

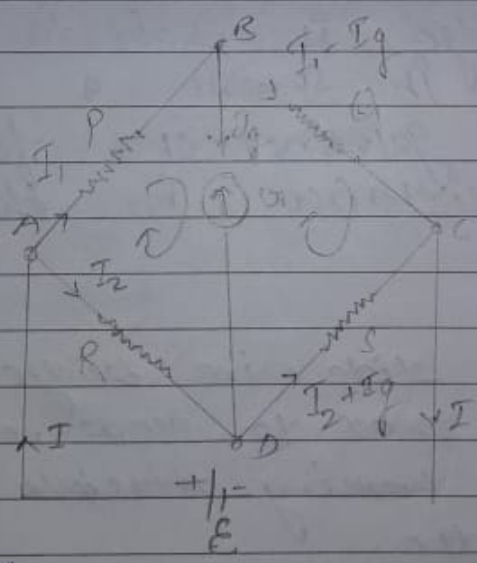
# Wheatstone Bridge :-

It is an arrangement of four resistances used to determine one of these resistances in terms of remaining three resistances.

A Wheatstone Bridge consists of four resistances P, Q, R and S connected to form the arm of a quadrilateral ABCD. A battery of emf E and a galvanometer is connected across their diagonal.

When the bridge is in balancing condition.

$$\frac{P}{Q} = \frac{R}{S}$$



### Derivation:

Consider a loop ABDA, according to Kirchhoff's voltage law

$$I_1 P + I_g G - I_2 R = 0$$

Here G Resistance of galvanometer.

Consider a loop BCDB, Apply Kirchoff's <sup>second</sup> law

$$(I_1 - I_g) \phi - (I_2 + I_g) s - G I_g = 0$$

In the balance condition of the bridge  $I_g = 0$

$$I_1 P - I_2 R = 0$$

$$I_1 P = I_2 R \quad \text{--- (1)}$$

$$I_1 \phi - I_2 s = 0$$

$$I_1 \phi = I_2 s \quad \text{--- (2)}$$

Hence

$$\boxed{\frac{P}{\phi} = \frac{R}{s}}$$

Note:- A bridge is said to be a sensitive if it shows a large deflection in the galvanometer for a small change of resistance in the resistance arm.

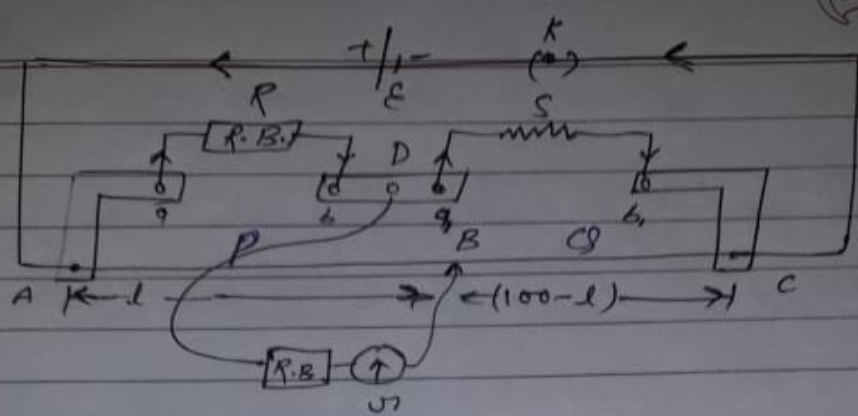
\* Meter bridge or slide wire bridge :-

It is a device used to measure unknown resistance. Its working principle based on wheatstone bridge.

When bridge is balanced

$$\frac{P}{Q} = \frac{R}{S}$$

Construction:



Working: After taking out a resistance  $R$  from resistance box, the jockey is moved along the wire  $AC$  till there is no deflection in the galvanometer. This is balance condition of bridge;

$$\frac{P}{Q} = \frac{R}{S}$$

$\therefore$  Resistance  $\propto$  length of wire  
let resistance per unit length is  $x$  then

$$P = lx$$

$$Q = (100-l)x$$

$$\frac{lx}{(100-l)x} = \frac{R}{S}$$

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



sensitivity of a potentiometer :-

A potentiometer is sensitive if  
(i) it is capable of measuring very small potential differences.

(ii) it shows a significant change in balancing length for a small change in the potential difference being measured.

Note :- Smaller the potential gradient, Greater will be the sensitivity of the potentiometer.