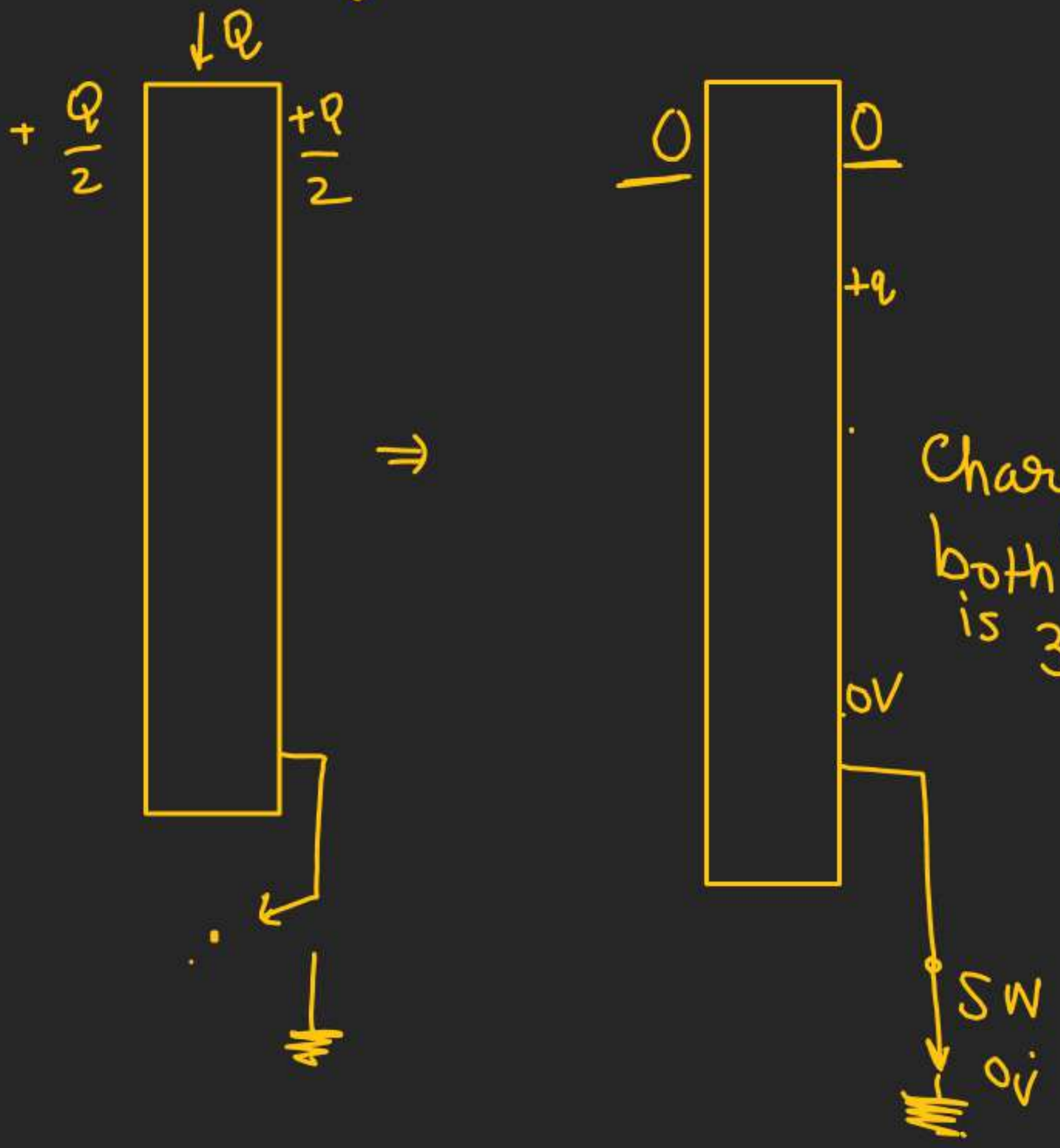
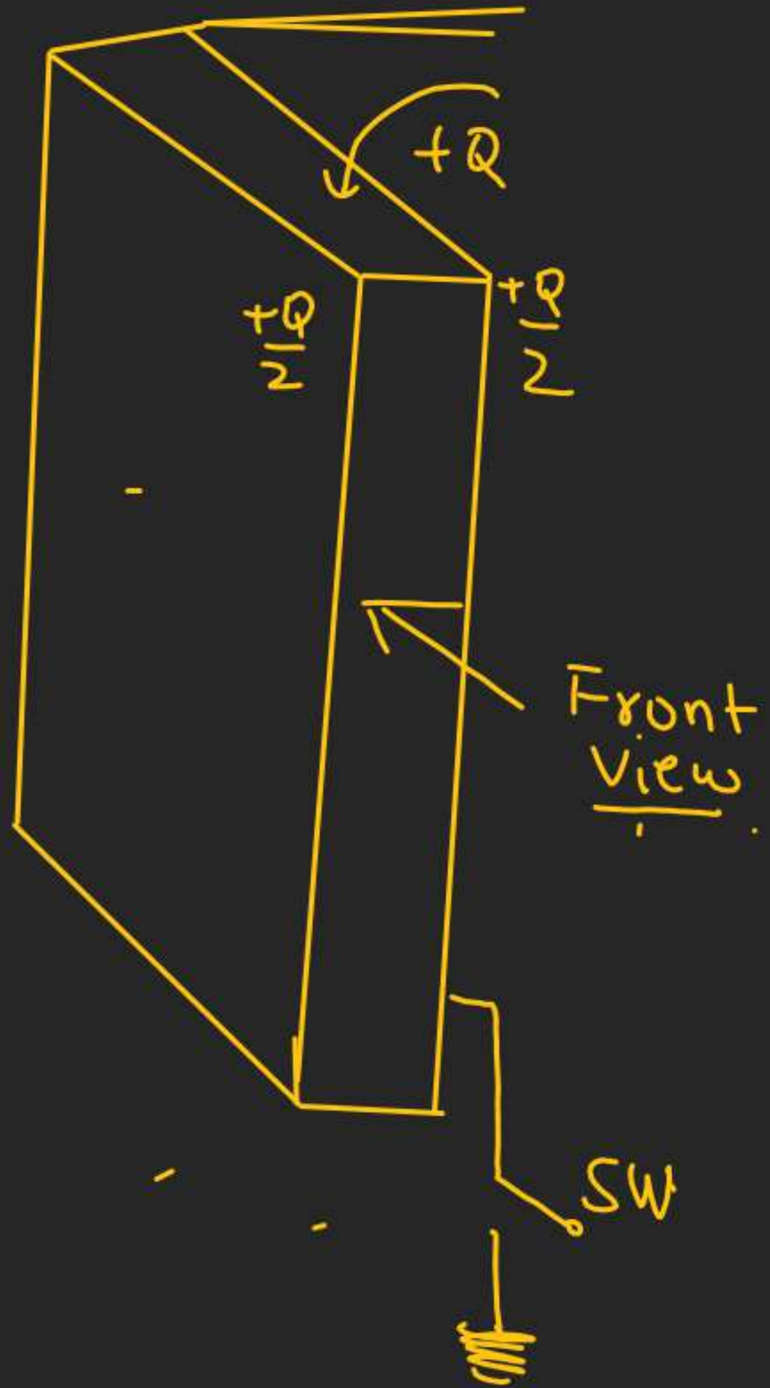
Conductor

