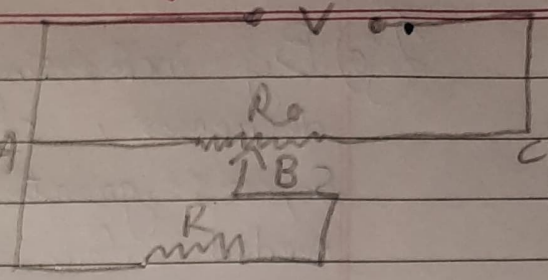
29.6.24

Ch-3 Home assignment

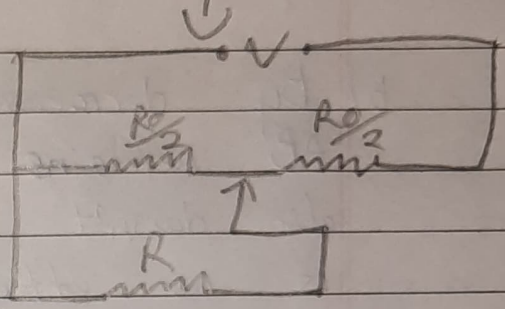
1) Let R_1 be the equivalent resistance betⁿ A & B i.e

$$R_1 = \frac{\frac{R_0}{2} \times R}{\frac{R_0}{2} + R} = \frac{RR_0}{R_0 + 2R}$$



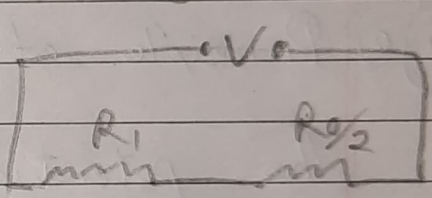
Let R_{eq} be the resultant of R_1 & $\frac{R_0}{2}$ i.e $R_{eq} = R_1 + \frac{R_0}{2}$

$$\Rightarrow R_{eq} = \frac{2R_1 + R_0}{2}$$

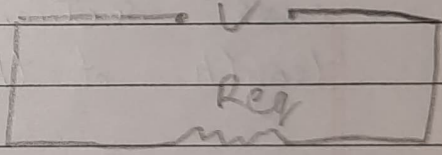


Current in the circuit, $I = \frac{V}{R_{eq}}$

i.e $I = \frac{V}{\frac{2R_1 + R_0}{2}} = \frac{2V}{2R_1 + R_0}$



Voltage across $R = V_{AB}$ = Voltage across $R_1 = IR_1$



$$V_{AB} = \frac{2V}{2R_1 + R_0} \times \frac{RR_0}{R_0 + 2R}$$

$$= \frac{2V}{\frac{2RR_0}{R_0 + 2R} + R_0} \times \frac{RR_0}{R_0 + 2R} = \frac{2V(R_0 + 2R)}{R_0(2R + R_0 + 2R)} \times \frac{RR_0}{R_0 + 2R}$$

$$= \frac{2VR}{4R + R_0}$$

So, Voltage across R_0

$$= \frac{2VR}{4R + R_0}$$

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

b) By decreasing resistance S, the current through AB remains the same, & potential gradient also doesn't 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.

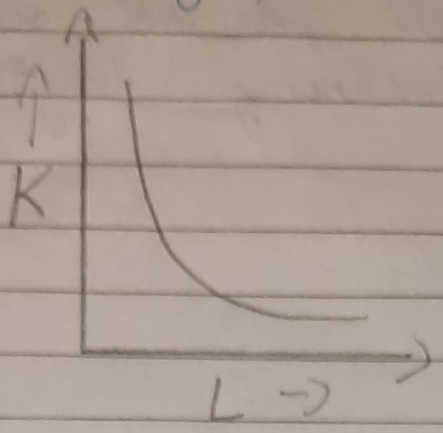
i) We use a long wire to have a lower value of potential gradient i.e a greater sensitivity of the potentiometer.

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

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

b) Potential gradient, $K = V/L$

The required graph is shown below ⇒



4) a) The purpose of high resistance R_2 is to protect the galvanometer by decreasing the current through it for positions which are far away from balance point.

b) When resistance R_1 is increased, the current through potentiometer wire circuit decreases. Due to it, potential gradient across it decreases. As a result, the balance point shift towards the end B.

c) 1) When emf ε is greater than 2V, the balance point can not be obtained because the potential drop across the potentiometer wire will be less than 2V.

2) When the key K is closed, the cell emf ε gets short circuated. Due to it, the balance point is not obtained on the potentiometer wire.

5) a) If R_1 is decreased, current increases as a result potential gradient increases, So the balancing length would decrease.

b) When R_2 is increased, current decreases as a result terminal pot. diff^n across the cell increases. So the balancing length would increase.