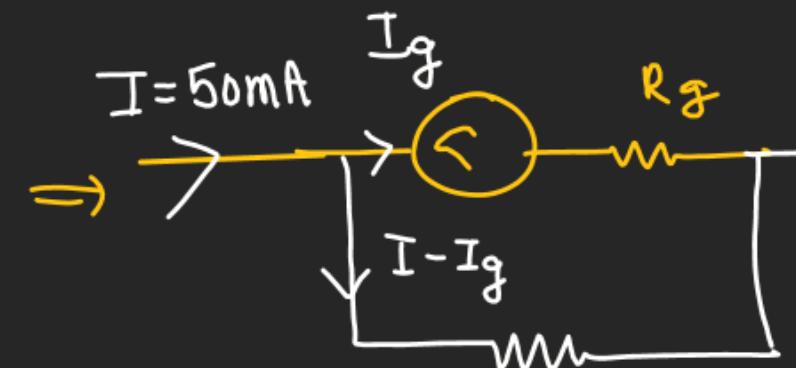
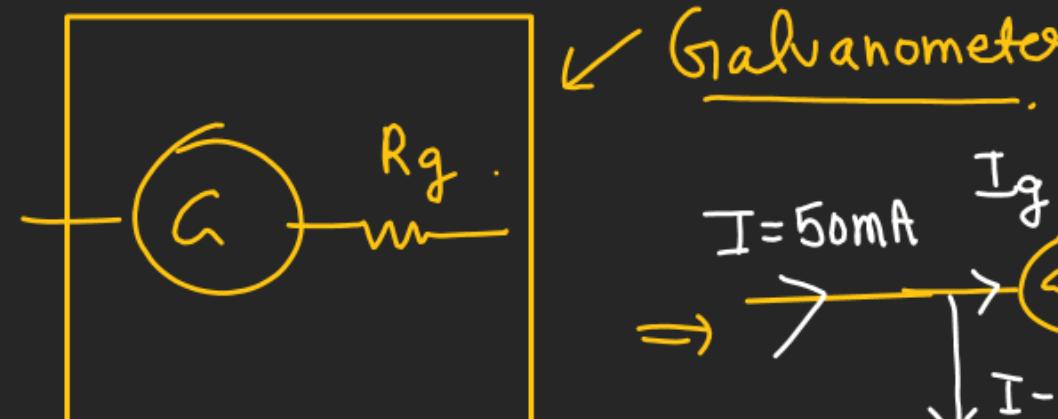


Q.1 What shunt resistance is required to make the 1.00 mA, 20Ω galvanometer into an ammeter with a range of 0 to 50.0 mA ?