(α). Earthing of a parallel plate Conductors :→



Charge on both the face is zero



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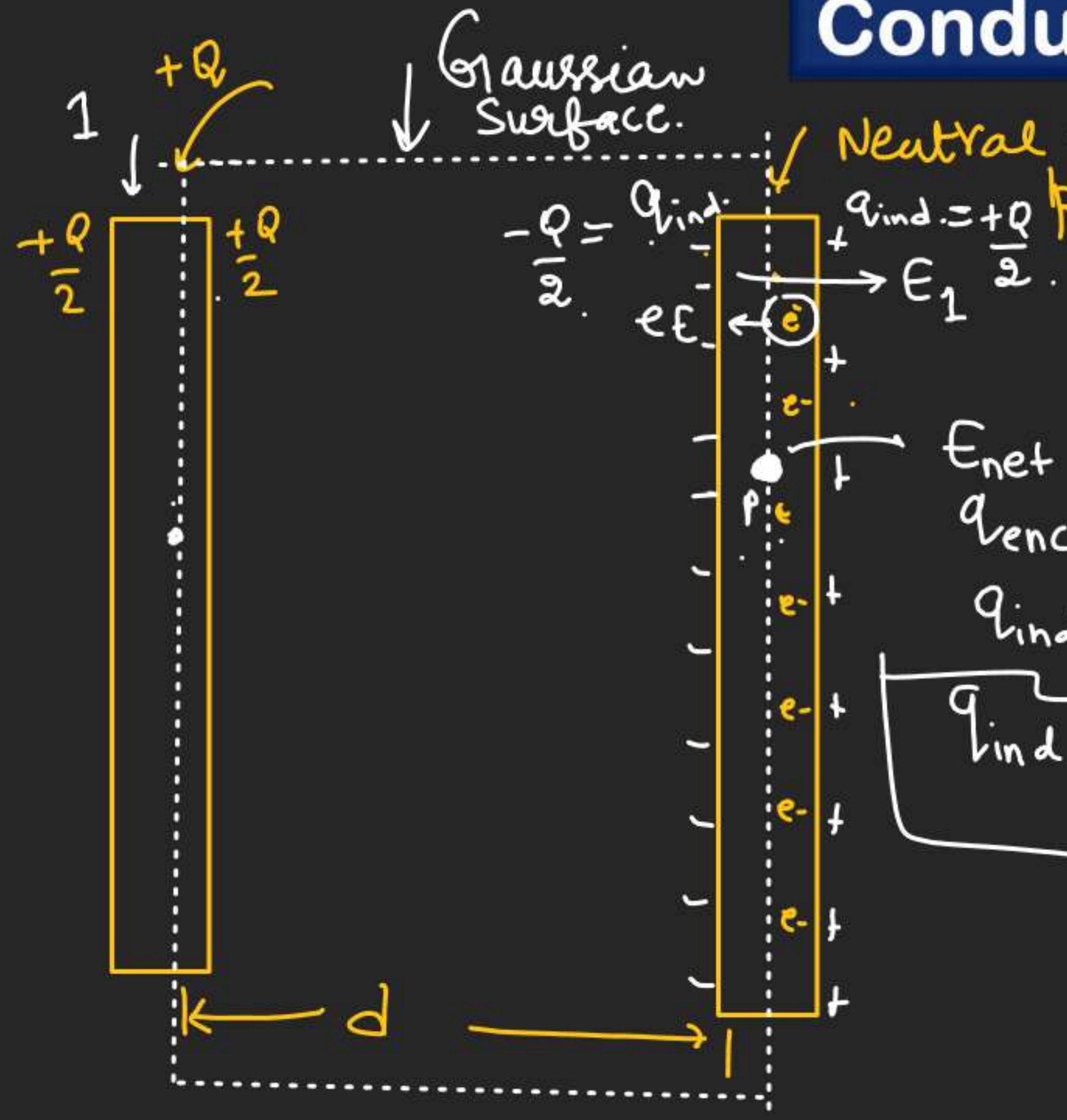
Conductor

