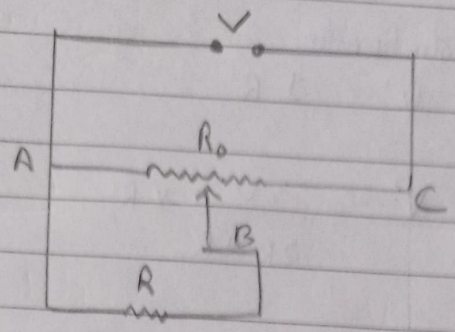
P.D. HOME ASSIGNMENT



Resistance between A & B:

$$R_{equ} = \frac{\frac{R_0}{2} \times R}{\frac{R_0}{2} + R}$$

$$= \frac{\frac{R_0 R}{2}}{\frac{R_0 + 2R}{2}}$$

$$R' = \frac{R_0 R}{R_0 + 2R}$$

Total Resistance:

$$R_{equ\ both\ A\ \&\ C} = \frac{R_0 R}{R_0 + 2R} + \frac{R_0}{2}$$

$$= R' + \frac{R_0}{2}$$

$$= \frac{2R' + R_0}{2}$$

$$I = \frac{V}{R_{equ}}$$

$$= \frac{V}{2R' + R_0/2} = \frac{2V}{2R' + R_0}$$

The Voltage taken from potentiometer

$$V' = I R'$$

$$V' = \frac{2V}{2R' + R_0} \times R'$$

$$= \frac{2V}{2R' + R_0} \times \frac{R_0 R}{R_0 + 2R}$$

$$= \frac{2V}{2\left(\frac{R_0 \times R}{R_0 + 2R}\right) + R_0} \times \frac{R_0 \times R}{R_0 + 2R}$$

$$= \frac{2VR}{2R + R_0 + 2R} \quad \text{(Ans)}$$

Q2) Two students X & Y perform an experiment on potentiometer separately using the circuit given below. Keeping other parameters unchanged, how will the position of the null point be affected if

a) X increases the value of resistance R in the setup by keeping the key K_1 closed and the key K_2 open?

ans By increasing 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 Y decreases the value of resistance S in the setup, while the key K_2 remains open and then K_1 closed?

ans) 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.

Q Answer the following:

(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) Why is it necessary to use a

i) long wire

ans to have a lower value of potential gradient or greater sensitivity of the potentiometer.

(ii) have uniform area of cross-section of the wire.

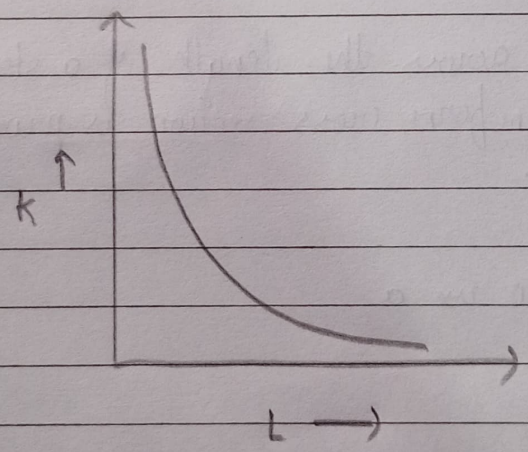
ans So that it obeys the principle of potentiometer

(iii) Use a driving cell whose emf is taken to be greater than the emfs of the primary cell.

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

b) In a potentiometer experiment, if the area of the cross-section of the wire increases uniformly from one end to the other, draw a graph showing how potential would vary as the length of the wire increases from one end.

ans) $K = \frac{V}{L}$



Q/

(a) What is the purpose of using high resistance R_2?

ans So that the galvanometer doesn't gets damaged as it is very sensitive.

(b) ans The balance point (J) moves towards B if the resistance R_1 is increased.

c) Why cannot the point be obtained,

1) When the emf $\mathcal{E}$ is greater than 2V, and

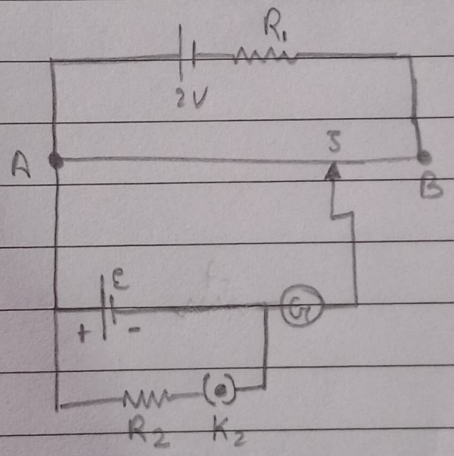
ans Because the maximum emf across potentiometer wire is 2V

2) When the key K is closed

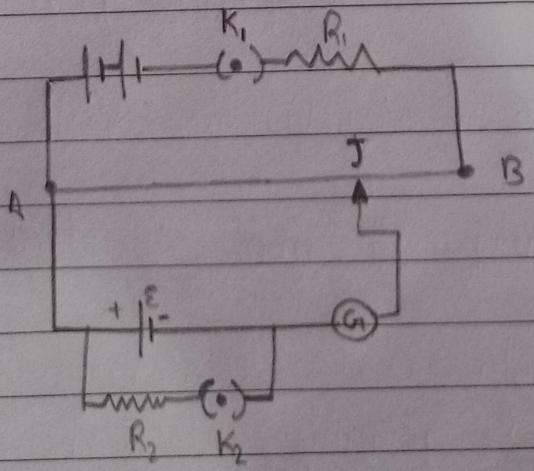
ans When key(K) is closed, the terminal P.D. of cell is zero; so balance point cannot be between A & B.

Since $\Rightarrow V = kl$

As for $V = 0$, $l = 0$



Q



a) R_1 is decreased

ans The ~~bala~~ balancing length decreases
(K ~~decreases~~ increases)

b) R_2 is increased

ans The balancing length increases
(The terminal p.d. across the cell would increase