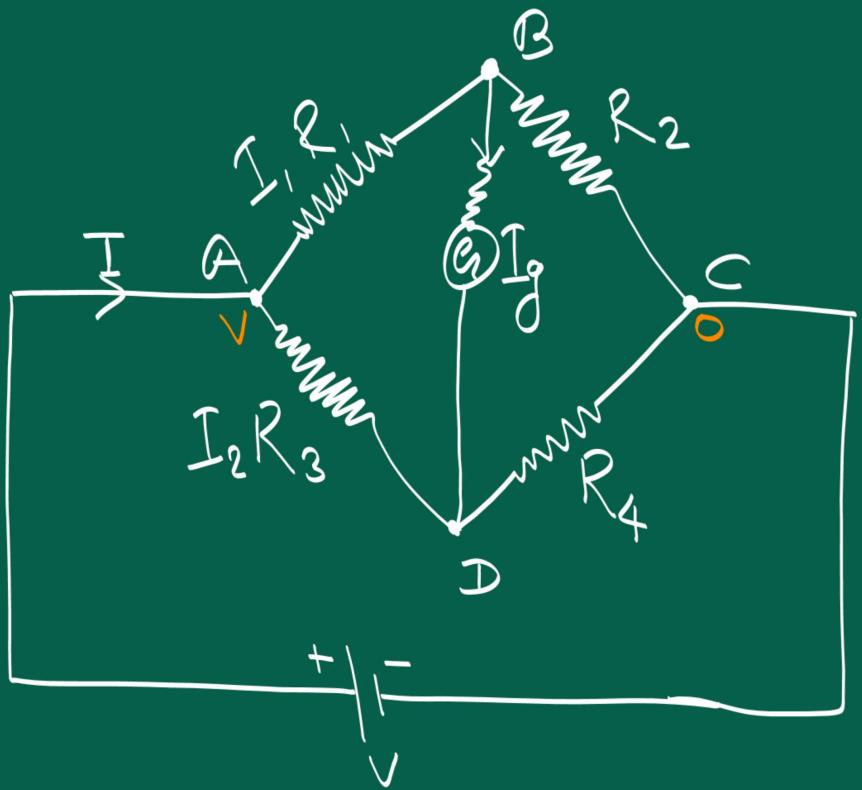


* Wheatstone Bridge :-

The Wheatstone bridge diamond shaped circuit whose concept was developed by Charles Wheatstone can be used to accurately measure unknown resistance values.

* Unbalanced:

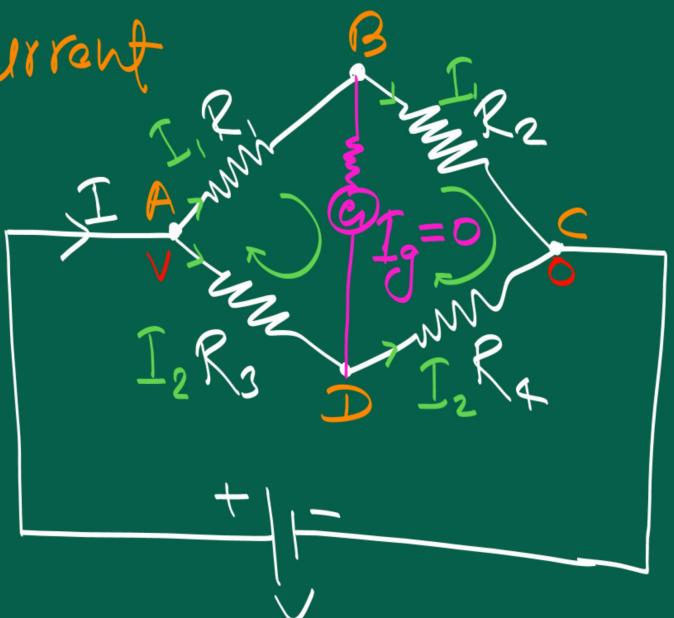
When there is current in Galvanometre.
 $V_B \neq V_D$



* Balanced:

When there is no current
in Galvanometer.

i.e $V_B = V_D$



Applying Kirchoff's rule:

Loop ABDA

$$I_1 R_1 - I_2 R_2 = 0$$

$$I_1 R_1 = I_2 R_3$$

$$\frac{I_1}{I_2} = \frac{R_3}{R_1} \quad \textcircled{1}$$

Loop BCDB

$$I_1 R_2 - I_2 R_4 = 0$$

$$I_1 R_2 = I_2 R_4$$

$$\frac{I_1}{I_2} = \frac{R_4}{R_2} \quad \textcircled{2}$$

From eqn. ① and ②, we get

$$\frac{R_3}{R_1} = \frac{R_4}{R_2}$$

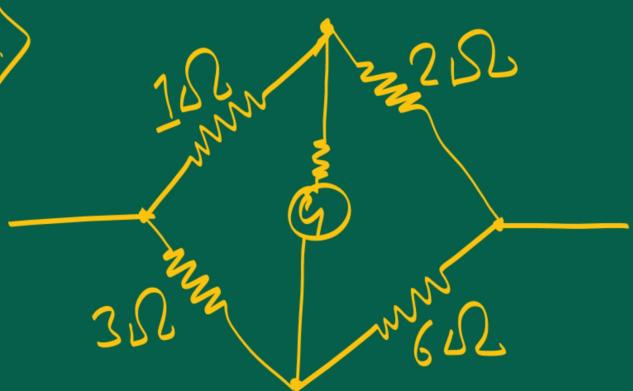
$$\Rightarrow R_3 R_2 = R_1 R_4$$

$$\Rightarrow \frac{R_3}{R_4} = \frac{R_1}{R_2}$$

$$\frac{R_1}{R_2} = \frac{R_3}{R_4}$$

It is possible when $I_g = 0$
(bridge is balanced).

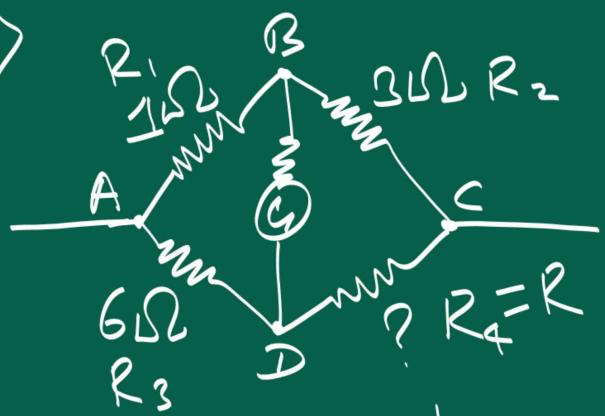
$\langle Q \rangle$



$$\frac{R_1}{R_2} = \frac{R_3}{R_4} \quad \left| \quad \frac{1}{2} = \frac{3}{6} \quad \right| \Rightarrow \frac{1}{2} = \frac{1}{2}$$

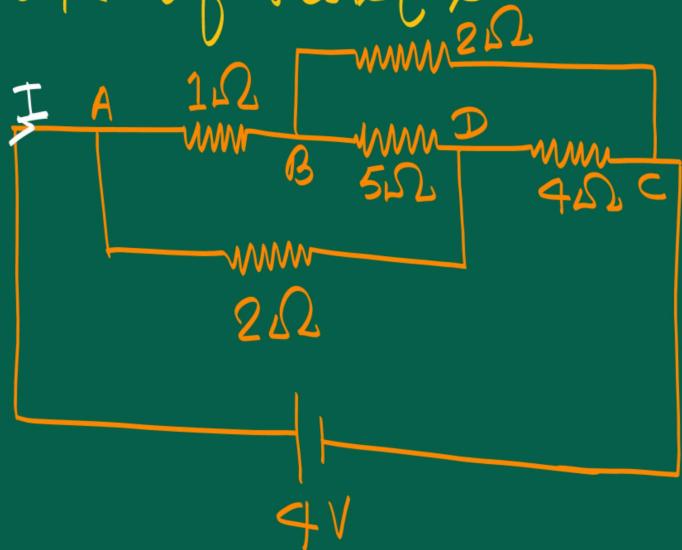
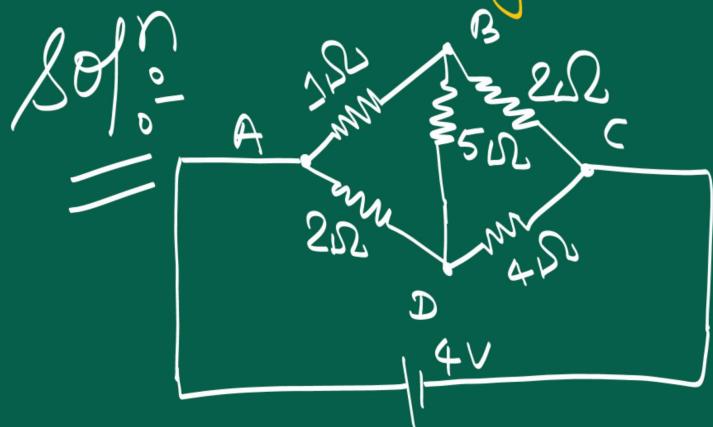
This bridge is balanced.
($I_g = 0$)