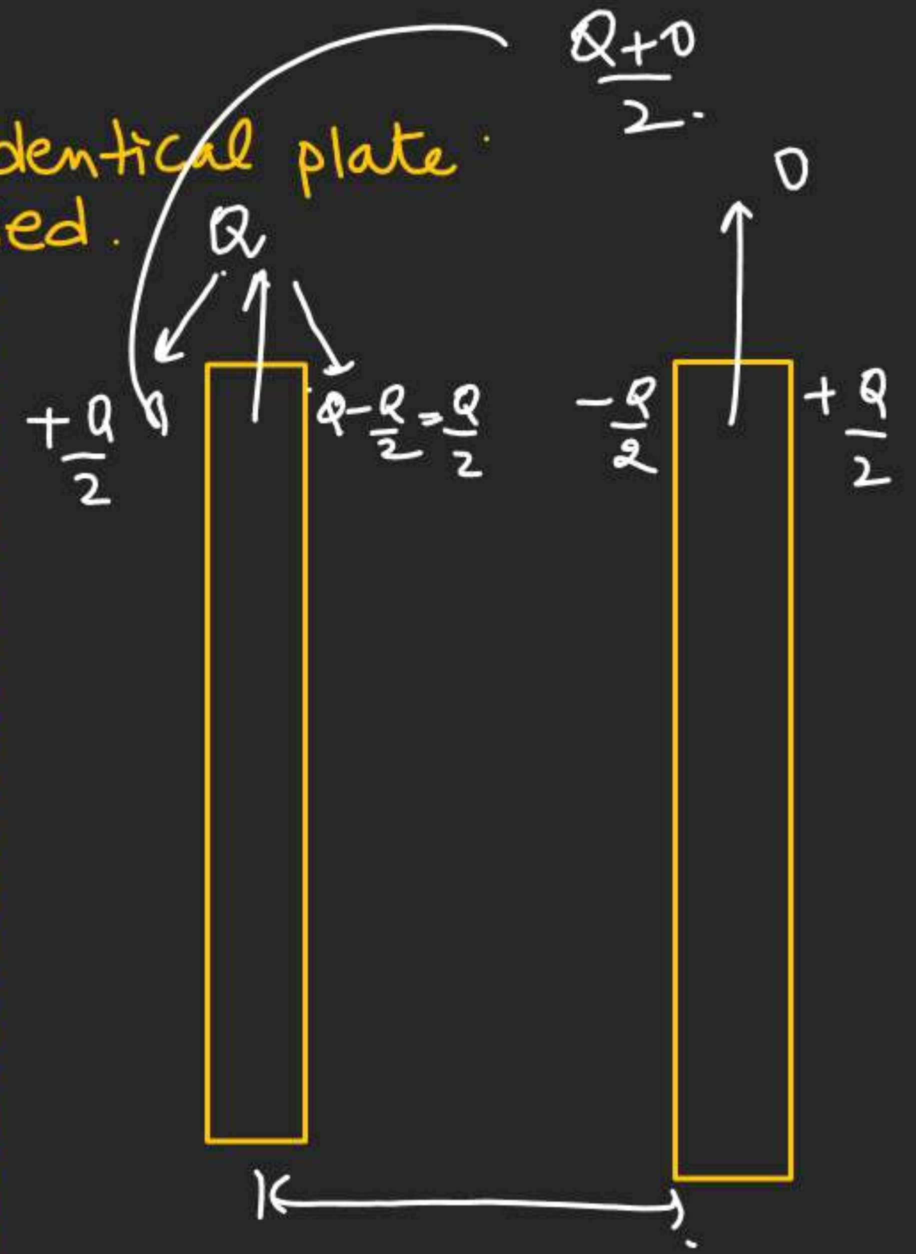


$E_{net} = 0$

$q_{enc} = 0$

$q_{ind} + \frac{Q}{2} = 0$

$\boxed{q_{ind} = -\frac{Q}{2}}$



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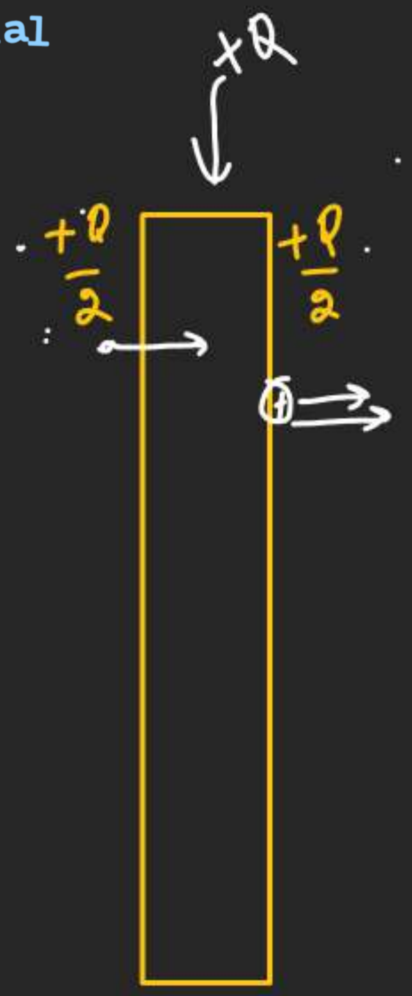