$$I_g = 1 \times 10^{-3} \text{ A}$$

$$R_g = 20\Omega$$

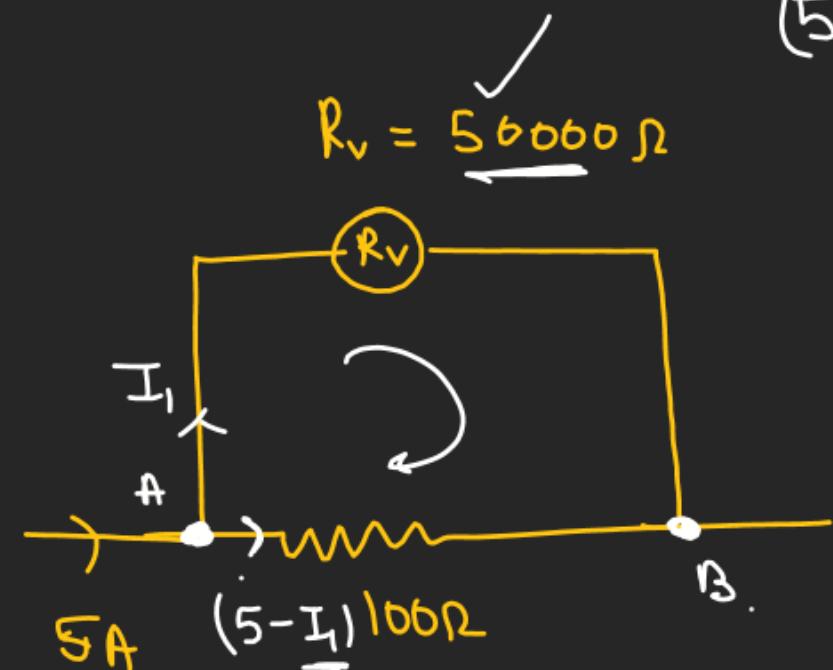
$$0 < I_g < I$$

$$I_g R_g = (I - I_g) R_{sh}$$

$$R_{sh} = \frac{I_g R_g}{I - I_g} = \frac{10^{-3} \times 20}{(50 - 1) \times 10^{-3}} = \left(\frac{20}{49}\right) \Omega$$

Error of VoltmeterEx:-

$$I = 5 \text{ A} \quad A \quad 100 \Omega \quad B$$



$$\begin{aligned} V_A - V_B &= 100 \times 5 \\ &= \boxed{500 \text{ Volt}} \end{aligned}$$

$$\begin{aligned} V_A - V_B &= (5 - I_1) \times 100 \\ &= (5 - \frac{5}{501}) \times 100 \\ &= 5 \times \frac{500}{501} \times 100. \end{aligned}$$

$$(5 - I_1) \times 100 = I_1 \times \underline{50000}$$