$\langle Q \rangle$



$$\frac{R_1}{R_2} = \frac{R_3}{R_4} \quad \left| \frac{1}{3} = \frac{6}{R} \right| \Rightarrow R = 18 \Omega \quad \underline{\underline{\text{Ans}}}$$

(Q) Calculate the current drawn from the battery by the network of resistors shown in Fig.

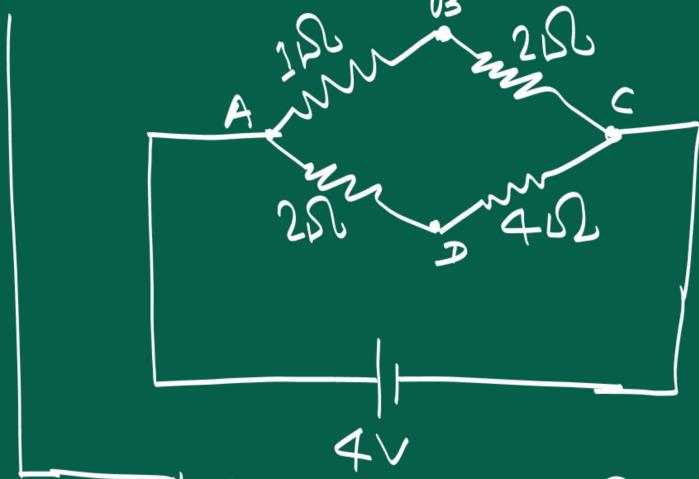


$$\frac{R_1}{R_2} = \frac{R_3}{R_4}$$

$$\frac{1}{2} = \frac{2}{4}$$

$$\Rightarrow \frac{1}{2} = \frac{1}{2}$$

This bridge is balanced.



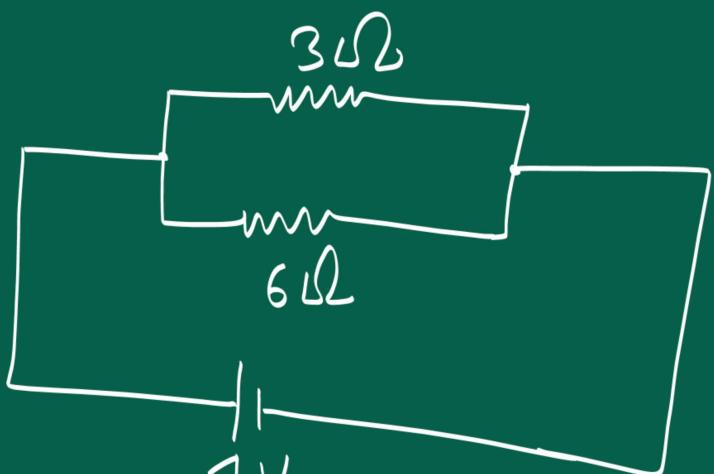
$$R_{S_1} = 1 + 2 = 3\Omega$$

$$R_{S_2} = 2 + 4 = 6\Omega$$

$$R_{eq} = ?$$

$$\frac{1}{R_{eq}} = \frac{1}{3} + \frac{1}{6}$$

$$\frac{1}{R_{eq}} = \frac{6+3}{18} = \frac{9}{18} \quad \left| \frac{1}{R_{eq}} = \frac{1}{2} \right| \boxed{R_{eq} = 2\Omega}$$



$$V = IR$$

$$I = \frac{V}{R}$$

$$I = \frac{E^2}{R}$$

$$I = 2A$$