HW #6

6-1

a. $R_2 \parallel R_3$

b. $E \parallel R_3$

c. $R_2 \parallel R_3$

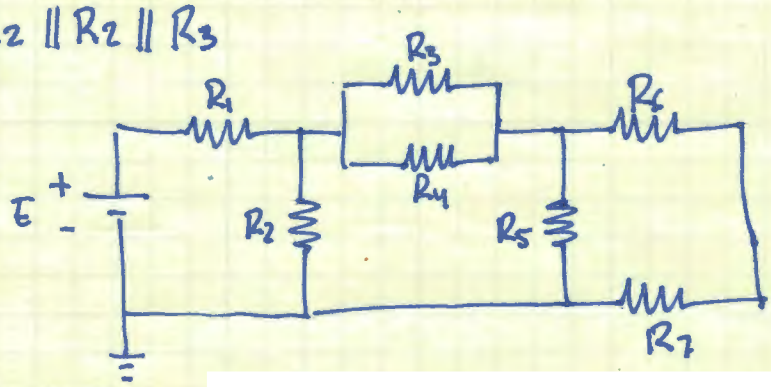
d. $R_2 \parallel R_3$

e. $E \parallel R_1 \parallel R_2 \parallel R_3 \parallel R_4$

f. $E \parallel R_1 \parallel R_2 \parallel R_3$

g. $E_2 \parallel R_2 \parallel R_3$

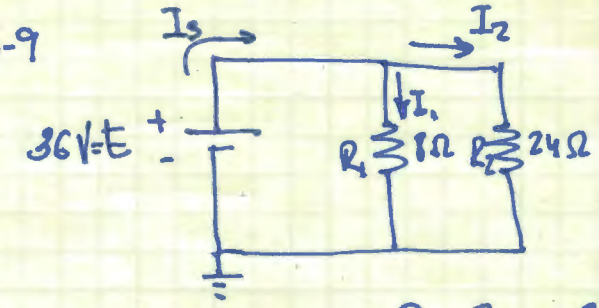
6-2



a. $R_3 \parallel R_4$,

b. $E + R_1$, $R_6 + R_7$

6-9



a) $R_T = R_1 \parallel R_2 = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{8\Omega \cdot 24\Omega}{8\Omega + 24\Omega} = \boxed{6\Omega = R_T}$

b) $V_{R1} = V_{R2} = E = 36\ V$

c) $I_T = \frac{E_T}{R_T} = \frac{36V}{6\Omega} = \boxed{6\ A = I_T}$

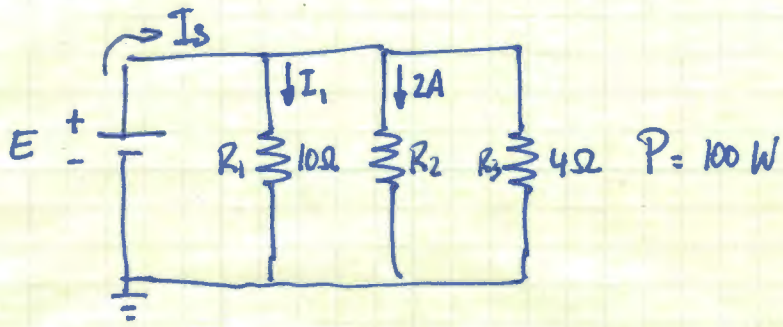
$I_1 = \frac{V_{R1}}{R_1} = \frac{36V}{8\Omega} = \boxed{4.5\ A = I_1}$

$I_2 = \frac{V_{R2}}{R_2} = \frac{36V}{24\Omega} = \boxed{1.5A = I_2}$

d) $I_T = I_1 + I_2$?

$6A = 4.5A + 1.5A = 6A$

6-14



a. $P = \frac{V^2}{R}$ ∴ $V = \sqrt{P \cdot R} = \sqrt{100\,W \cdot 4\Omega} = \boxed{20\,V = E}$

b. $R_2 = \frac{E}{I_2} = \frac{20\,V}{2A} = \boxed{10\,\Omega = R_2}$

c. $I_1 = \frac{V_1}{R_1} = \frac{E}{R_1} = \frac{20\,V}{10\,\Omega} = \boxed{2A = I_1}$

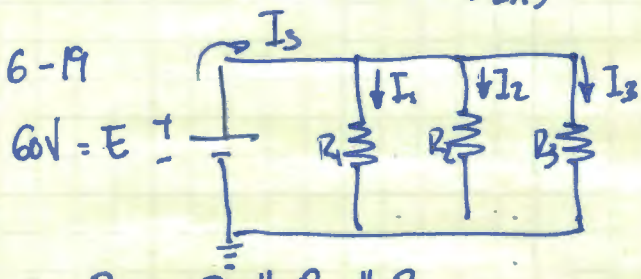
d. $I_s = I_1 + I_2 + I_3 = 2A + 2A + \left(\frac{20\,V}{4\Omega}\right) = \boxed{9A = I_s}$

e. $P_s = E \cdot I_s = 20\,V \cdot 9A = 180\,W$

f. $P_{R1} = \frac{V^2}{R_1} = \frac{E^2}{R_1} = \frac{20\,V^2}{10\,\Omega} = \boxed{40\,W = P_{R1}}$