$$5 - I_1 = 500 I_1$$

$$5 = 501 I_1$$

$$I_1 = \left(\frac{5}{501} \right) \checkmark$$

$$\Rightarrow \% \text{ error} = \left(\frac{500 - 499}{500} \times 100 \right)$$

$$\left[\begin{array}{l} \frac{25}{501} \times 10^4 \\ = \\ 0.0499 \times 10^4 \\ = \\ \underline{499 \text{ volt}} \end{array} \right]$$

$\Delta \Phi$ Meter bridge :→

↳ [Based on the principle of balance Wheat-Stone bridge]

↳ To find Unknown resistance

⇒ AB → [Uniform Cross section]
 $100\text{cm} = L$

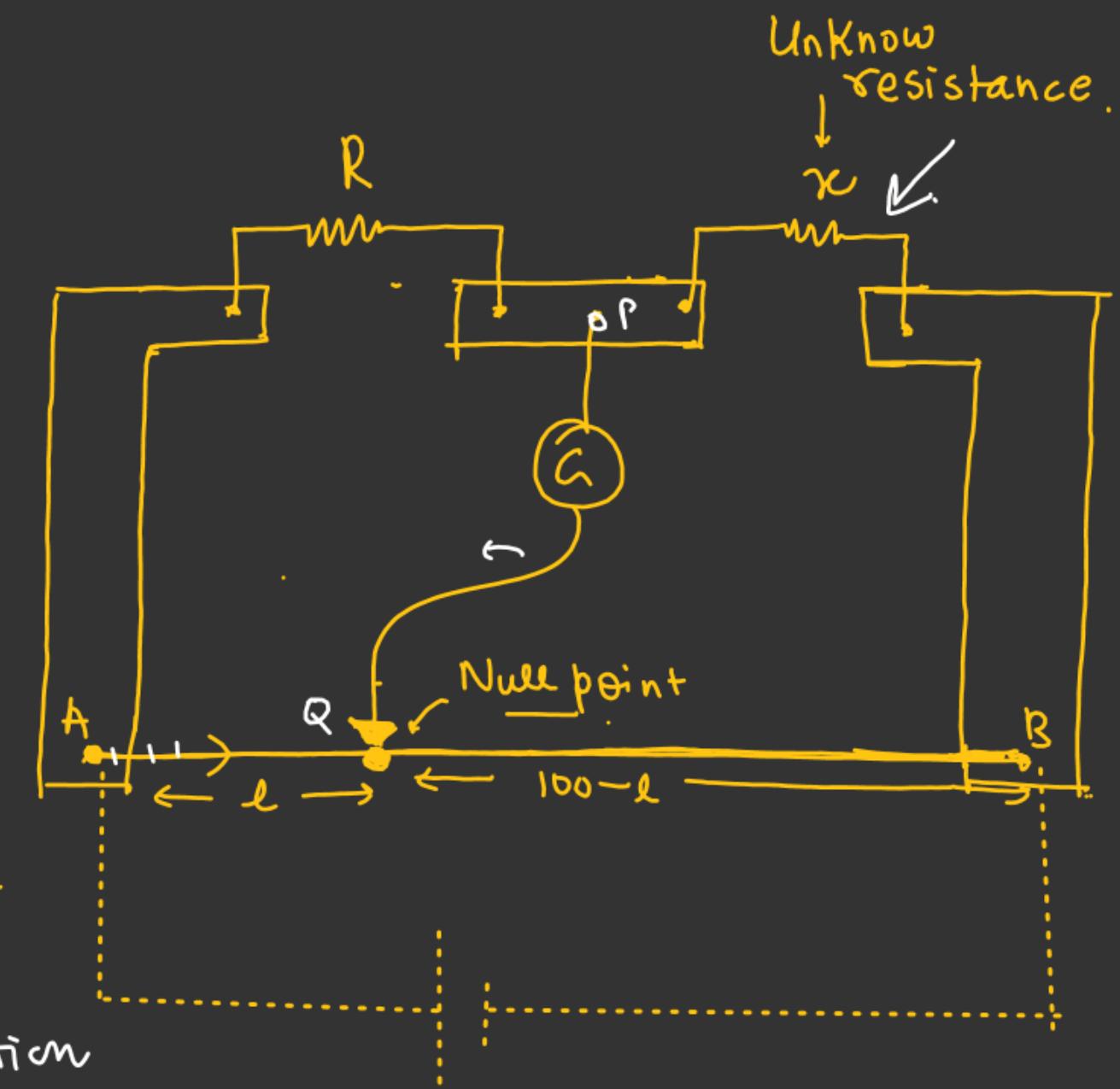
Null point = [potential difference across the galvanometer
 $R = (\rho \frac{l}{A})$ is zero, $(V_p = V_Q)$]

