Solution

1.

$$\frac{15 - x}{12} = \frac{x - 2}{6} + \frac{x - 3}{4} + \frac{x - 4}{8}$$

$$\frac{15 - x}{6} = \frac{x - 2}{3} + \frac{x - 3}{2} + \frac{x - 7}{4}$$

$$\frac{15 - x}{6} = \frac{4x - 3 + 6x - 18 + 3x - 12}{12}$$

$$30 - 2x$$

$$= 13x - 38$$

$$15x = 68$$

$$x = \frac{68}{15}$$

I in 12Ω

$$= 15 - \frac{68}{15}$$

$$= \frac{225 - 68}{15 \times 12}$$

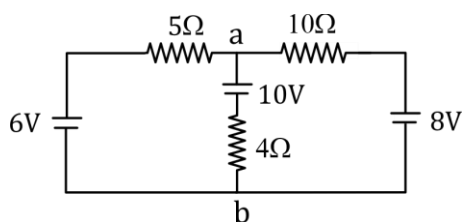$$i = \frac{157}{180}$$

$$= \frac{k}{180}$$

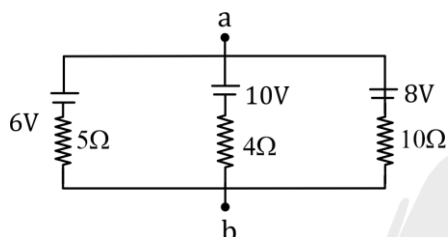$$k = 157$$

2.

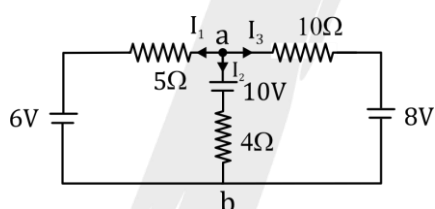
Method I : through equivalent emt of battery.

$$\varepsilon_{net} = \frac{\varepsilon_1/r_1 + \varepsilon_2/r_2 + \varepsilon_3/r_3}{\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3}}$$

$$\varepsilon_{net\ (a,b)} = \frac{6/5 + 10/4 + 8/10}{\frac{1}{5} + \frac{2}{4} + \frac{1}{10}} = \frac{18 \times 20}{4 \times 11} = \frac{90}{11} \text{Volt} = \frac{N}{11}$$

N = 90

Method 2 : Using

$I_1 + I_2 + I_3 = 0$ Let potential of b is zero

$$\frac{V_a - 6}{5} + \frac{V_a - 8}{10} + \frac{V_a - 10}{4} = 0 \Rightarrow \frac{4V_a - 24 + 2V_a - 16 + 5V_a - 50}{20} = 0 \Rightarrow 11V_a - 90 = 0$$
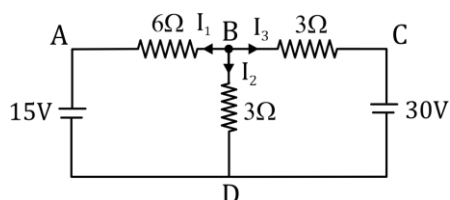
$$V_a = \frac{90}{11}$$

$$V_a - V_b = \frac{90}{1I} = \frac{N}{11}$$

N = 90

3.   by nodel method

Let potential of D is zero.

$$I_1 + I_2 + I_3 = 0$$

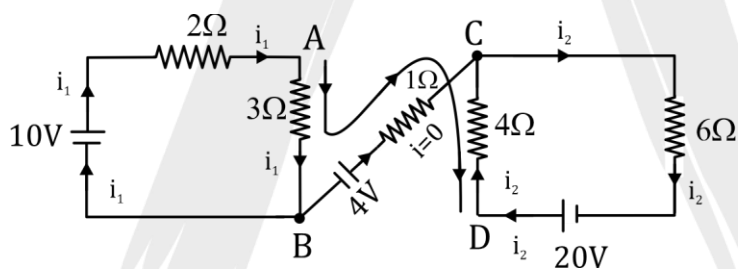$$\frac{V_B - 15}{6} + \frac{V_B - 0}{3} + \frac{V_B - 30}{3} = 0$$

$$V_B - 15 + 2V_B + 2V_B - 60 = 0$$

$$SV_B = 75$$

$$V_B = 15 \text{ Volt}$$

$$I_2 = \frac{15 - 0}{3} = 5 \text{Amp}$$
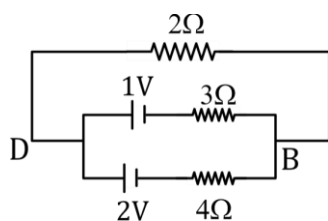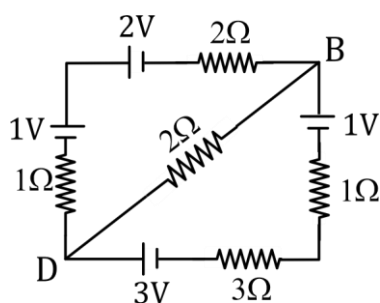
4.

$$l_1 = \frac{10}{S} = 2 \text{ Amp} \qquad\qquad l_2 = \frac{20}{10} = 2 \text{ Amp}$$

$$V_A - 6 + 4 + 2 \times 4 = V_D$$
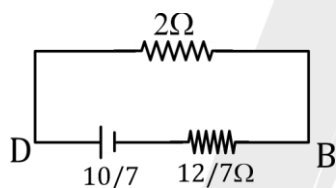
$$V_A - V_D = 6 \text{ Volt.}$$

5.

$$\varepsilon_{net} = \frac{\varepsilon_2 r_1 + \varepsilon_1 r_2}{r_1 + r_2} = \frac{-1 \times 4 + 2 \times 3}{7} = \frac{10}{7}$$

$$r_{eq} = \frac{r_1 r_2}{r_1 + r_2} = \frac{12}{7}$$

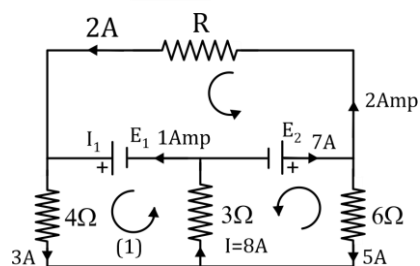
$$r_{eq} = \frac{12 + 14}{7} = \frac{26}{7}$$

$$i = \frac{10/7}{26/7} = \frac{70}{26} = \frac{5}{13}$$

$$V_D - V_B = \frac{5}{13} \times 2 = \frac{10}{13} \text{ Volt}$$

Solution of Q.6 to Q.8.

$3A - I + 5A = 0$

$I = 8\ Amp$

(1) Using KVL

$E_1 - 12 - 24 = 0$

$E_1 = 36\text{Volt}$

$-E_2 + 24 + 30 = 0$

$E_2 = 54\text{Volt}$

$-2R - E_1 + E_2 = 0$

$2R = E_2 - E_1$

$= 54 - 36$

$2R = 18$

$R = 9\Omega$