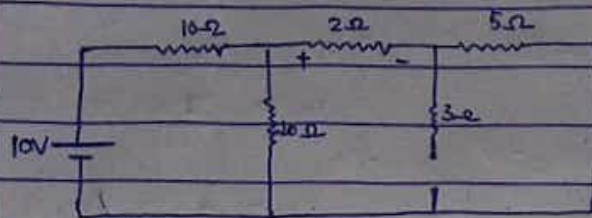
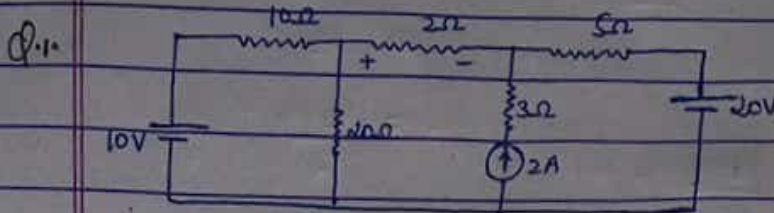


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$$R = 5 + 2 = 7\Omega$$

$$R' = \frac{7 \times 20}{27} = \frac{140}{27}\Omega$$

$$i = \frac{10 \times 27}{410} = \frac{270}{410}\Omega$$

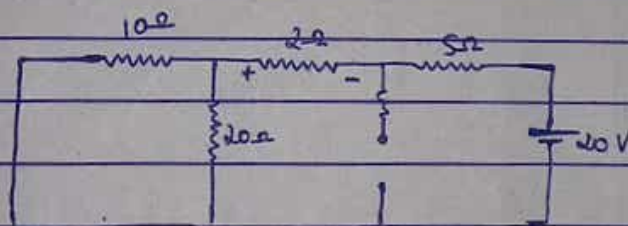
$$R_{net} = \frac{140}{27} + 10 = \frac{410}{27}\Omega$$

$$V_{10} = \frac{2700}{410}V$$

$$V' = 10 - \frac{2700}{410} = \frac{1400}{410}V$$

$$i_{2\Omega} = \frac{1400}{410} \times \frac{1}{7} = \frac{200}{410}A \quad \therefore V_{2\Omega} = \frac{400}{410} = \frac{40}{41}V$$

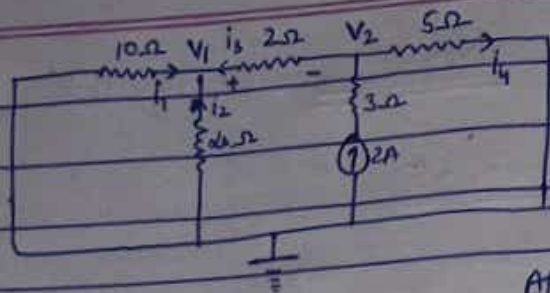
$$V_{2\Omega} = +\frac{40}{41}V \quad \text{--- (i)}$$



$$R = \frac{10 \times 20}{30} = \frac{20}{3} \quad \therefore R_{net} = \frac{20}{3} + 7 = \frac{41}{3}\Omega$$

$$i_{net} = \frac{20 \times 3}{41} = \frac{60}{41}\Omega$$

$$V_{2\Omega} = -\frac{120}{41}V \quad \text{--- (ii)}$$



At V_1

$$i_1 + i_2 + i_3 = 0$$

$$-\frac{V_1}{10} - \frac{V_1}{20} + \frac{V_2 - V_1}{2} = 0$$

$$-\frac{3V_1}{20} + \frac{V_2 - V_1}{2} = 0$$

$$-3V_1 + 10V_2 - 10V_1 = 0$$

$$10V_2 = 13V_1$$

At V_2

$$2 = \frac{V_2 - V_1}{2} + \frac{V_2}{5}$$

$$20 = 5V_2 - 5V_1 + 2V_2$$

$$20 = 7V_2 - 5V_1$$

$$30 = \frac{90V_1}{10} - 5V_1 = 4V_1$$

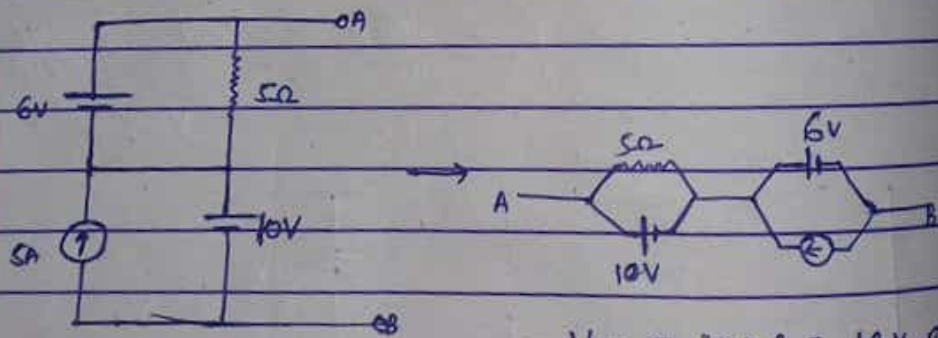
$$V_1 = +200/41 \text{ V}$$

$$V_2 = +260/41 \text{ V}$$

$$V_{20} = V_2 - V_1 = -\frac{60}{41} \text{ V}$$

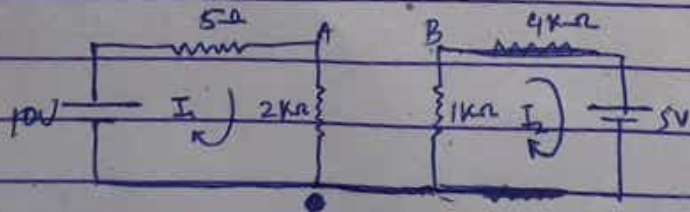
$$V_{\text{net}} \Big|_{20} = \frac{40 - 120 - 60}{41} = \frac{-140}{41} = -3.41 \text{ V}$$

Q.2.



$$V_{AB} = 10 + 6 = 16 \text{ V}$$

Q.3.