$R_{QB} = \frac{\rho (100-l)}{A}$ At the time of Null deflection

$$R_{AQ} = \left(\frac{\rho l}{A} \right)$$

$$\frac{R}{R_{AQ}} = \frac{x}{R_{QB}} \Rightarrow x = R \times \frac{R_{QB}}{R_{AQ}}$$

$$x = R \times \left(\frac{100-l}{l} \right)$$



(A) Potentiometer

Potential difference

Principle :- across any length of the wire is directly proportional to its length.

Wire AB

L = Total length

$$V_A - V_B = V$$



$$\text{Potential gradient} = \left(\frac{V}{L} \right)$$

$$V_{AC} = \left(\frac{V}{L} \right) \times (\underline{l})$$

④ To Compare the E.M.F of two ideal Cells \rightarrow

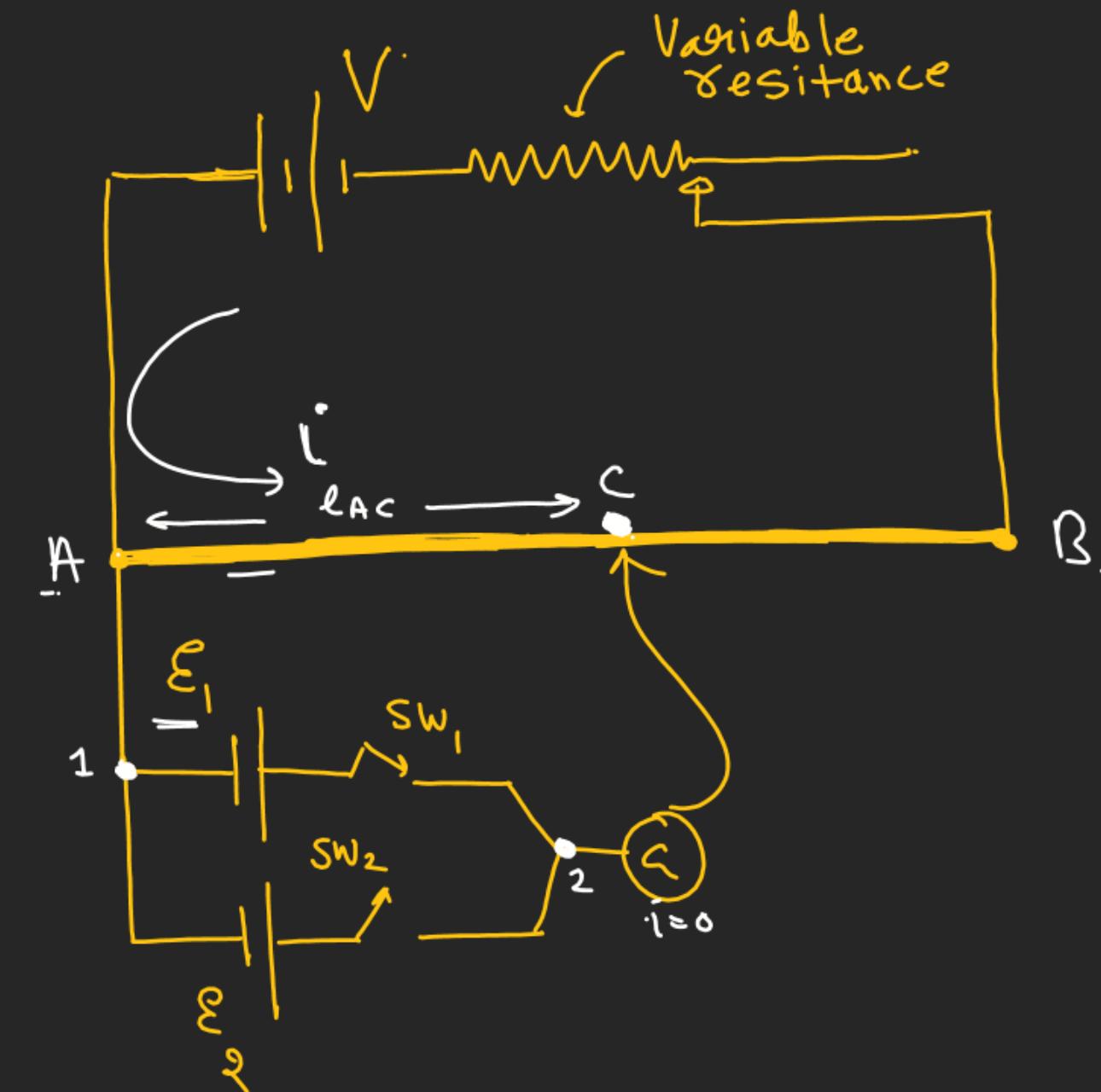
S_{W_1} is closed, S_{W_2} open.

let, l_{AC} be the length at the time of null deflection.

