DPP 2

SOLUTION

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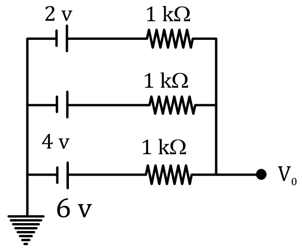
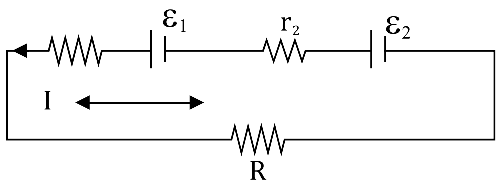


1. $\text{Enet} = \dfrac{\frac{\varepsilon_1}{r_1}+\frac{\varepsilon_2}{r_2}+\frac{\varepsilon_3}{r_3}}{\frac{1}{r_1}+\frac{1}{r_2}+\frac{1}{r_3}}$

$= \dfrac{\frac{2}{1}+\frac{4}{1}+\frac{6}{1}}{\frac{1}{1}+\frac{1}{1}+\frac{1}{1}} = \dfrac{12}{3} = 4\text{volt}$

Potential of $V_0 = 4\text{volt}$



2. $\varepsilon_{net} = \varepsilon_1 + \varepsilon_2$

$\text{Rnet} = r_1 + r_2 + R$

$I = \dfrac{\varepsilon_1 + \varepsilon_2}{r_1 + r_2 + R}$

$\varepsilon_1 - Ir_1 = 0$

$\varepsilon_1 - \left(\dfrac{\varepsilon_1 + \varepsilon_2}{r_1 + r_2 + R}\right) r_1 = 0$

$\varepsilon_1 = \varepsilon_2 = \varepsilon$ given

$\varepsilon - \dfrac{2\varepsilon r_1}{r_1 + r_2 + R} = 0$

$1 = \dfrac{2r_1}{r_1 + r_2 + R}$

$r_1 + r_2 + R = 2r_1$

$r_1 = r_2 + R$

$R = r_1 - r_2$

3. $\varepsilon_{net} = \varepsilon_1 + \varepsilon_2$

$\text{Rnet} = r_1 + r_2 + R$

$I = \dfrac{\varepsilon_1 + \varepsilon_2}{r_1 + r_2 + R}$

$\varepsilon_1 - Ir_1 = 0$

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$r_1 + r_2 + R = 2r_1$

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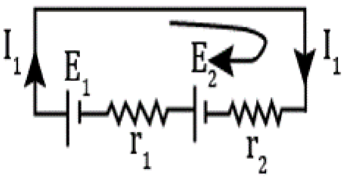
$\frac{r_1=r_2+R}{R=r_1-r_2}$

Only one value of R exist for which potential difference across battery having internal resistance r_1 is zero.

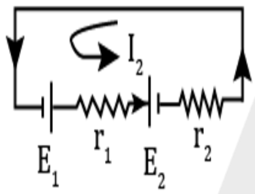
4. The correct option is $AE_1=\frac{I_1+I_2}{I_1-I_2}E_2$



Using kirchhoff's loop law, we get:

$-l_1r_2+E_2-l_1r_1+E_1=0$

$\frac{E_1+E_2}{r_1+r_2}=I_1 \ldots.(1)$



Again using kirchhoff's loop law:

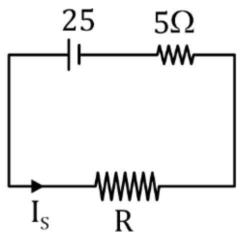
$E_1-I_2r_1-E_2-I_2r_2=0$

$\frac{(E_1-E_2)}{r_1+r_2}=I_2 \ldots.(2)$

From equation (1) and (2):

$\frac{E_1+E_2}{E_1-E_2}=\frac{I_1}{I_2}\Rightarrow E_1=\frac{(I_1+I_2)}{I_1-I_2}E_2$