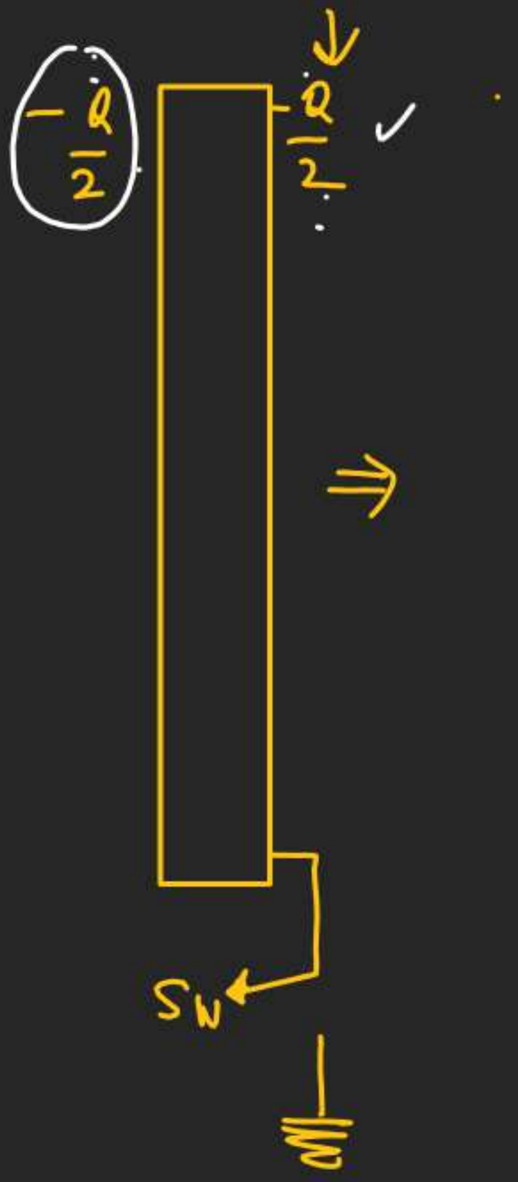

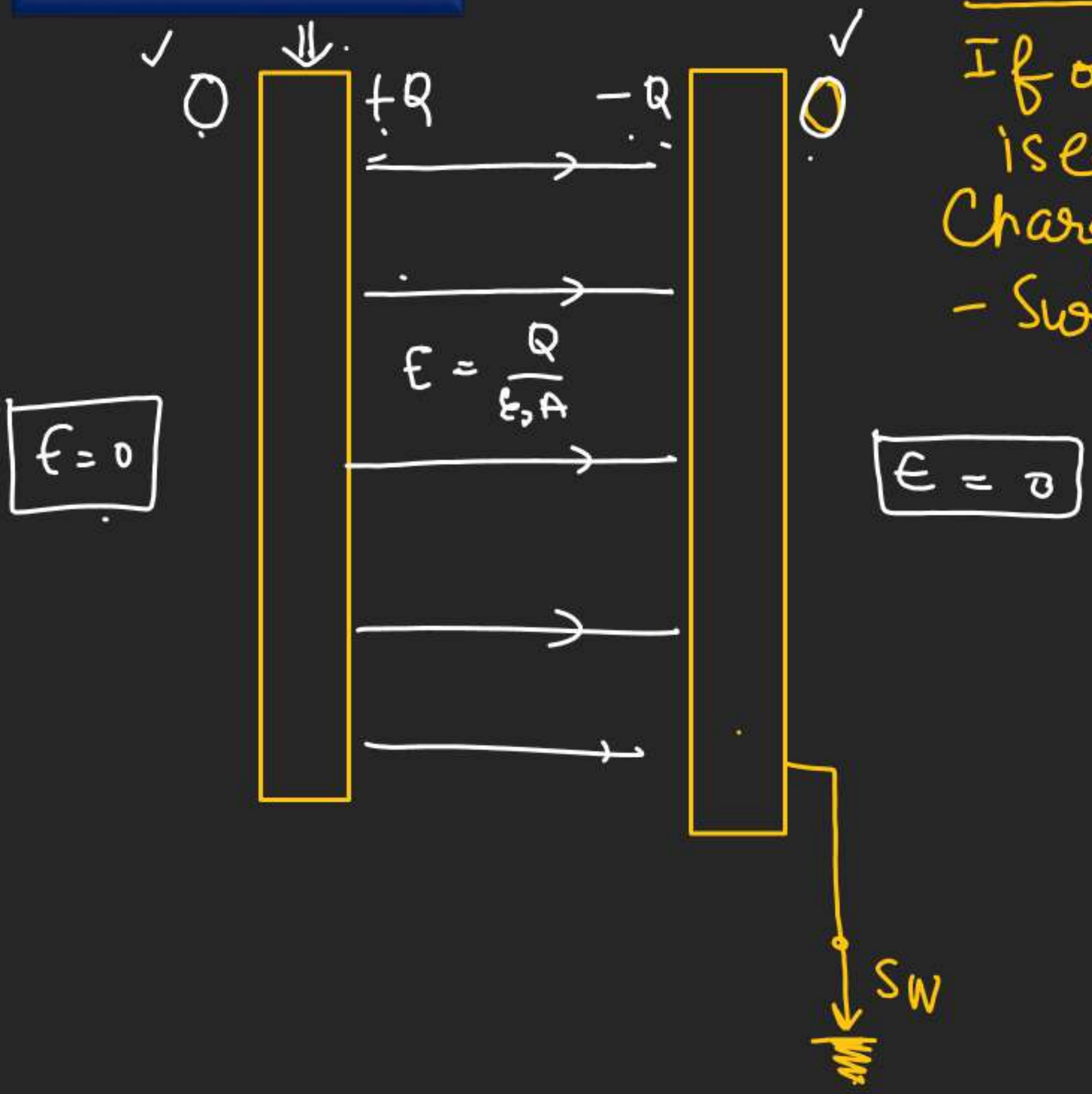

→ Rule

If one of the plate is earthed then Charge on the outer - Surface is zero.

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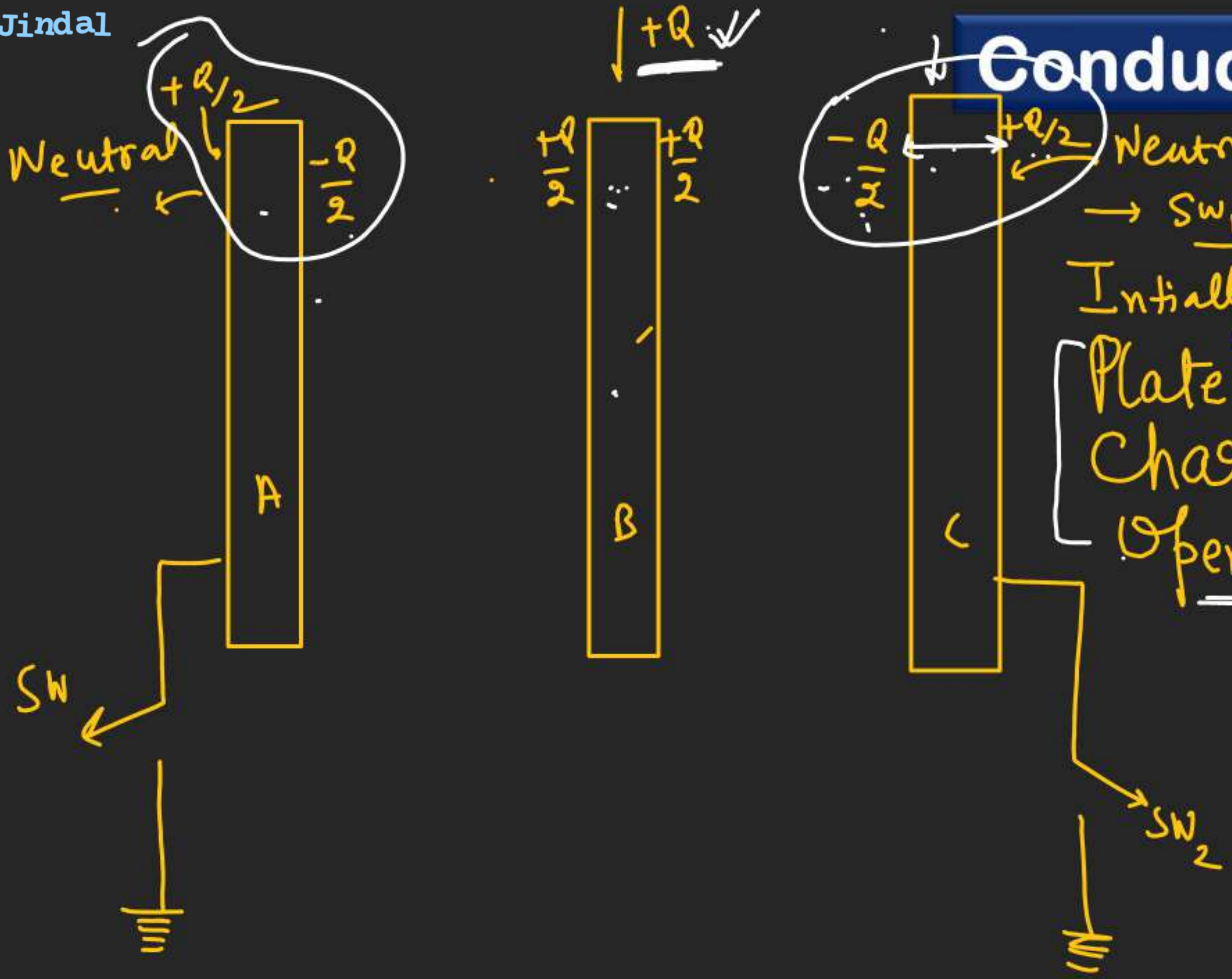