$$V_{AC} = \mathcal{E}_1$$

$$V_{AC} = \left(\frac{V_{AB}}{L} \right) \times l_{AC}$$

$$\mathcal{E}_1 = \left(\frac{V_{AB}}{L} \right) l_{AC} - ①$$



SW₁ Open and SW₂ Closed

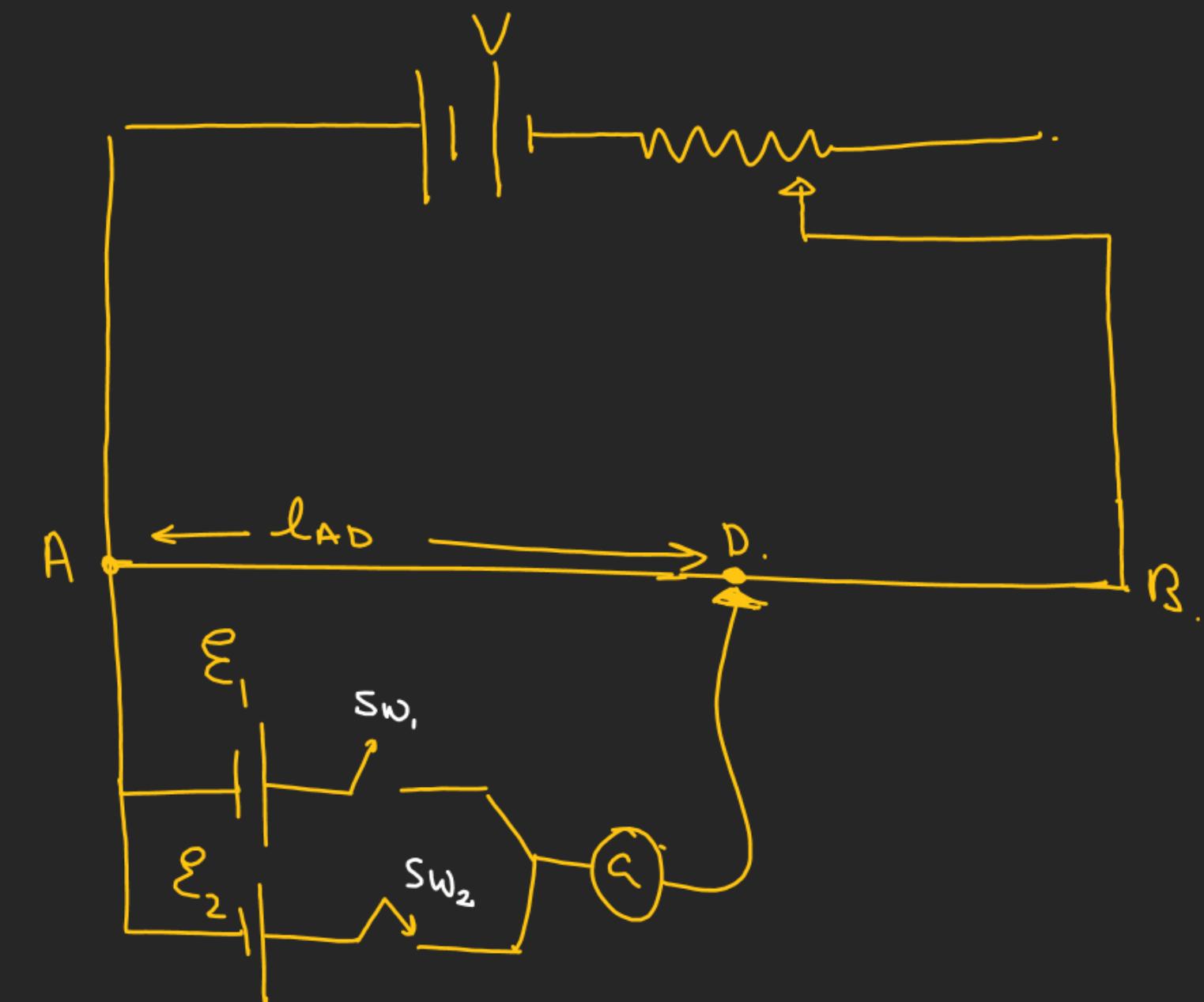
At the time of Null deflection.

$$V_{AD} = \mathcal{E}_2$$

$$\mathcal{E}_2 = \left(\frac{V_{AB}}{L} \right) \times l_{AD} - ②$$

① ÷ ②

$$\boxed{\frac{\mathcal{E}_1}{\mathcal{E}_2} = \left(\frac{l_{AC}}{l_{AD}} \right) **}$$