5. first in series connection



$I_S=\frac{25}{S+R}$

In parallel connection

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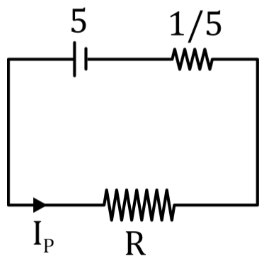


$$I_p = \frac{5}{R + 1/5}$$

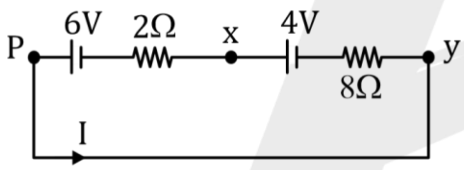
$$I_p = I_s \Rightarrow \frac{25}{5+R} = \frac{5}{\frac{5R+I}{5}}$$

$5R + I = 5 + R$

$4R = 4$

$R = 1\Omega$

6. $\varepsilon_{net} = 6 - 4 = 2$ volt $[-4 \vdash]$



$I = \frac{2}{10} = 0.2$Amp

$V_x + 4 + 8 \times 0 \cdot 2 = V_y$

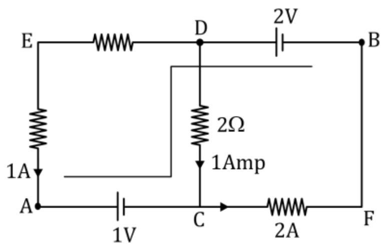
$v_x - V_y = -5.6$volt

$V_y - V_x = 5.6$volt

7. $V_A + 1 + 2 - 2 = V_B$

$V_A - V_B = -1$volt

$V_B - V_A = 1$volt



8. $\varepsilon_{net} = \frac{1/1+2/1+3/1}{\frac{1}{1}+\frac{1}{1}+\frac{1}{1}} = \frac{6}{3} = 2$ volt

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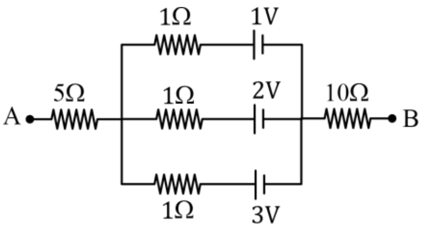
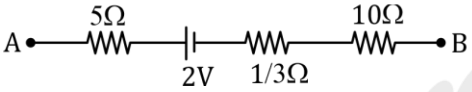


$\Rightarrow \frac{1}{req} = \frac{1}{1} + \frac{1}{1} + \frac{1}{1}$

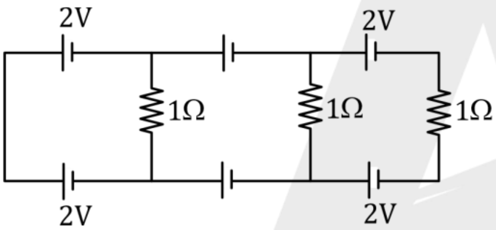
$req = \frac{1}{3}\Omega$



$v_A - 2 = v_B$ i=0

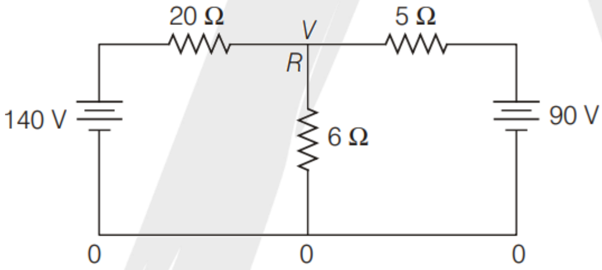
$v_A - v_B = 2volt$

9.



0.

10. The given figure can be represented as



From the above figure, it can be clearly seen that the voltage across point R is assumed as V.

Therefore, applying Kirchhoff's current law at point R, we can write

$$\frac{V-0}{6} + \frac{V-90}{5} + \frac{V-140}{20} = 0$$

$$\Rightarrow \frac{V}{6} + \frac{V-90}{5} + \frac{V-140}{20} = 0$$

$$\Rightarrow \frac{10\,V + 12\,V - 1080 + 3\,V - 420}{60} = 0$$

$$\Rightarrow 25\,V = 1500 \Rightarrow V = 60\,V$$

Therefore, current through 6Ω resistor is

$$I = \frac{V}{R} = \frac{60}{6} = 10\,A$$