→ SW1 & SW2 open

Intially A & C Neutral

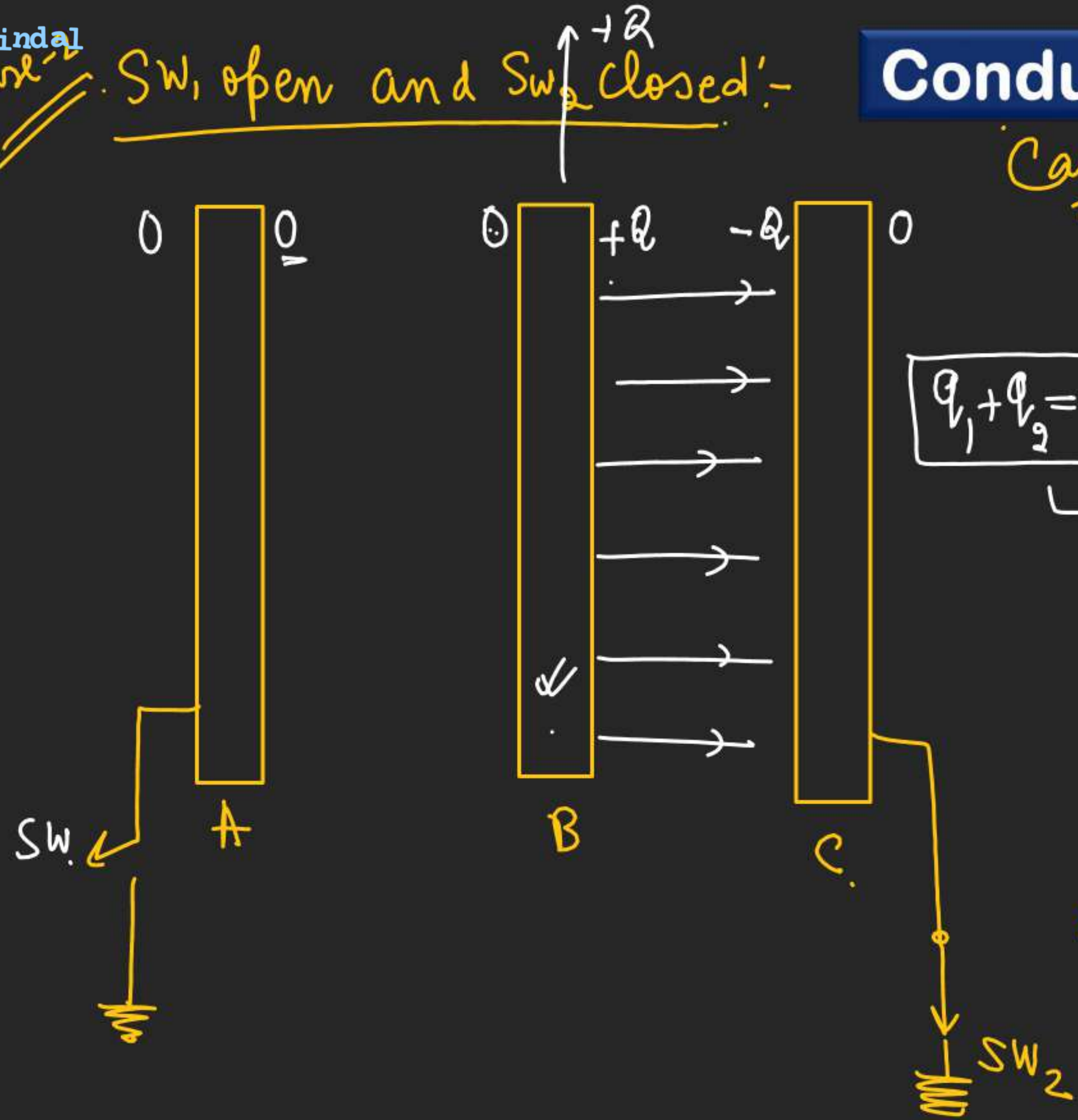
Plate B is given a Charge +Q. SW1 & SW2 open