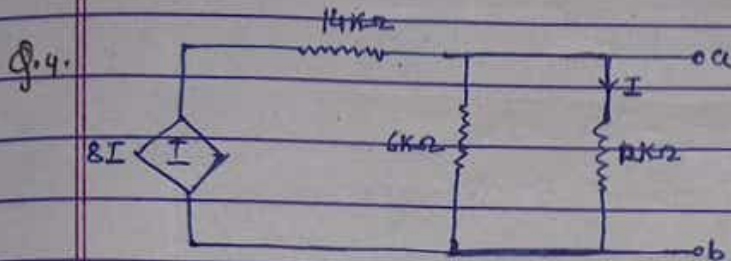


$$R_{th} = \frac{5 \times 2}{7} + \frac{4}{5} = \frac{50 + 28}{35} = \frac{78}{35} = 2.23 \text{ k}\Omega$$

$$I_1 = \frac{10}{7 \times 10^3} = \frac{10 \times 10^{-3}}{7} \text{ A}, \quad I_2 = \frac{-5}{5 \times 10^3} = -1 \times 10^{-3} \text{ A}$$

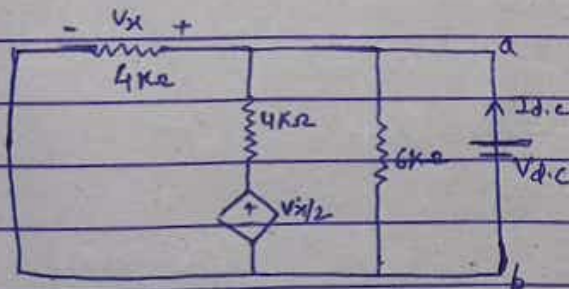
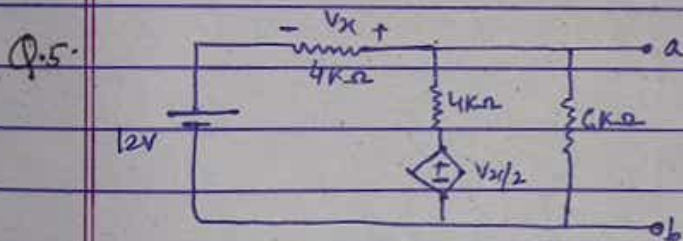
$$\therefore V_{th} = V_{ab} = \frac{2 \times 10^3 \times 10 \times 10^{-3}}{7} - 10^3 \times 10^{-3} \text{ A}$$

$$= 2.85 - 1 = 1.85 \text{ V}$$



There is no independent source so the V_{th} is zero.

$$\therefore R_{th} = \frac{\frac{14 \times 6}{14 + 6} \times 12}{\frac{14 \times 6}{14 + 6} + 12} = 3.12 \text{ k}\Omega$$

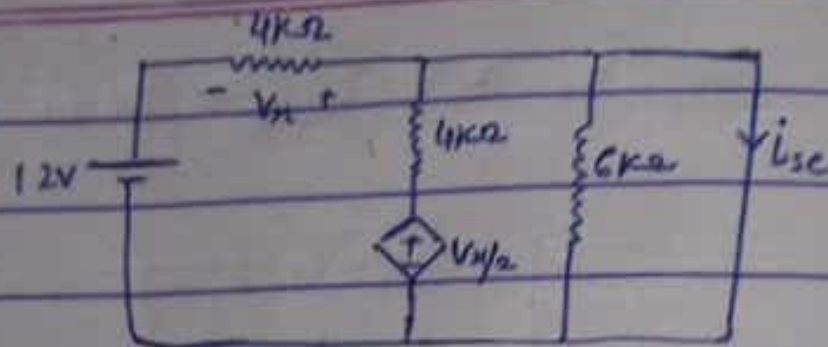


for R_{th} : $\frac{V_{dc}}{4} + \frac{V_{dc} - V_{x/2}}{4} + \frac{V_{dc}}{6} = I_{dc}$

$$\therefore V_x = V_{dc}$$

$$\frac{V_{dc}}{4} + \frac{V_{dc} - 0.5V_{dc}}{4} + \frac{V_{dc}}{6} = I_{dc}$$

$$R_{th} = \frac{V_{dc}}{I_{dc}} = \frac{12}{9.5} = \frac{24}{19} \text{ k}\Omega$$

for I_{sc} :

$$= \frac{-12}{4} + \frac{(-V_x/2)}{4} + I_{sc} = 0$$

$$V_x = -12V$$

$$-3 + 3/2 = -I_{sc}$$

$$I_{sc} = 3/2 = 1.5A$$

$$V_{th} = \frac{24}{19} \times \frac{3}{2} = \frac{36V}{19}$$