Current Electricity

Ohm's Law V = Potential; R = Resistance	$I \propto V$ $V = IR$

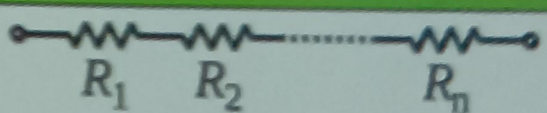
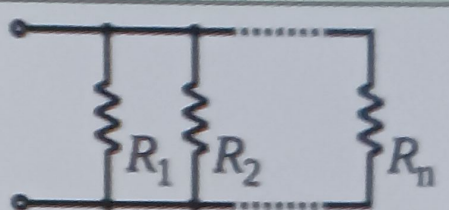
Resistivity (ρ)	$R = \rho\frac{l}{A}$	$\rho = \frac{1}{\sigma}$	$\rho = \frac{m}{ne^2\tau}$

n = no. of e-, e = electronic charge, τ = Relaxation time, σ =conductivity.

Temperature dependence of Resistivity ρ_t = Resistivity at t^oC;	$\rho_t = \rho_0(1 + \alpha t)$ ρ_0 = Resistivity at 0^oC
Drift velocity of free electrons (v_d) E = Electric field intensity	$v_d = \frac{eE\tau}{m} = \frac{eV\tau}{ml} = \frac{I}{Ane}$
Mobility of electron (μ)	$\mu = \frac{v_d}{E} = \frac{e\tau}{m}$

EMF of cell(e)= $\frac{W}{q}$	**Relation between EMF and Internal Resistance,** $e = V + Ir$

Grouping of Resistors

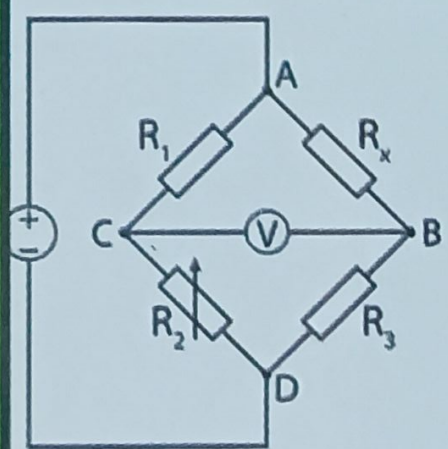
In series	$R_{eq} = R_1 + R_2 + .. + R_n$	
In parallel	$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + .. + \frac{1}{R_n}$	

Grouping of Cells

In series	In Parallel
$e_{eq} = e_1 + e_2 + .. + e_n = ne$	$\frac{1}{r_{eq}} = \frac{1}{r_1} + \frac{1}{r_2} + \cdots + \frac{1}{r_n} = \frac{n}{r}$
$r_{eq} = r_1 + r_2 + \cdots r_n = nr$	$r_{eq} = \frac{r}{n}$
$I = \frac{e_{eq}}{(R + r_{eq})} = \frac{ne}{(R + nr)}$	$I = \frac{e}{(R + r/n)}$

