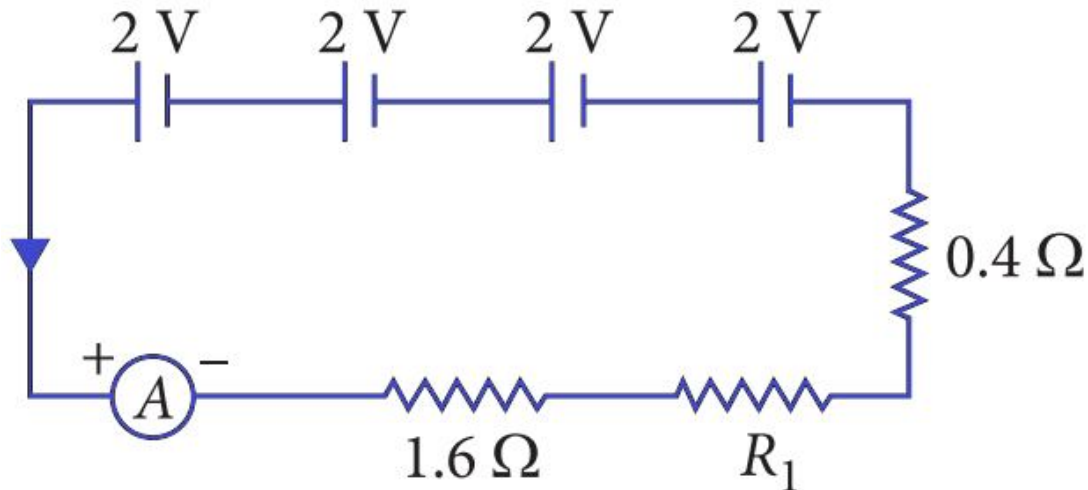


CASE STUDY QUESTION 31

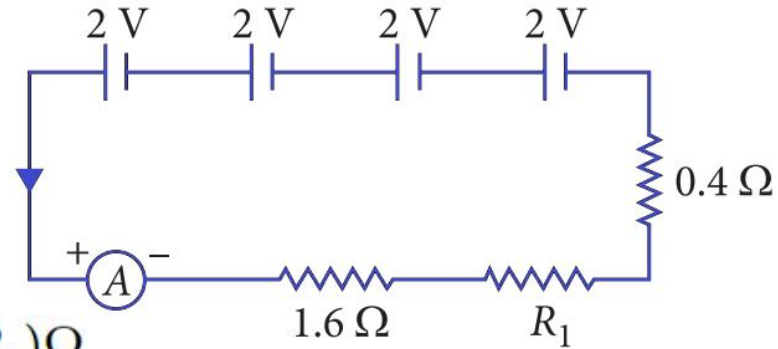
Read the following and answer any four questions from (i) to (v)

A student is making his Physics project. He purchased four cells, an ammeter and three resistors for his project. In his project, Four cells each of emf 2 V are connected in series. The combination in series is joined to an ammeter of negligible resistance, a 1.6 Ω resistor, a 0.4 Ω resistor and unknown resistor R_1 as shown in figure. The current in the circuit is 2 A.



(i) What is the value of R_1 ?

- (a) 1Ω (b) 2Ω (c) 4Ω (d) 6Ω



$$\text{Total emf} = 2 \text{ V} + 2 \text{ V} + 2 \text{ V} + 2 \text{ V} = 8 \text{ V}$$

$$\text{Total resistance of the circuit} = 0.4 \Omega + 1.6 \Omega + R_1 = (2 + R_1)\Omega$$

$$\text{Current in the circuit, } I = \frac{\text{Total emf}}{\text{Total resistance}} \quad \therefore \quad 2 = \frac{8}{2 + R_1}$$

$$\text{or } 4 + 2R_1 = 8 \quad \text{or } R_1 = 2 \Omega$$

(ii) Find the value of potential difference across R_1 .

- (a) 4 V (b) 2 V (c) 8 V (d) 12 V

$$\begin{aligned} \text{The potential difference across } R_1 \text{ is} &= (2 \text{ A})(2 \Omega) \\ &= 4 \text{ V} \end{aligned}$$

(iii) Calculate the total resistance of the circuit.

- (a) 3.75Ω (b) 3.125Ω (c) 3.5Ω (d) 4Ω

$$\begin{aligned}\text{Total resistance of the circuit} &= 0.4 \Omega + 1.6 \Omega + 2.0 \Omega \\ &= 4 \Omega.\end{aligned}$$

(iv) Find the value of current across resistor R_1 .

- (a) 1.33 A (b) 0.25 A (c) 2 A (d) 3 A

As current flowing in the circuit is 2 A , so current across R_1 is also 2 A .

(v) If one of the cell is removed, the current through 1.6Ω will be

- (a) 2 A (b) 1.5 A (c) 6 A (d) 0.25 A

If one of cell is removed, total emf. $= 2 + 2 + 2 = 6 \text{ V}$

$$\text{So, current in the circuit, } I = \frac{6}{4} = 1.5 \text{ A}$$

\therefore Current through 1.6Ω will also be 1.5 A .

