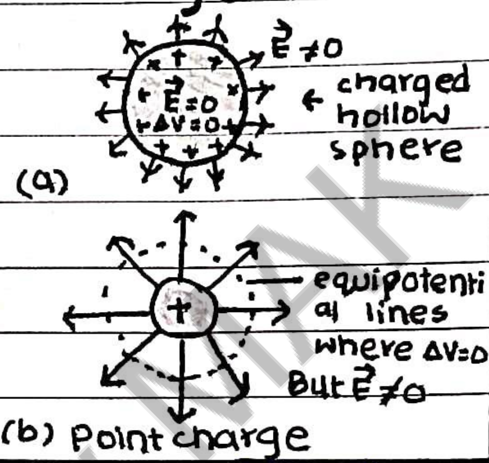
→ **FOR CHARGED HOLLOW SPHERE:** Inside a charged hollow sphere electric field strength will be **zero.**

Mathematically: $\vec{E} = -\Delta V/\Delta r$

V = constant, $\Delta V = 0$ thus $\vec{E} = 0/\Delta r$

$\boxed{\vec{E} = 0}$

Diagram:



→ **FOR A POINT CHARGE:** At surrounding region of a point charge, the potential is constant at equal distance from the charge but electric field is **not zero** at those points. **Mathematically:** V = 0 but $\boxed{\vec{E} \neq 0}$

→ **CONCLUSION:** Thus inside a charged hollow sphere $\vec{E}$ will be zero whereas surrounding a point charge $\vec{E} \neq 0$

Q. No. 2 (xvi) Yes, point charge will perform rectlinear motion

→ **REASONS:**

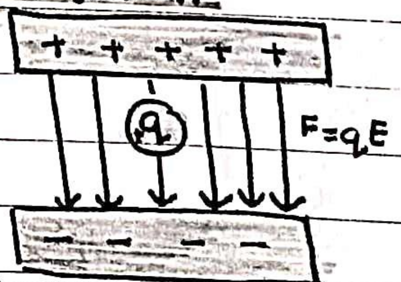
(i) Direction of field lines: Although the electric field is non uniform meaning it's varrying in magnitude but its direction is uniform i.e., in one direction thus causing rectlinear motion of charge.

(ii) Force experienced by charge q: The charge will experience a force $\vec{F}$ equal to product of $\vec{E}$ and q.

Mathematically:

$\boxed{F = qE}$

Diagram:



▲charge will perform rectlinea motion along field lines

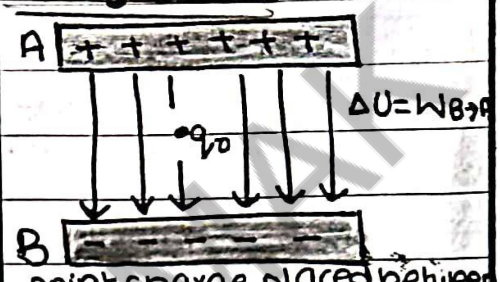
→ **CONCLUSION:** Thus motion of of charge will be along field lines due to a force of varrying magnitude

Q No.3 (xv) The two terms are relative and closely related.

→EXPLANATION: Let a positive charge $+q_o$ be displaced towards high potential between two oppositely charged plates then;

Electric potential energy will be equal to work done in displacing charge from B to A

Diagram:



point charge placed between oppositely charged plates

Mathematically:

$$W_{BA} = \Delta U$$

Potential difference will be the work done per unit charge

Mathematically:

$$\Delta V = \frac{\Delta U}{q_o}$$

→CONCLUSION: Hence electric potential energy is possessed by charge whereas potential difference is associated with the field

Q. No. 4 (xvi) Volt is unit of potential difference whereas electron volt is the unit of energy.

→EXPLANATION:

(i) Volt: If 1J work is done moving unit positive charge from one point to another, keeping electrostatic equilibrium then potential difference between two points is one volt (1V) **Mathematically:** $1\text{volt} = \frac{1\text{Joule}}{1\text{Coulomb}}$

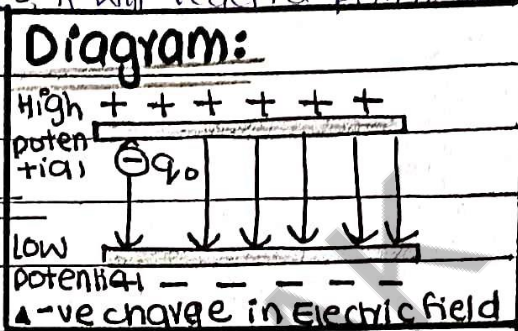
(ii) Electron volt: The energy acquired or lost by an electron as it moves between two points having a potential difference of one volt is called one electron volt

Mathematically: $1eV = (1e)(1V)$ $e = 1.6\times10^{-19}C$

$$1eV = 1.6\times10^{-19}\,CV \text{ or } 1.6\times10^{-19}\,J$$

→CONCLUSION: Electron volt is unit of energy, volt is unit of electric potential energy per unit charge or potential difference

Q.No.9.5) → HIGH ELECTRIC POTENTIAL WHILE ELECTRIC POTENTIAL ENERGY IS LOW: If a negative charge is released in an electric field of two oppositely charged plates, it will reach a point of high electric potential while its P.E is low.