Case-1 :-

SW1 Closed and SW2 open

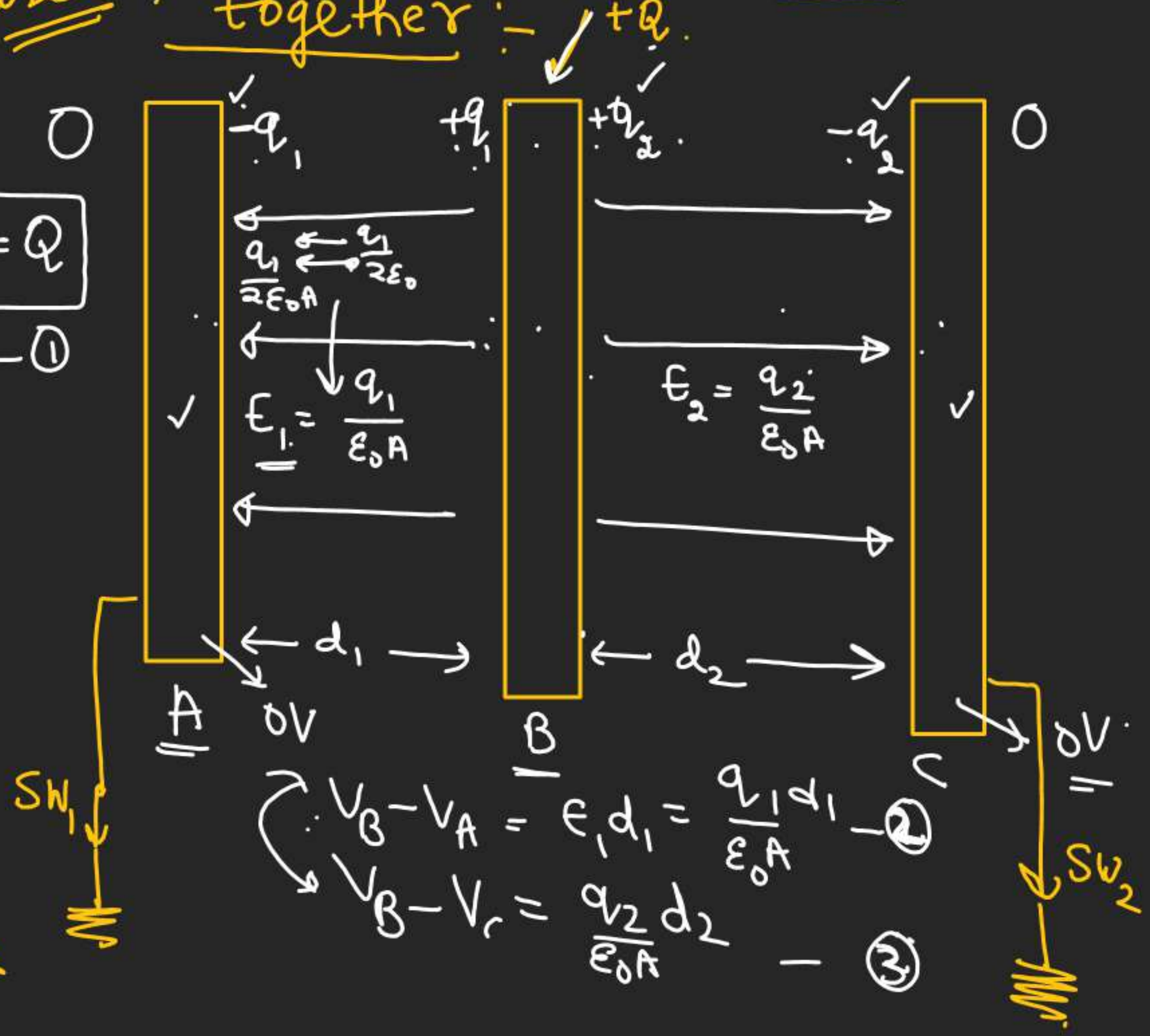
Conductor

Case-2 :- SW_1 open and SW_2 closed :-



$$\boxed{q_1 + q_2 = Q} \quad \text{---} (1)$$

Case-3 :- SW_1 and SW_2 closed together :-



$$V_B - V_A = E_1 d_1 = \frac{q_1 d_1}{\varepsilon_0 A} \quad \text{---} (2)$$

$$V_B - V_C = \frac{q_2 d_2}{\varepsilon_0 A} \quad \text{---} (3)$$

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$$V_B - V_A = \frac{q_1 d_1}{\varepsilon_0 A}$$

$$V_B - V_C = \frac{q_2 d_2}{\varepsilon_0 A}$$

$$\underset{0}{V_C} - \underset{0}{V_A} = \frac{q_1 d_1 - q_2 d_2}{\varepsilon_0 A}$$

$$0 = q_1 d_1 - q_2 d_2$$

$$q_2 = \left(\frac{q_1 d_1}{d_2}\right)$$

$$q_1 + q_2 = Q$$

$$q_1 + \frac{q_1 d_1}{d_2} = Q$$

$$q_1\left(1 + \frac{d_1}{d_2}\right) = Q$$

**

$$\boxed{q_1 = \frac{Q d_2}{d_1 + d_2}}$$ ✓

**

$$\boxed{q_2 = \frac{Q d_1}{d_1 + d_2}}$$ ✓

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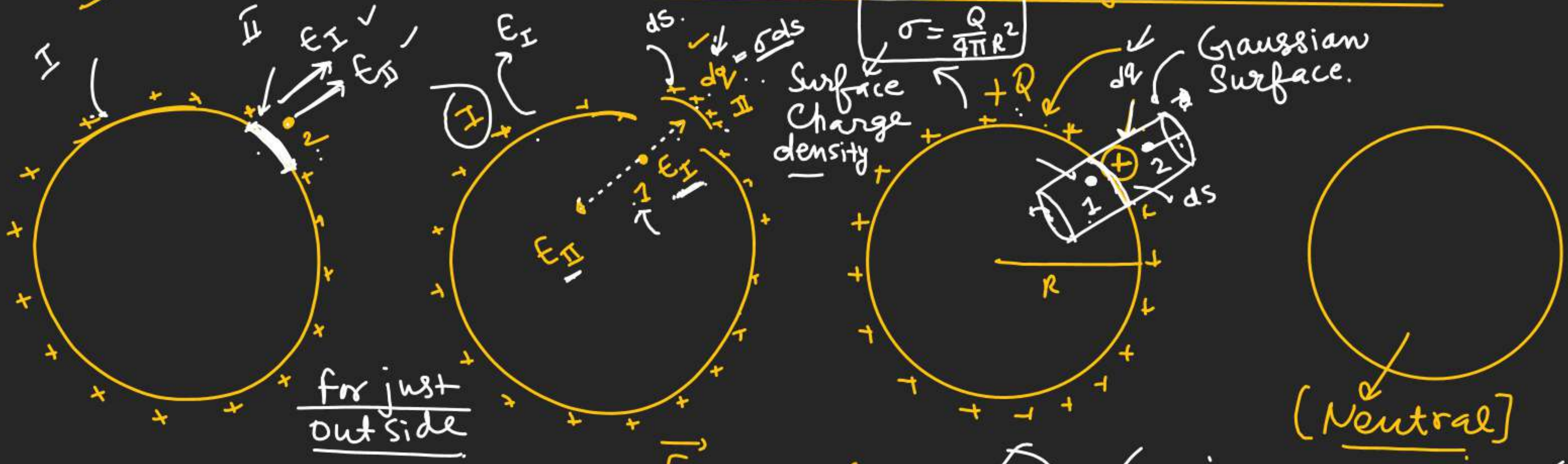
Conductor

(A). Electric pressure on a Charge Conductor: →



$\cancel{(X)}$ $\quad \frac{\sigma}{\varepsilon_0} = E_I + E_{II}$

$$\boxed{E_{II} = E_I = \frac{\sigma}{2\varepsilon_0}}$$

$$(\vec{E_1})_{net} = 0$$

$$\vec{E}_I + \vec{E}_{II} = 0$$

$$\vec{E}_I = -\vec{E}_{II}$$

$$\Rightarrow \boxed{E_I = E_{II}} \quad (1)$$

$$E_{net}\, ds = \frac{q_{enc}}{\varepsilon_0} = \frac{dq}{\varepsilon_0} = \frac{\sigma\, \cancel{ds}}{\varepsilon_0}$$

$$\boxed{E_{net} = \left(\frac{\sigma}{\varepsilon_0}\right)} \quad (II)$$

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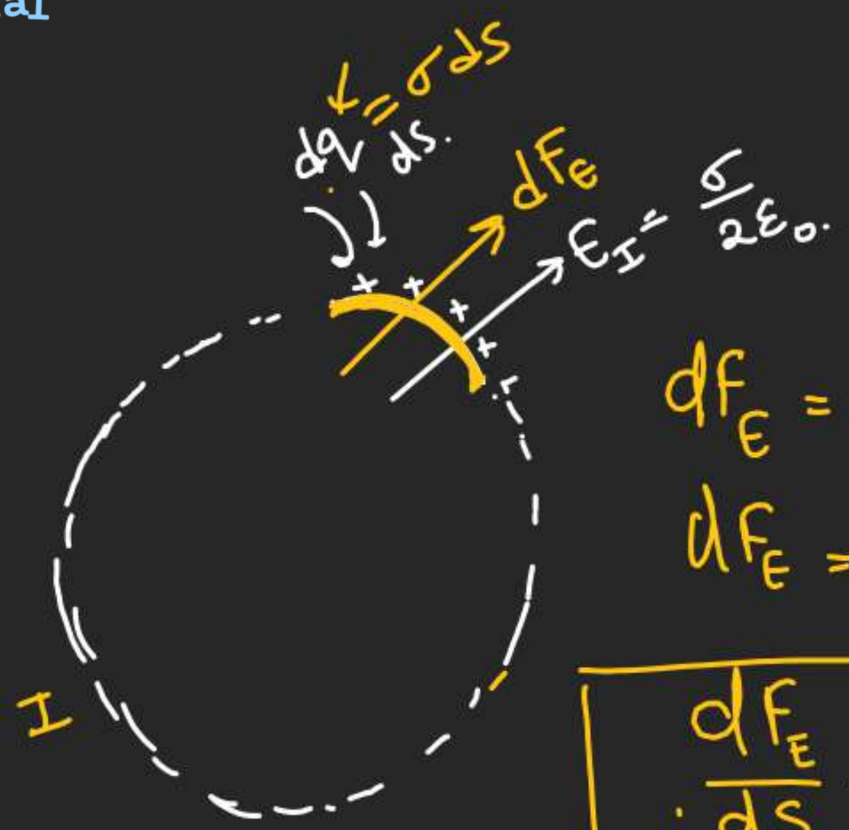
Conductor