$P_{R2} = \frac{V^2}{R_2} = \frac{E^2}{R_2} = \frac{20\,V^2}{\left(\frac{20\,V}{2A}\right)} = \boxed{40\,W = P_{R2}}$

6-19



a. $R_T = R_1 \parallel R_2 \parallel R_3 = \frac{1}{\frac{1}{1k\Omega} + \frac{1}{4.7k\Omega} + \frac{1}{10k\Omega}} = \boxed{761.6\,\Omega = R_T}$

$I_1 = \frac{V_{R1}}{R_1} = \frac{E}{R_1} = \frac{60\,V}{1k\Omega} = 60\,mA$

$I_2 = \frac{V_{R2}}{R_2} = \frac{E}{R_2} = \frac{60\,V}{4.7k\Omega} = 12.8\,mA$

$I_3 = \frac{V_{R3}}{R_3} = \frac{E}{R_3} = \frac{60\,V}{10\,k\Omega} = 6\,mA$

$I_T = I_1 + I_2 + I_3 = 60\,mA + 12.8\,mA + 6\,mA$

$I_T = 78.8\,mA$

b. $P_{R1} = V_{R1} \cdot I_1 = 60\,V \cdot 60\,mA = 3.6\,W$

$P_{R2} = V_{R2}\, I_2 = 60\,V \cdot 12.8\,mA = 768\,mW$

$P_{R3} = V_{R3} \cdot I_3 = 60\,V \cdot 6\,mA = 360\,mW$

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c. $I_S = \frac{E_T}{R_T} = \frac{60\,V}{761{,}6\,\Omega} = 78{,}8\ mA$

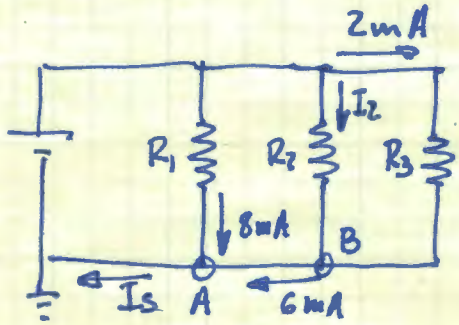
$P_S = E_S\, I_S = 60\,V \cdot 78{,}8\,mA = \boxed{4{,}73\,W = P_S}$

d. $P_S = P_{R1} + P_{R2} + P_{R3} = 4{,}73\,W = 3{,}6\,W + 0{,}768\,W + 0{,}36\,W = 4{,}73\,W$

e. $R_1 \Rightarrow$ the smallest parallel resistor.

6-24

I_S, I_2?



