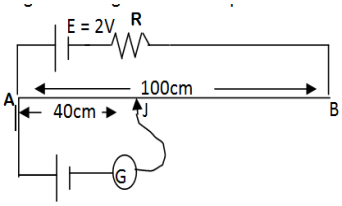
A potentiometer wire of length 100cm has a resistance of 10Ω. It is connected in series to to a resistance R and a cell of emf 2V and negligible internal resistance. A source of emf of 10mV is balanced by a length of 40cm of the potentiometer wire. What is the value of the resistance R?

a. 200Ω b. 950Ω c. 2000Ω d. 790Ω

Solution



If J is current through the potentiometer wire then

$$J = \frac{E}{R+10} = \frac{2}{R+10}.$$

As the source of e.m.f. $E' = 10mV = 10 * 10^{-3}V$ is balanced by a length of 40cm of the potentiometer wire, it follows that $10 * 10^{-3}$=J*resistance of 40cm of the potentiometer wire.

Now resistance of 40cm of the potentiometer wire $= \frac{10}{100} * 40 = 4\Omega.$

So

$$10 * 10^{-3} = \frac{2}{R+10} * 4 \rightarrow R = 790\Omega.$$

Answer: d. 790Ω.