$$dF_E = E_I \, dq$$

$$dF_E = \frac{\sigma}{2\varepsilon_0} \times \sigma \cdot (ds)$$

$$\boxed{\frac{dF_E}{ds} = \frac{\sigma^2}{2\varepsilon_0}}$$

$$\Downarrow$$

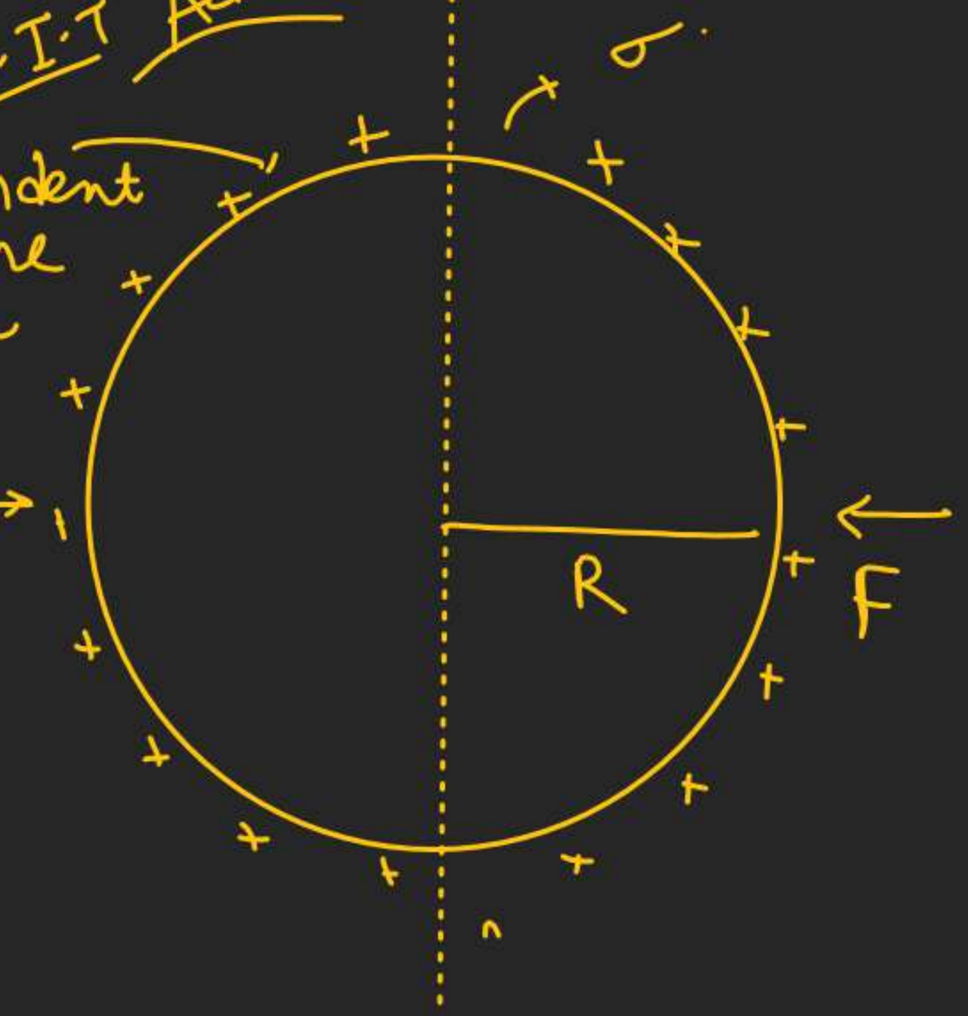
$$\boxed{\text{Electrostatic pressure} = \frac{\sigma^2}{2\varepsilon_0}}$$

**

I.I.T Adv

Independent two hemisphere kept closed by applying force F.