$\sum I_{in} = \sum I_{out}$

Node A

$\sum I_{in} = 8\,mA + 6\,mA = \sum I_{out}$

$I_S = 8\,mA + 6\,mA = 14\,mA$

$\boxed{I_S = 14\,mA}$

$I_S =$

Node B

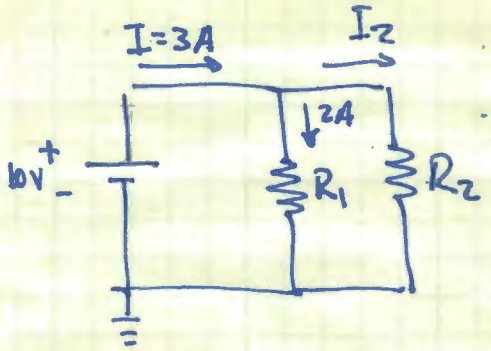
$\sum I_{in} = I_2 + 2\,mA$

$\sum I_{out} = 6\,mA$

$I_2 + 2\,mA = 6\,mA$

$\boxed{I_2 = 4\,mA}$

6-28



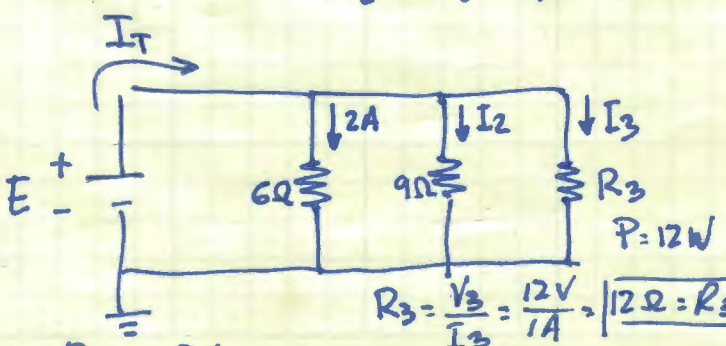
$V_{R1} = I \cdot R_1$

$V_{R1} = E = 10\,V = I \cdot R_1$

$R_1 = \frac{10\,V}{2A} = \boxed{5\,\Omega = R_1}$

$I_2 = I_T - I_1 = 3 - 2 = 1A$

$R_2 = \frac{V_{R2}}{I} = \frac{10\,V}{1A} = \boxed{10\,\Omega = R_2}$



$E = V_{R1} = I_1 \cdot R_1 = 2A \cdot 6\Omega = \boxed{12\,V}$

$E = V_{R2} = 12\,V = I_2 \cdot 9\,\Omega$ $\boxed{I_2 = 1{,}33\,A}$

$R_3 = \frac{V_3}{I_3} = \frac{12\,V}{1A} = \boxed{12\,\Omega = R_3}$

$P = 12\,W = V_{R3}\, I_3 = 12\,V \cdot I_3$ $\therefore \boxed{I_3 = 1A}$

$R_T = \frac{E_T}{I_T} = \frac{12\,V}{4{,}33\,A} = 2{,}77\,\Omega$

$I_T = I_1 + I_2 + I_3 = 2A + 1{,}33\,A + 1A = \boxed{4{,}33\,A = I_T}$

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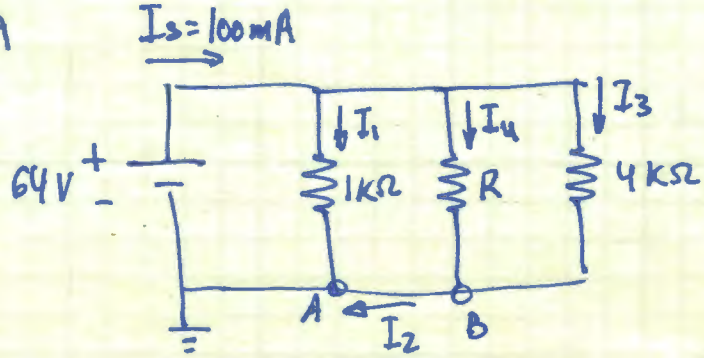
6-29



$$I_1 = \frac{V_{R1}}{R_1} = \frac{64\,V}{1\,K\Omega} = 64\,mA$$

$$I_3 = \frac{V_{R3}}{R_3} = \frac{64\,V}{4\,K\Omega} = 16\,mA$$

Node A

$$\sum I_{in} = \sum I_{out}$$

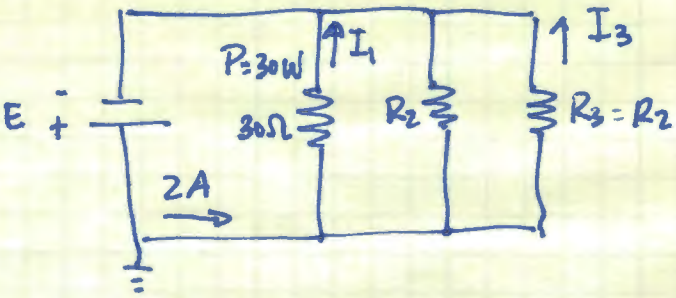
$$I_1 + I_2 = I_s \quad \therefore \quad 64\,mA + I_2 = 100\,mA \quad \therefore \quad \boxed{I_2 = 36\,mA}$$

Node B

$$\sum I_{in} = \sum I_{out}$$

$$I_4 + I_3 = I_2 \qquad I_4 = 36\,mA - 16\,mA = 20\,mA$$

$$R_4 = \frac{V_{R4}}{I_4} = \frac{64\,V}{20\,mA} = \boxed{3{,}2\,K\Omega = R}$$



$$P = \frac{V^2}{R} \quad \therefore \quad V = \sqrt{P \cdot R}$$

$$V = \sqrt{30\,W \cdot 30\,\Omega} = 30\,V$$

$$\boxed{E = V = 30\,V}$$

$$I_1 = \frac{V_{R1}}{R_1} = \frac{30\,V}{30\,\Omega} = \boxed{1A = I_1}$$

If $R_3 = R_2 \Rightarrow I_3 = I_2$

$$I_T = I_1 + I_2 + I_3 = I_1 + 2I_2 \qquad I_2 = \frac{I_T - I_1}{2} = \frac{2A - 1A}{2} = 0{,}5A$$

$$R_2 = \frac{V_{R2}}{I_2} = \frac{30\,V}{0{,}5A} = \boxed{60\,\Omega = R_2} \qquad \boxed{I_2 = I_3 = 0{,}5\,A}$$

$$P_{R2} = I_2^2 \cdot R_2 = (0{,}5\,A)^2 \cdot 60\,\Omega = \boxed{15\,W = P_{R2}}$$

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