To find the internal resistance of a cell: →

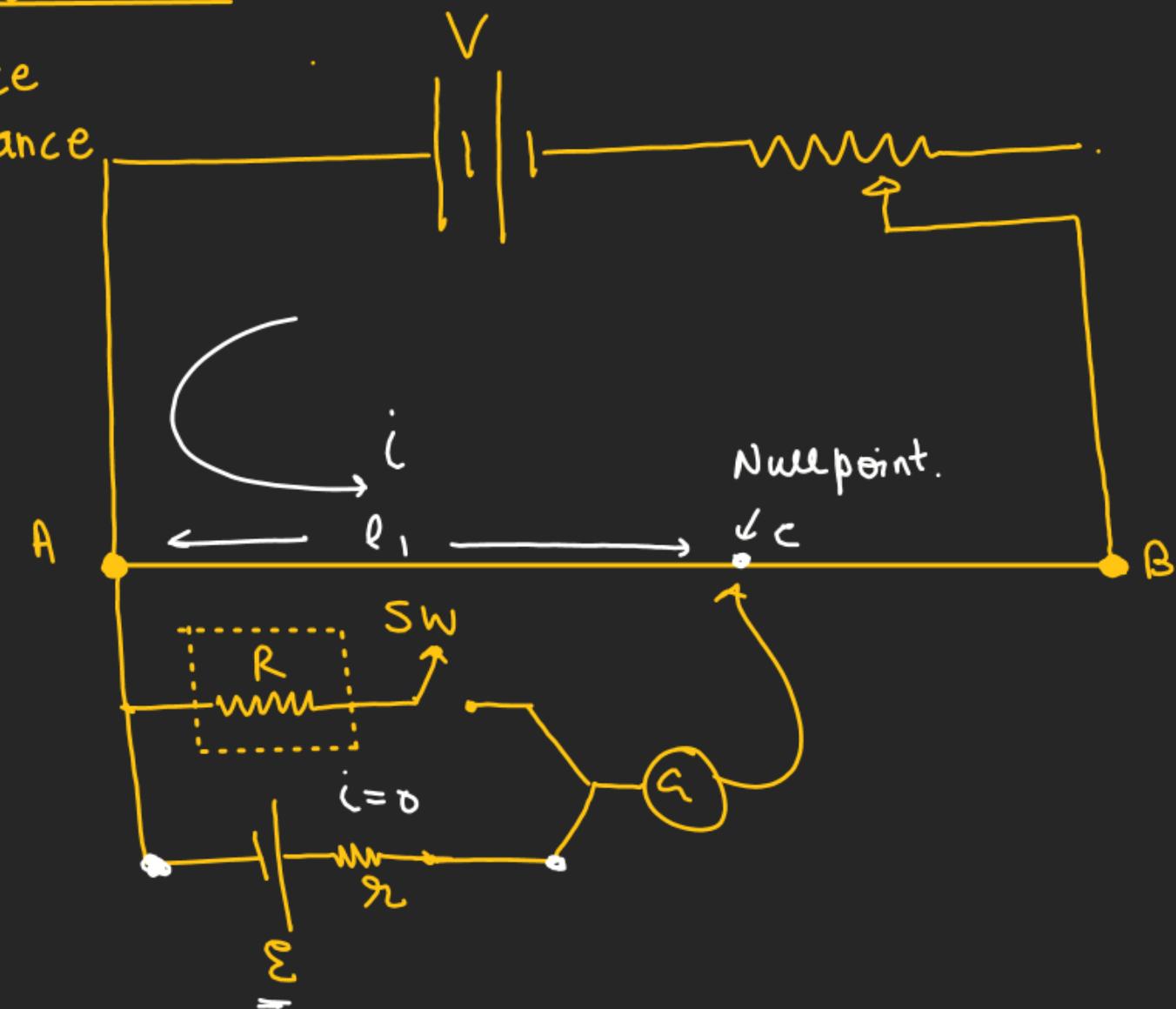
Step 1:- SW open and find null deflection.

R → Resistance
of Resistance
box.
[Known]

Let, l_1 be the length of wire
from A at the time of null
deflection.

$$\mathcal{E} = \frac{V_{AC}}{L}$$

$$\mathcal{E} = \frac{V_{AB}}{L} \times l_1 - ①$$



Step-2, SW is closed.

$$V_{12} = \mathcal{E} - i_1 r$$

$$i_1 = \left(\frac{\mathcal{E}}{R+r} \right)$$

$$V_{AD} = \mathcal{E} - i_1 r$$

$$= \mathcal{E} - \frac{\mathcal{E} r}{R+r} = \left(\frac{\mathcal{E} R}{R+r} \right)$$

