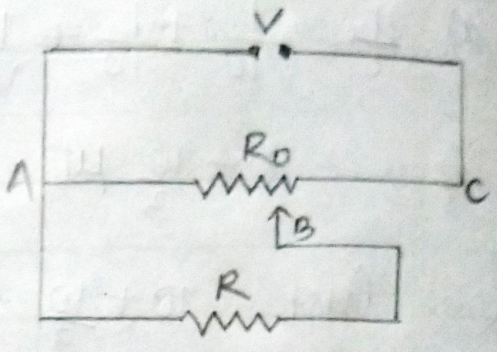
# Current Electricity

4 July 2021 — **Home Assignment**

1) $R_{total} = \frac{R_0}{2} + \frac{\frac{R_0}{2} \times R}{\frac{R_0}{2} + R}$

$= \frac{R_0(R_0 + 4R)}{2(R_0 + 2R)}$




$I_{total} = \frac{V}{R_{total}}$

Current through R

$= I_2 = I_{total} \times \frac{\frac{R_0 \times R}{2}}{\frac{R_0}{2} + R}$

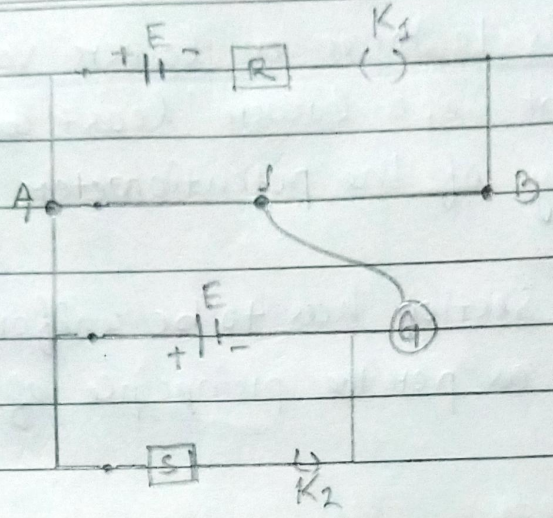
$= I_{total} \times \frac{R_0}{R_0 + 2R}$

$= \frac{V \cdot 2(R_0 + 2R)}{R_0(R_0 + 4R)} \times \frac{R_0 \times R}{R_0 + 2R}$

$= \frac{2VR_0R}{R_0(R_0 + 4R)}$

Voltage across $R = I_2R = \left(\frac{2VR}{R_0 + 4R}\right)$

2)




(i) By increasing resistance R the current through AB decreases, so potential gradient decreases. Hence a greater length of wire would be needed for balancing the same potential difference. So the null point would shift towards B.

(ii) By decreasing resistance S, the current through AB remains the same potential gradient does not change, As $K_2$ is open so there is no effect of S on null point.

3)(a) Principle of potentiometer :

The potential drop across the length of a steady current carrying wire of uniform cross section is proportional to the length of the wire.

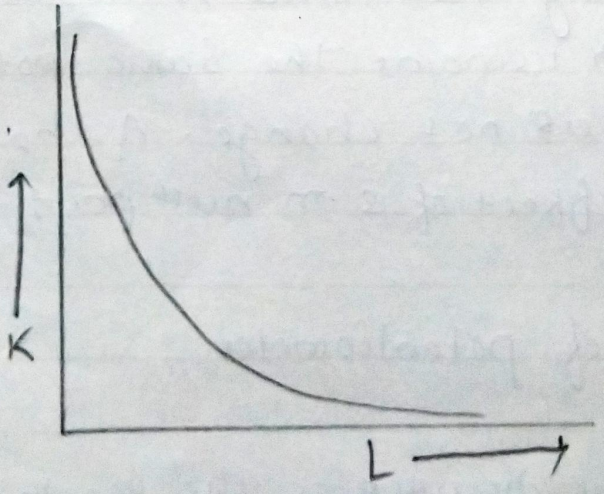
i) We use a long wire to have a lower value of potential gradient i.e. a lower 'least count' or greater sensitivity of the potentiometer.

ii) The area of cross-section has to be uniform to get a 'uniform wire' as per the principle of the potentiometer.

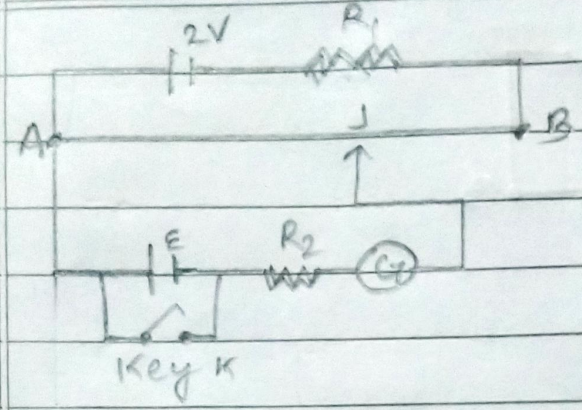
iii) The emf of the driving cell has to be greater than the emf of the primary cells as otherwise no balance point would be obtained.

(b) Potential gradient $K = \frac{V}{L}$

∴ The required graph is as shown below.



4)



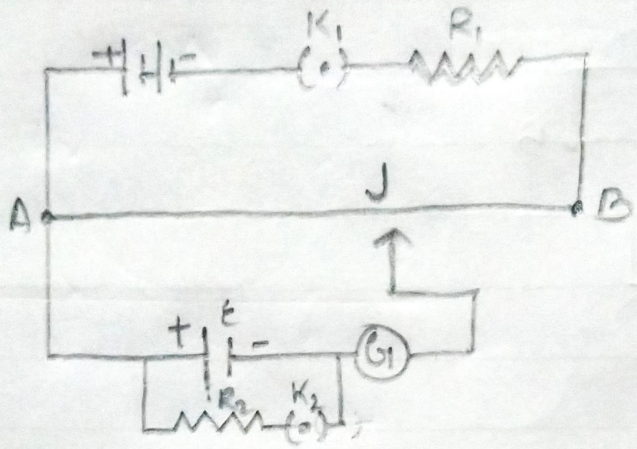

a) The purpose of high resistance $R_2$ is to reduce the current through the galvanometer when jockey is far from balance point, this saves the galvanometer and the cell (of emf ε) from being damaged.

b) When resistance $R_1$ is decreased, the potential gradient of potentiometer wire increases, so balance point (J) shifts to longer length of wire.

c)(1) The balance point is not obtained because maximum emf across potentiometer wire is 2V.

(2) When Key (K) is closed, the terminal potential difference of cell is zero; so balance point cannot be between A & B. (since $V = Kl$ $\Rightarrow l = 0$ for $V = 0$).

5)




~~(a) (i) $R_2$, is decreased~~
~~(ii) The potential gradient would increase~~

(i) $R_1$ is increased because the potential gradient would increase.

(ii) $R_2$ is increased because the terminal p.d. across the cell would increase.