→ EXPLANATION:

(i) Gain in kinetic energy & Loss in P.E: As -q charge travels from -ve to +ve plate it loses potential energy and gains kinetic energy because no external work is done on charge.

(ii) High potential of Positive plate: Positive plate is at high potential. As it attracts the negative charge -q towards itself, the charge reaches a high potential point.

→ CONCLUSION: Although the charge -q reaches a high potential point but loses its electric potential energy in the journey.

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Q.No.9.6) No, electric potential around non uniformly charged sphere will not be the same as that of a point charge.

→ REASONS:

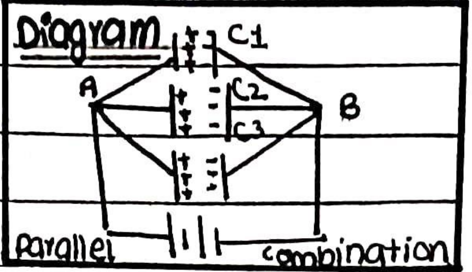
(i) Lack of uniformity of charge in sphere: As sphere isn't uniformly charged, concentration and strength of electric field around charge will vary. Thus electric potential will varry as well

(ii) Uniform electric field of point charge: A point charge has uniform electric field all around and for a certain distance, electric field strength remains constant. Thus electric potential will be constant or uniform all around it.

Mathematically: $V = k\frac{q}{r}$

→ SCENARIO IF WE ARE FAR FROM SPHERE: If we are far enough from the sphere then its potential may behave like point charge.

Q.No (7) Capacitor will store more energy in parallel combination than the series combination.



→ REASON: Energy depends on capacitance and square of voltage thus;

In Parallel combination all capacitors will get same voltage, net energy storage will be the sum of all individual energy storages. $C_P = 3C$ (i)

In series combination all capacitors will not get the same voltage, net energy storage will be the sum of inverse of each individual energy storage. $C_S = \frac{C}{3}$ (ii)

→ Mathematically: we know that $U = \frac{1}{2}CV^2$

$U_{parallel} = \frac{1}{2}C_P V^2$

$U_P = \frac{1}{2}(3C)V^2 = \frac{3}{2}CV^2$ (iii)

$U_{series} = \frac{1}{2}C_S V^2$ (Putting values from (i) and (ii))

$U_S = \frac{1}{2}(\frac{C}{3})V^2 = \frac{1}{6}CV^2$ (iv)

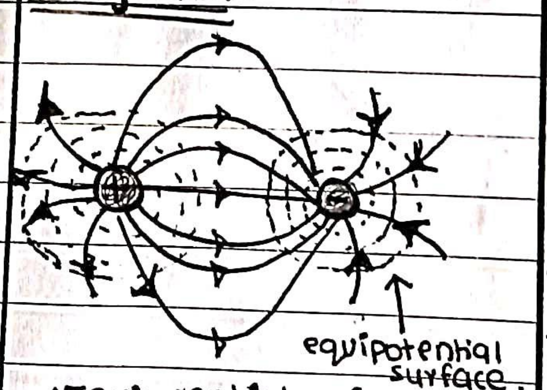
Divide (iii) by (iv) $U_{parallel} = 9U_{series}$, $U_{parallel} > U_{series}$

Q.No.8: No, equipotential lines never cross each other.

→ REASON:

Equipotential lines represent points in a field with the same potential. If they were to cross, it would imply that those points have different potentials at the point of intersection which contradicts the definition of equipotential lines. In a uniform field, where the potential changes consistently, equipotential lines are parallel and never intersect.

Diagram:



▲Equipotential surfaces

→ CONCLUSION: crossing of these lines would thus mean different electric field directions at one point which is impossible.

Q NO 3 (ix) Although water has very high value of dielectric constant 78·5, it is rarely used in capacitors as dielectric

→ **REASONS:**

(i) **Dipole moment:** Water molecules have dipole moments and can easily be polarized thus decrease the effect of electric field between a capacitor's plate

(ii) **Conductivity:** Water can conduct electricity due to H^+ and OH ions.

(iii) **Mobile ions:** H^+ and OH^- are mobile that may leak charge between the plates of a capacitor and discharge it.

(iv) **Variation with temprature:** Value of dielectric constant of water varies with temprature.

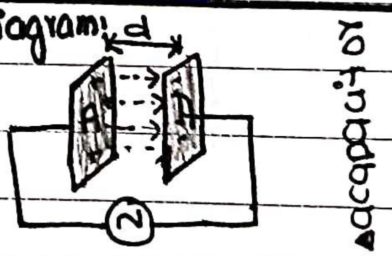
Q. No. 3 (x) → **WAYS TO INCREASE CAPACITANCE 'C':**

(i) **Increasing area of plates:** By increasing area of plates, more charges can be stored. $C \propto A$

(ii) **Decreasing distance between plates:** By decreasing distance between plates phenomenon of electrostatic induction is aided. $C \propto \frac{1}{d}$

(iii) **Dielectric:** By using dielectric of greater permittivity between two plates of capacitor. $C \propto \varepsilon$

Diagram:



→ **Mathematically:** $C_{med} = \frac{A\varepsilon}{d} = \frac{A\varepsilon_0\varepsilon_r}{d}$

→ **CONCLUSION:** Thus keeping in view the parameters expressed in mathematical equation capacitance of capacitor can be increased.