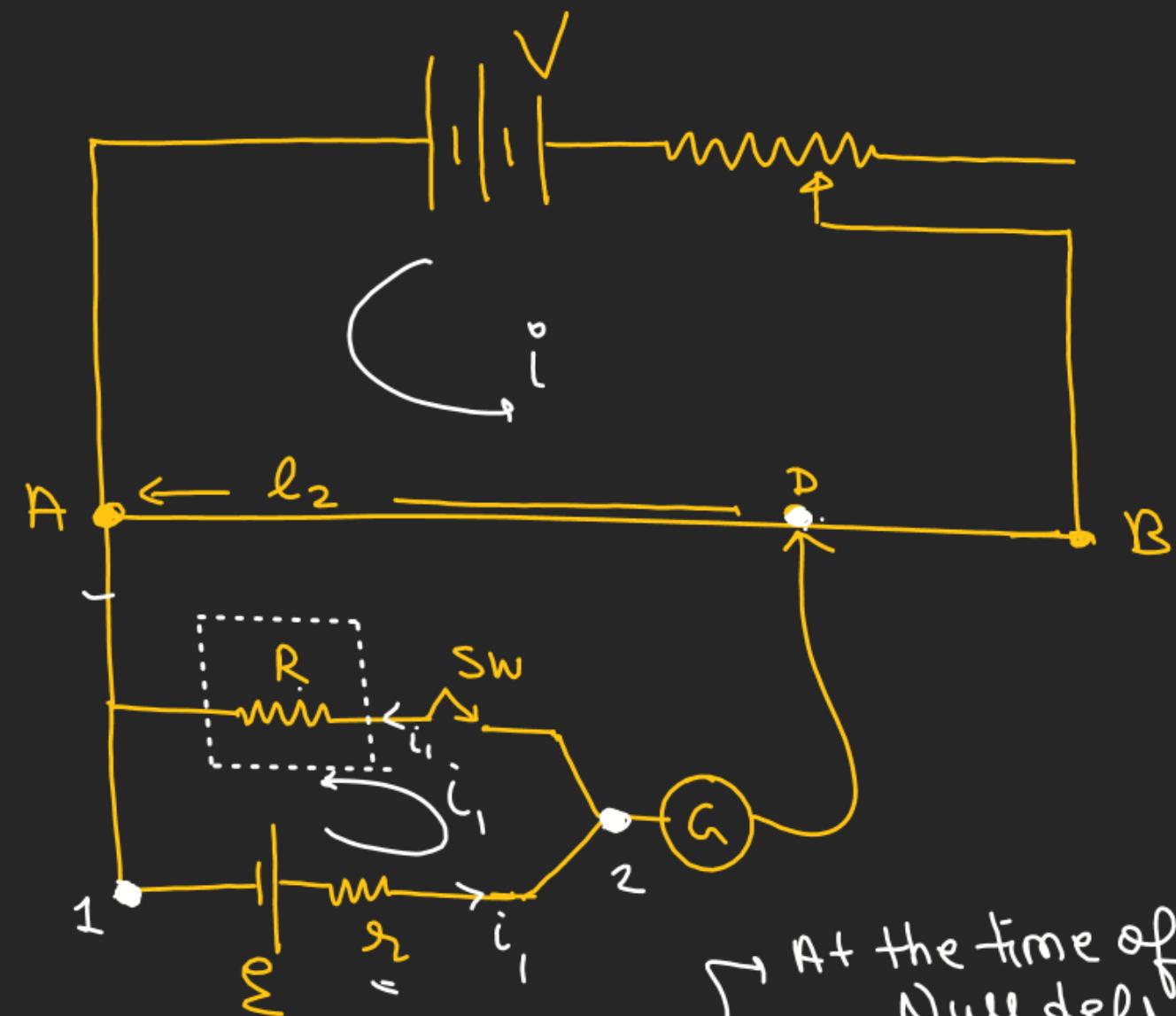
$$V_{AB} = \left(\frac{V_{AB}}{L} \times l_2 \right)$$

$$\frac{V_{AB}}{L} \times l_2 = \frac{\mathcal{E} R}{R+r} - ②$$

① ÷ ②

$$\frac{l_1}{l_2} = \frac{R+r}{R} = 1 + \frac{r}{R} \Rightarrow \frac{r}{R} = \left(\frac{l_1}{l_2} - 1 \right)$$