Wheatstone Bridge

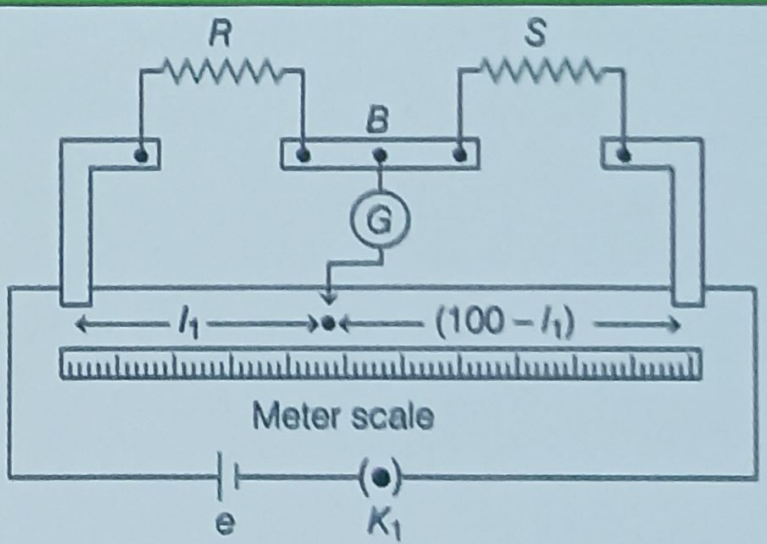
Bridge is balanced when $I_G = 0$



$$\frac{R_x}{R_1} = \frac{R_3}{R_2}$$

Meter Bridge

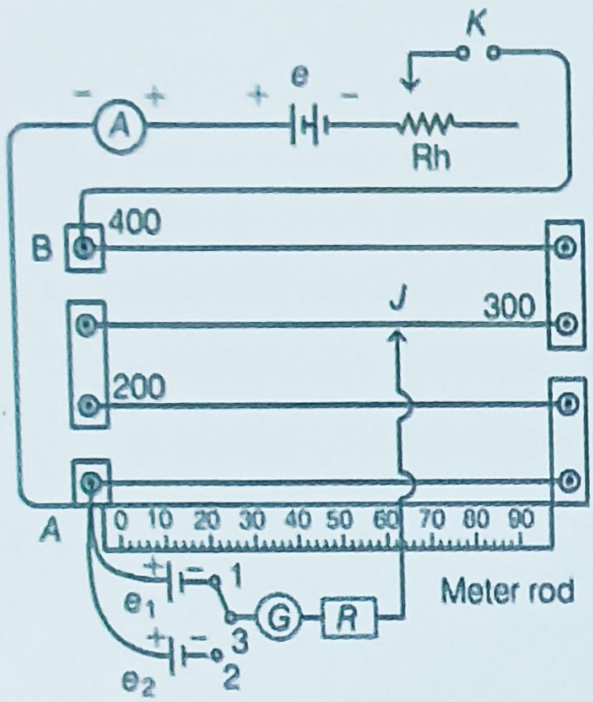
(where, l_1 is the length of wire from one end where null point is obtained)



$$\frac{R}{S} = \frac{l_1}{(100 - l_1)}$$

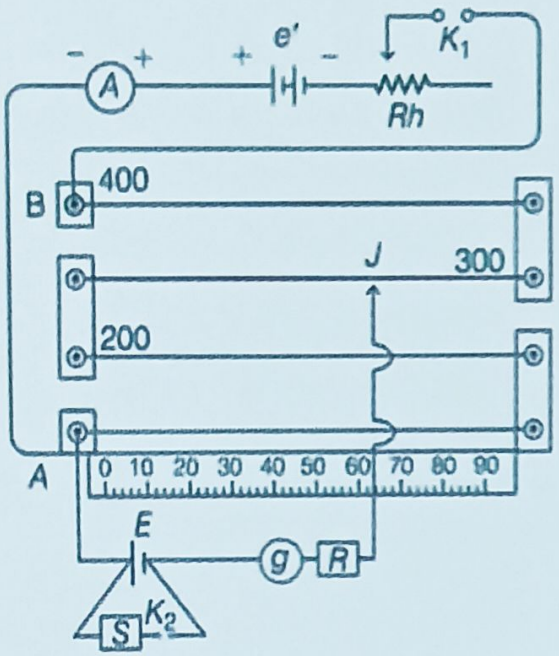
POTENTIOMETER

To Compare EMF of Two Cells



$$\frac{e_1}{e_2} = \frac{l_1}{l_2}$$

Determination of internal resistance of a cell



$$r = \frac{e - V}{V} R = \frac{l_1 - l_2}{l_2} R$$

Kirchhoff's Law

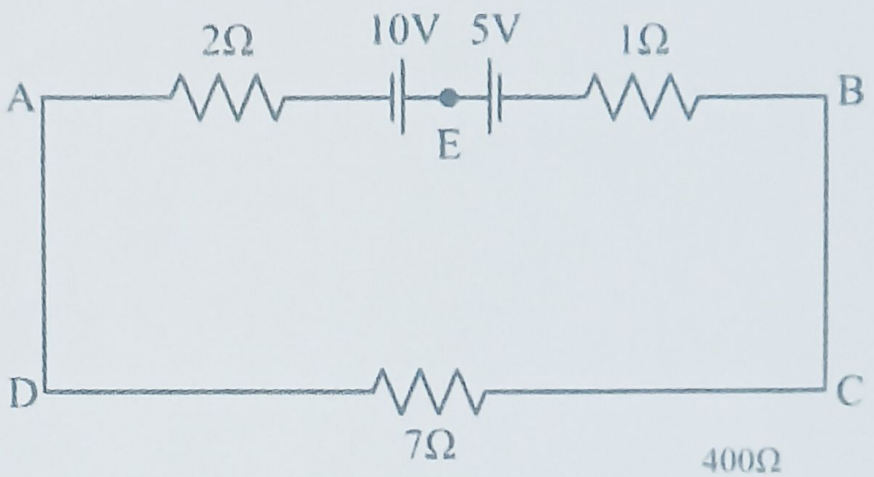
I) Junction Rule The algebraic sum of all currents meeting at a junction in a closed circuit is zero, i.e.

$$\sum I = 0$$

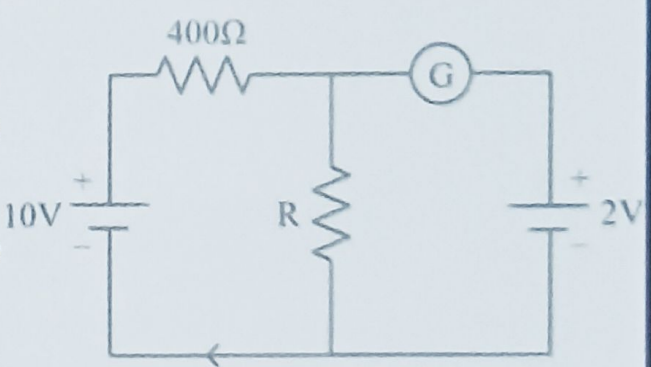
ii) Loop Rule The algebraic sum of all the potential differences in any close circuit is zero, i.e.

$$\sum \Delta V = 0$$

- The magnitude and direction of the current in the following circuit is : **0.5A from A to B through E**



- If the galvanometer G does not show any deflection in the circuit shown, the value of R is given by: **100 ohm**



- The equivalent capacitance of the system shown in the following circuit is: **2μF**