Find F = ?? F



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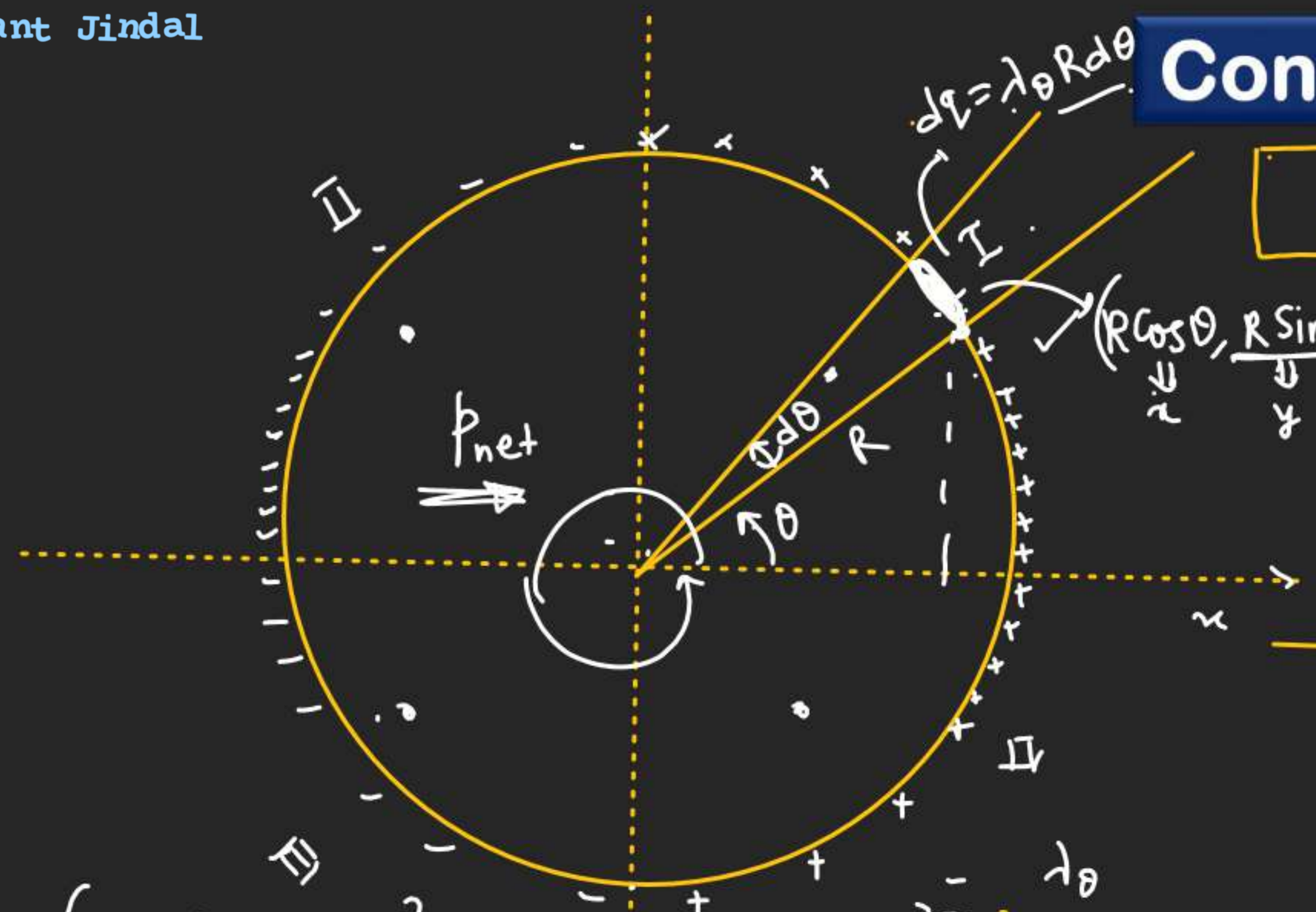
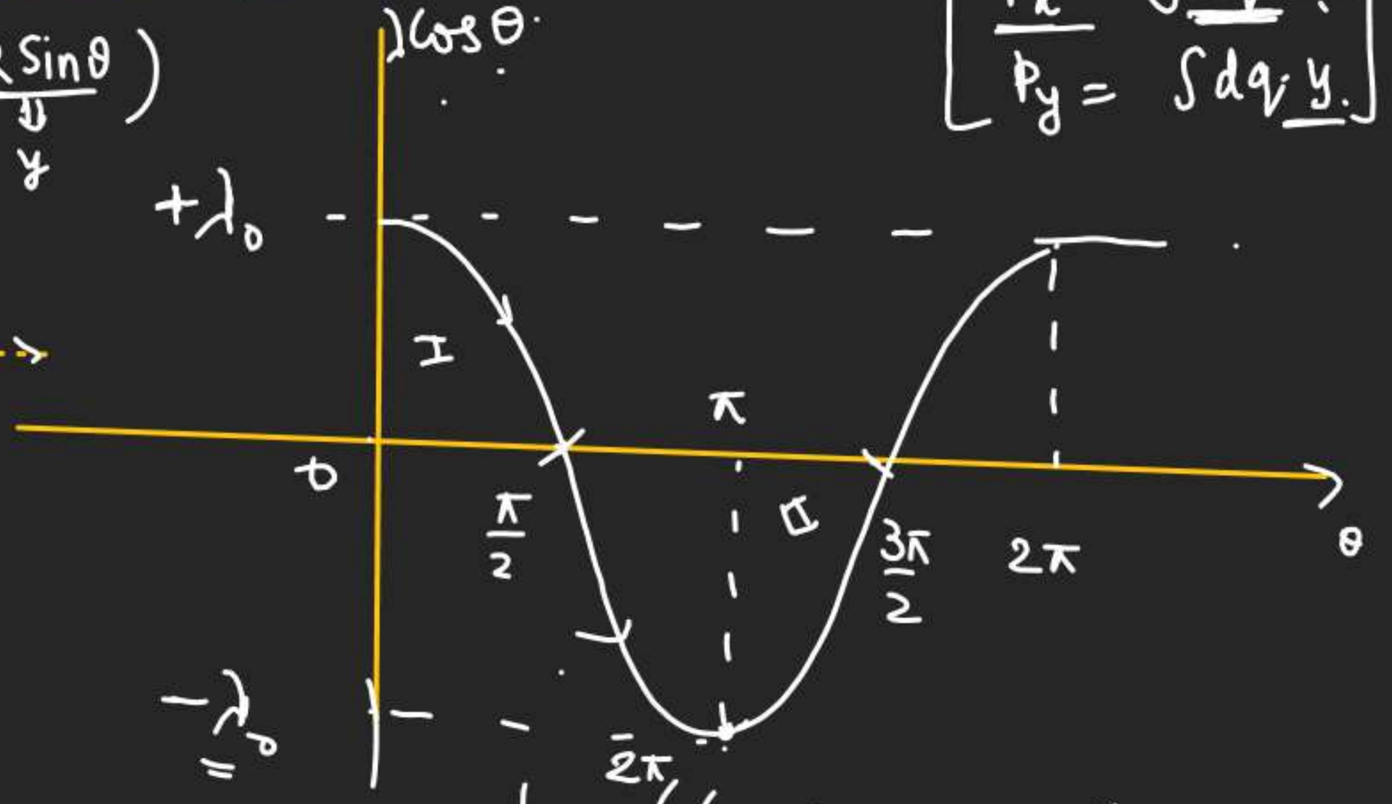
Conductor

Dipole Moment = ??

$$\boxed{\lambda = \lambda_0 \cos\theta}$$





$$\left[\begin{aligned} p_x &= \int dq \cdot x \\ p_y &= \int dq \cdot y \end{aligned}\right] \quad \vec{p} = p_x\hat{i} + p_y\hat{j}$$

$$\cos 2\theta = 2\cos^2\theta - 1$$

$$\cos^2\theta = \left[\frac{1+\cos 2\theta}{2}\right]$$

$$p_x = \int_0^{2\pi} (\lambda_0 \cos\theta)\, R\, d\theta\, (R\cos\theta)$$

$$p_x = \lambda_0 R^2 \left[\int_0^{2\pi} \cos^2\theta \cdot d\theta\right] \Rightarrow \quad p_x = ?$$

$$p_y = \int_0^{2\pi} (\lambda_0\cos\theta)\, R\, d\theta\, (R\sin\theta)$$

$$p_y = \frac{\lambda_0 R^2}{2}\int_0^{2\pi} 2\sin\theta\cdot\cos\theta\cdot d\theta = \frac{\lambda_0 R^2}{2}\int_0^{2\pi}\sin 2\theta \cdot d\theta$$

$$0$$