$$r = R \left(\frac{l_1}{l_2} - 1 \right) **$$



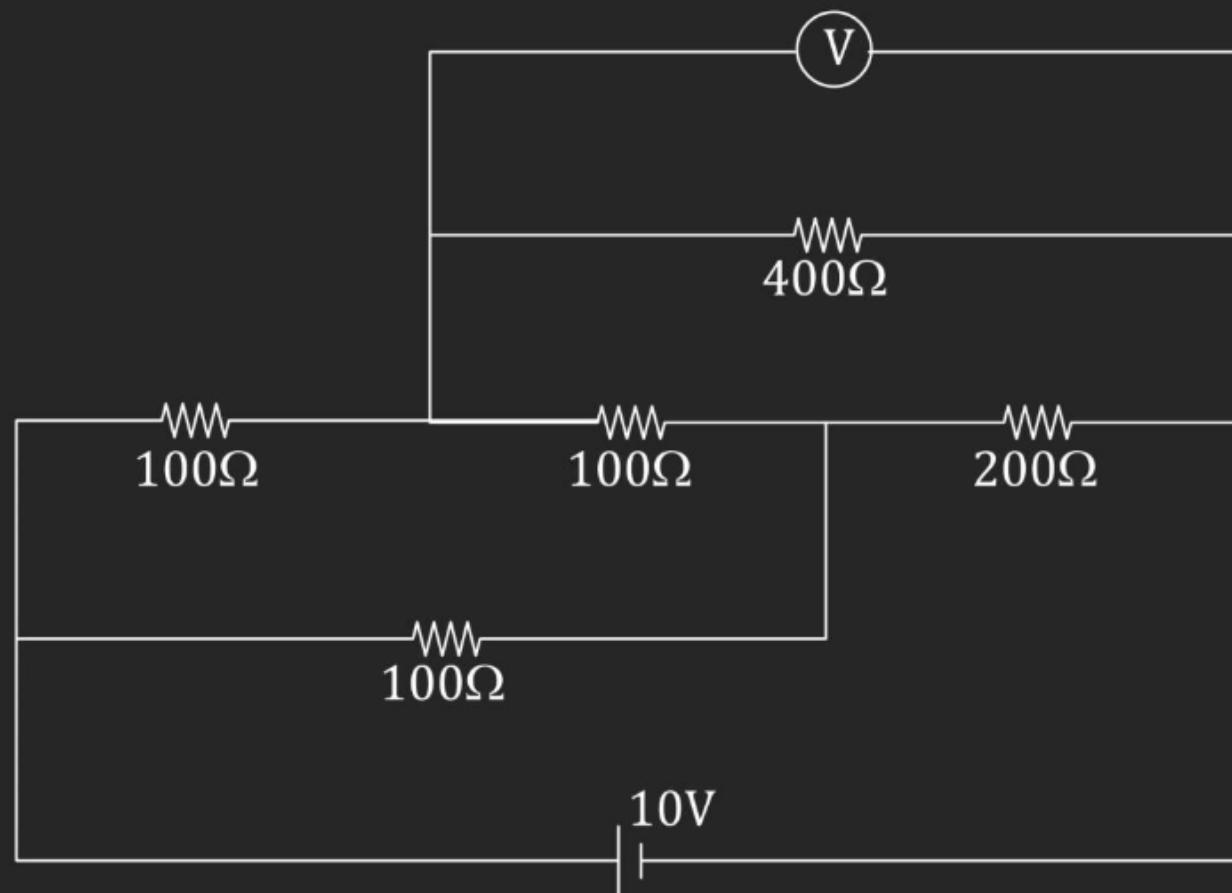
At the time of
Null deflection

$$V_1 - V_D = V_{AD}$$

H-W

CURRENT ELECTRICITY

Q.2 An electric circuit is shown in figure. Calculate the potential difference across the resistor of 400Ω , as will be measured by the voltmeter V of resistance 400Ω .



H.W.

Q.3 A battery of emf 1.4 V and internal resistance 2Ω is connected to a resistance of 100Ω through an ammeter. The resistance of ammeter is $\frac{4}{3}\Omega$. A voltmeter has also been connected to find the potential difference across the resistor.

- (a) Draw the circuit diagram.**
- (b) The ammeter reads 0.02 A. What is the resistance of voltmeter.**
- (c) the voltmeter reads 1.10 V. What is the error in the reading?**

Q.7 A galvanometer (coil resistance 99Ω) is converted into an ammeter using a shunt of 1Ω and connected as shown in Fig. (a). The ammeter reads 3 A. The same galvanometer is converted into a voltmeter by connecting a resistance of 101Ω in series. This voltmeter is connected as shown in Fig. (b). Its reading is found to be $4/5$ of the full scale reading. Find:

- (i) internal resistance of the cell (r).
- (ii) range of the ammeter and voltmeter.
- (iii) full scale deflection current of the galvanometer.

