Answer on Question#53161 - Physics - Electric Circuits

A potentiometer wire has length $l = 4\ \mathrm{m}$ and resistance $R = 8\ \mathrm{ohm}$. The resistance r that must be connected in series with the wire and an accumulator of e.m.f $\varepsilon = 2\ \mathrm{V}$, so as to get a potential gradient $F = 1\ \mathrm{mV}$ per cm on the wire is- A) 44 ohm B) 48 ohm C) 32 ohm D) 40 ohm

Solution:

The potential drop through the potentiometer should be

$$V_R = F \cdot l$$

Since the potentiometer is connected in series with resistance r, this potential drop can also be expressed through the e.m.f:

$$V_R = \frac{R}{R + r}\varepsilon$$

Therefore we obtain an equation for r:

$$\frac{R}{R + r}\varepsilon = F \cdot l$$

$$r = \frac{R(\varepsilon - F \cdot l)}{F \cdot l} = \frac{8\Omega\left(2\mathrm{V} - 1\frac{\mathrm{mV}}{\mathrm{cm}} \cdot 4\mathrm{m}\right)}{1\frac{\mathrm{mV}}{\mathrm{cm}} \cdot 4\mathrm{m}} = 39992\ \Omega$$

Answer: $39992\ \Omega$.