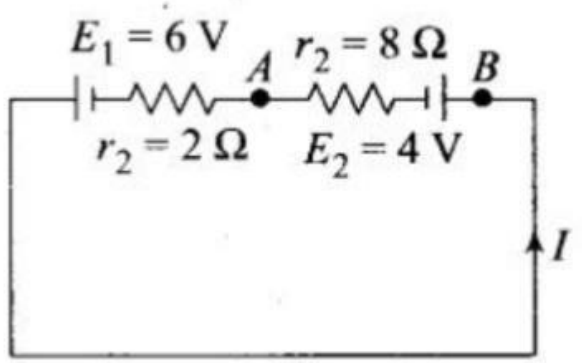
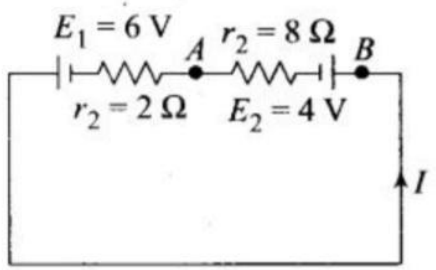
Q. 02 The circuit in figure shows two cells connected in opposition to each other. Cell E_1 is of emf 6 V and internal resistance 2 Ω; the cell E_2 is of emf 4 V and internal resistance 8 Ω. Find the potential difference between the points A and B.



Solution: Key concept: In this problem, after finding the electric current flow in the circuit by using Kirchoff's law or Ohm's law, the potential difference across AB can be obtained.

Applying Ohm's law.
Equivalent emf of two cells = 6 – 4 = 2 V and equivalent resistance = 2 Ω + 8 Ω = 10 Ω, so the electric current is given by



$$I = \frac{6-4}{2+8} = 0.2 \text{ A}$$

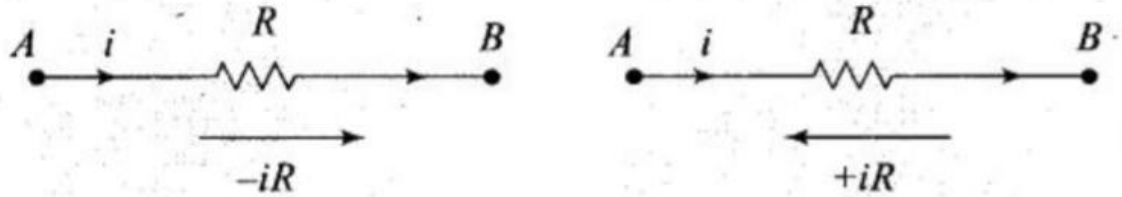
Taking loop in anti-clockwise direction, since $E_1 > E_2$
The direction of flow of current is always from high potential to low potential.
Therefore $V_B > V_A$.

$$\Rightarrow \quad V_B - 4V - (0.2) \times = V_A$$

Therefore, $V_B - V_A = 3.6$ V

Important point: *Sign convention for the application of Kirchoff's law:* For the application of Kirchoff's laws following sign convention are to be considered.

(i) The change in potential in traversing a resistance in the direction of current is $-iR$ while in the opposite direction $+iR$.



(ii) The change in potential in traversing an emf source from negative to positive terminal is $+E$ while in the opposite direction $-E$ irrespective of the direction of current in the circuit.