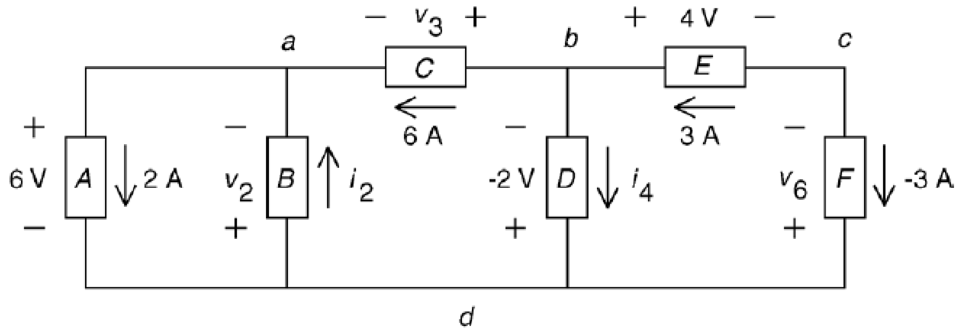
P3.3-2



Apply KCL at node *a* to get $\quad 2 = i_2 + 6 = 0 \Rightarrow\; i_2 = \text{-}4$ A

Apply KCL at node *b* to get $\quad 3 = i_4 + 6 \Rightarrow\; i_4 = \text{-}3$ A

Apply KVL to the loop consisting of elements *A* and *B* to get

$$-v_2 - 6 = 0 \Rightarrow\; v_2 = \text{-}6 \text{ V}$$

Apply KVL to the loop consisting of elements *C*, *D*, and A to get

$$-v_3 - (\text{-}2) - 6 = 0 \Rightarrow\; v_4 = \text{-}4 \text{ V}$$

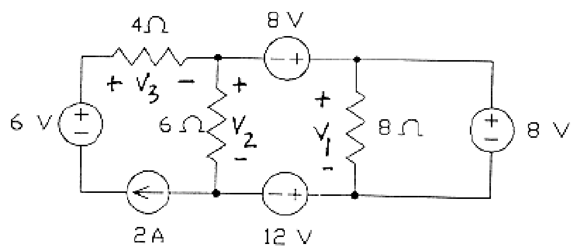
Apply KVL to the loop consisting of elements *E*, *F* and *D* to get

$$4 - v_6 + (\text{-}2) = 0 \Rightarrow\; v_6 = 2 \text{ V}$$

Check: The sum of the power supplied by all branches is

$$-(6)(2) - (\text{-}6)(\text{-}4) - (\text{-}4)(6) + (\text{-}2)(\text{-}3) + (4)(3) + (2)(\text{-}3) = \text{-}12 - 24 + 24 + 6 + 12 - 6 = 0$$

P3.3-5



$v_1 = 8$ V

$v_2 = -8 + 8 + 12 \;=\; 12$ V

$v_3 = 2 \cdot 4 \;=\; 8$ V

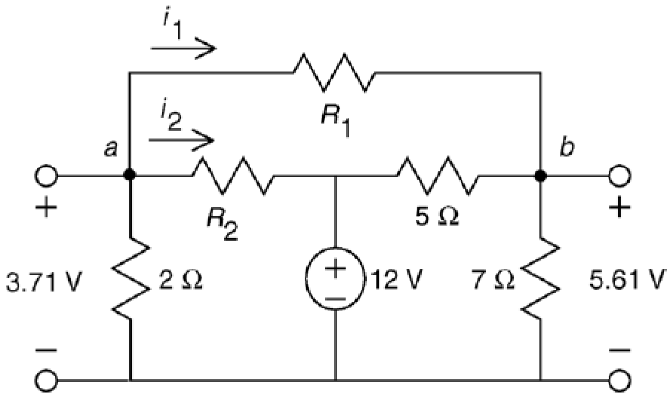
$4\Omega: \quad P \;= \dfrac{v_3^2}{4} = \underline{16 \text{ W}}$

$6\Omega: \quad P \;=\; \dfrac{v_2^2}{6} \;=\; \underline{24 \text{ W}}$

$8\Omega: \quad P = \dfrac{v_1^2}{8} = \underline{8 \text{ W}}$

(checked using LNAP 8/16/02)

P3.3-10



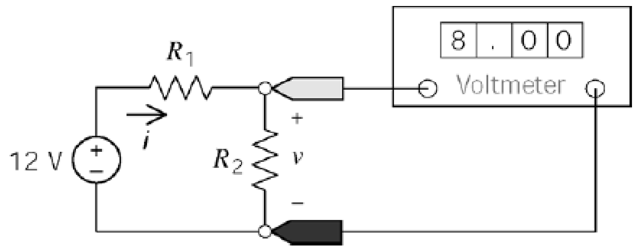
KCL at node *b*: $\frac{5.61}{7} = \frac{3.71-5.61}{R_1} + \frac{12-5.61}{5} \Rightarrow 0.801 = \frac{-1.9}{R_1} + 1.278$

$$\Rightarrow R_1 = \frac{1.9}{1.278-0.801} = 3.983 \approx 4\ \Omega$$

KCL at node *a*: $\frac{3.71}{2} + \frac{3.71-5.61}{4} + \frac{3.71-12}{R_2} = 0 \Rightarrow 1.855 + (-0.475) + \frac{-8.29}{R_2} = 0$

$$\Rightarrow R_2 = \frac{8.29}{1.855-0.475} = 6.007 \approx 6\ \Omega$$

P3.4-3



$i\,R_2 = v = 8\text{ V}$

$12 = i\,R_1 + v = i\,R_1 + 8$

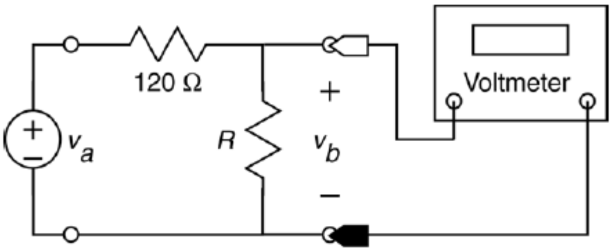
$\Rightarrow 4 = i\,R_1$

$(a)\ i = \frac{8}{R_2} = \frac{8}{100}\ ;\ R_1 = \frac{4}{i} = \frac{4\cdot 100}{8} = \underline{50\ \Omega}$

