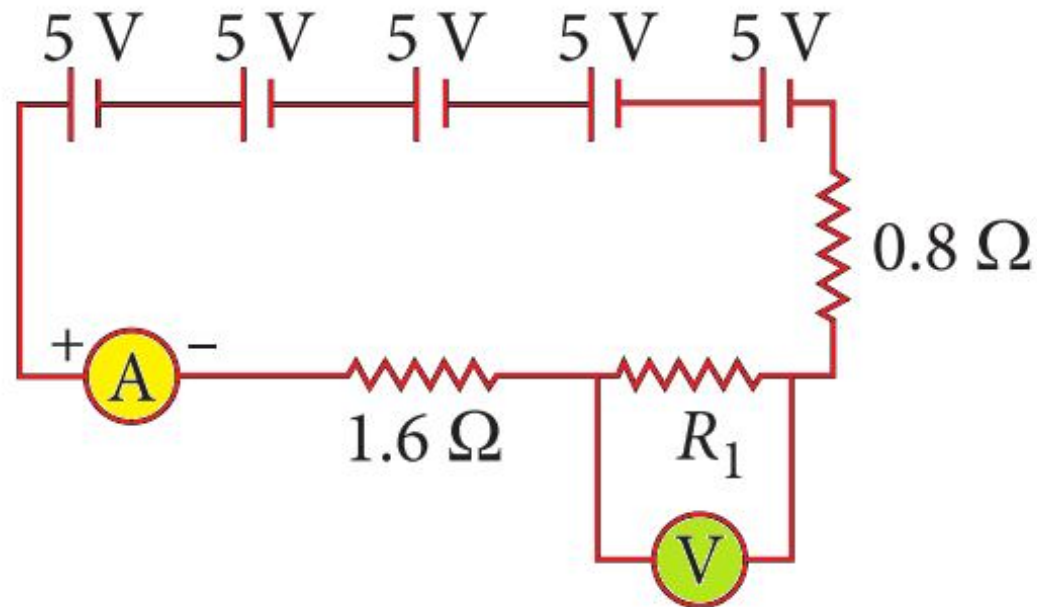# CASE STUDY QUESTION 19

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

Five cells each of emf 5 V are connected in series. The combination in series is joined to an ammeter of negligible resistance, a 1.6 W resistor, a 0.8 W resistor and an unknown resistor R_1 as shown in figure. The current in the circuit is 10 A. Assume the voltmeter to be ideal.

(i) Find the value of R_1.

(a) 2 Ω   (b) 0.1 Ω   (c) 0.5 Ω   (d) 5 Ω

Total emf $= 5\text{ V} + 5\text{ V} + 5\text{ V} + 5\text{ V} + 5\text{ V} = 25\text{ V}$

Total resistance of the circuit, $R = 1.6\ \Omega + 0.8\ \Omega + R_1$

$$= (2.4 + R_1)\ \Omega$$
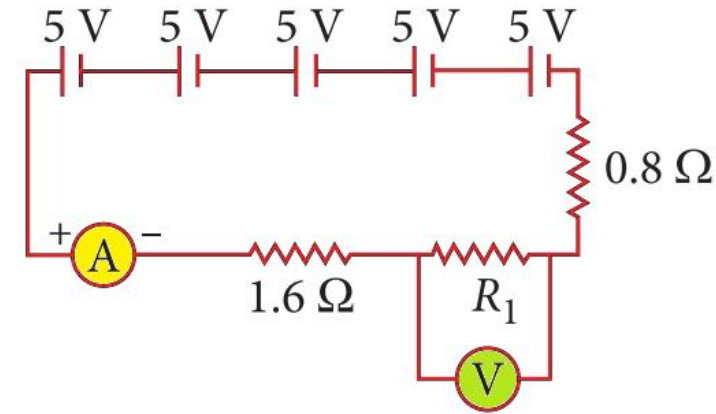
Current in the circuit, $I = \dfrac{\text{Total emf}}{\text{Total resistance}}$ or $10 = \dfrac{25}{2.4 + R_1}$

or $24 + 10R_1 = 25$ or $R_1 = 0.1\ \Omega$

(ii) The value of current across resistor R_1 is

(a) 3 A   (b) 0.5 A   (c) 10 A   (d) 2.5 A

As current flowing in the circuit is 10 A, so current through R_1 will also be 10 A.

(iii) Total resistance of the circuit is

(a) 4 Ω   (b) 2 Ω   (c) 0.5 Ω   (d) 2.5 Ω

Total resistance of the circuit, $R = 2.4 + 0.1$
$$= 2.5 \ \Omega$$

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

(a) 1 V   (b) 2 V   (c) 3 V   (d) 4 V

Potential difference across R_1, $V = I R$
$$= 10 \times 0.1$$
$$= 1 \ V$$

(v) If the voltmeter is not ideal, then current in the circuit will

(a) increase   (b) decrease   (c) remain same   (d) can't say.

If voltmeter is not ideal, then total resistance in the circuit decreases.
Hence, current through the circuit increases.