Answer on Question #44503-Physics-Electromagnetism

The length of potentiometer wire is 600cm and it carries a current of 40mA. For a cell of e.m.f. 2V and internal resistance 10ohm, the null point is found to be at 500cm. If a voltmeter is connected across the cell, the balancing length is decreased by 10cm. Find (a) the resistance of whole wire. (b) Reading of voltmeter and (c) resistance of voltmeter

Solution

(a) $E = Kl \to K = \frac{E}{l} = \frac{2}{500}\frac{V}{cm}$.

$$V = KL = \frac{2}{500} \cdot 600 = 2.4\,V,$$

where V is the potential difference across potentiometer wire.

The resistance of potentiometer wire is

$$R = \frac{V}{I} = \frac{2.4\,V}{40 \cdot 10^{-3} A} = 60\ \Omega.$$

(b) On connecting voltmeter new balancing length is $l' = 490\ cm$.
Reading of voltmeter is

$$U = \frac{l'}{L}V = \frac{490}{600} \cdot 2.4 = 1.96\,V.$$

(c) The resistance of voltmeter is

$$R_{\text{voltmeter}} = \frac{U}{I} = \frac{1.96\,V}{40 \cdot 10^{-3} A} = 49\ \Omega.$$