$(b)\ i = \frac{4}{R_1} = \frac{4}{100}\ ;\ R_2 = \frac{8}{i} = \frac{8\cdot 100}{4} = \underline{200\ \Omega}$

$(c)\ 1.2 = 12\,i \Rightarrow i = 0.1\text{ A}\ ;\ R_1 = \frac{4}{i} = \underline{40\ \Omega};\ R_2 = \frac{8}{i} = \underline{80\ \Omega}$

P3.4-6



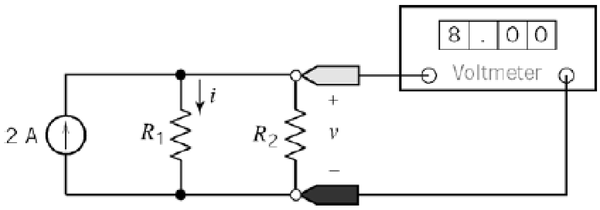
a.) $\left(\frac{240}{120+240}\right)18 = 12\text{ V}$

b.) $18\left(\frac{18}{120+240}\right) = 0.9\text{ W}$

c.) $\left(\frac{R}{R+120}\right)18 = 2 \quad \Rightarrow \quad 18\,R = 2\,R + 2\,(120) \quad \Rightarrow \quad R = 15\;\;\Omega$

d.) $0.2 = \frac{R}{R+120} \quad \Rightarrow \quad (0.2)(120) = 0.8\,R \quad \Rightarrow \quad R = 30\;\;\Omega$

P3.5-3



$i = \frac{8}{R_1}$ or $R_1 = \frac{8}{i}$

$8 = R_2(2-i) \;\Rightarrow\; i = 2 - \frac{8}{R_2}$ or $R_2 = \frac{8}{2-i}$

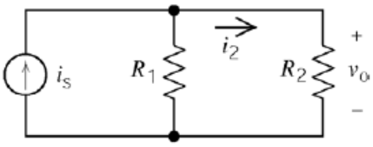
$(a)\;\; i = 2 - \frac{8}{12} = \underline{\frac{4}{3}\text{ A}}\;\; ; \; R_1 = \frac{8}{4/3} = \underline{6\,\Omega}$

$(b)\;\; i = \frac{8}{12} = \underline{\frac{2}{3}\text{ A}}\;\; ; \; R_2 = \frac{8}{2-\frac{2}{3}} = \underline{6\,\Omega}$

(c) $R_1 = R_2$ will cause $i = \frac{1}{2}2 = 1$ A. The current in both R_1 and R_2 will be 1 A.

$2 \cdot \frac{R_1\,R_2}{R_1+R_2} = 8\,; \quad R_1 = R_2 \quad \Rightarrow \quad 2 \cdot \frac{1}{2}R_1 = 8 \;\Rightarrow\; R_1 = 8 \;\therefore\; \underline{R_1 = R_2 = 8\,\Omega}$

P3.5-5



current division: $i_2 = \left(\dfrac{R_1}{R_1 + R_2}\right) i_s$ and

Ohm's Law: $v_o = i_2 R_2$ yields

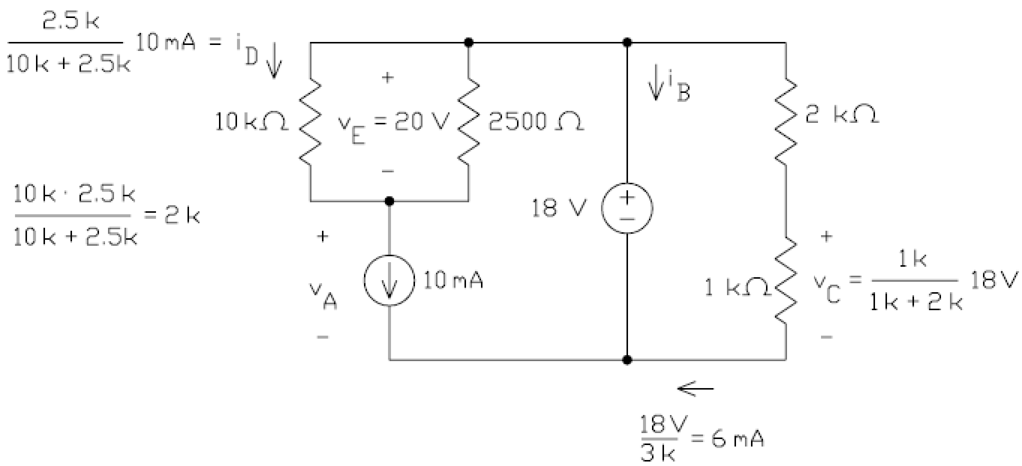
$$i_s = \left(\frac{v_o}{R_2}\right)\left(\frac{R_1 + R_2}{R_1}\right)$$

plugging in $R_1 = 4\Omega$, $v_o > 9$ V gives $i_s > 3.15$ A

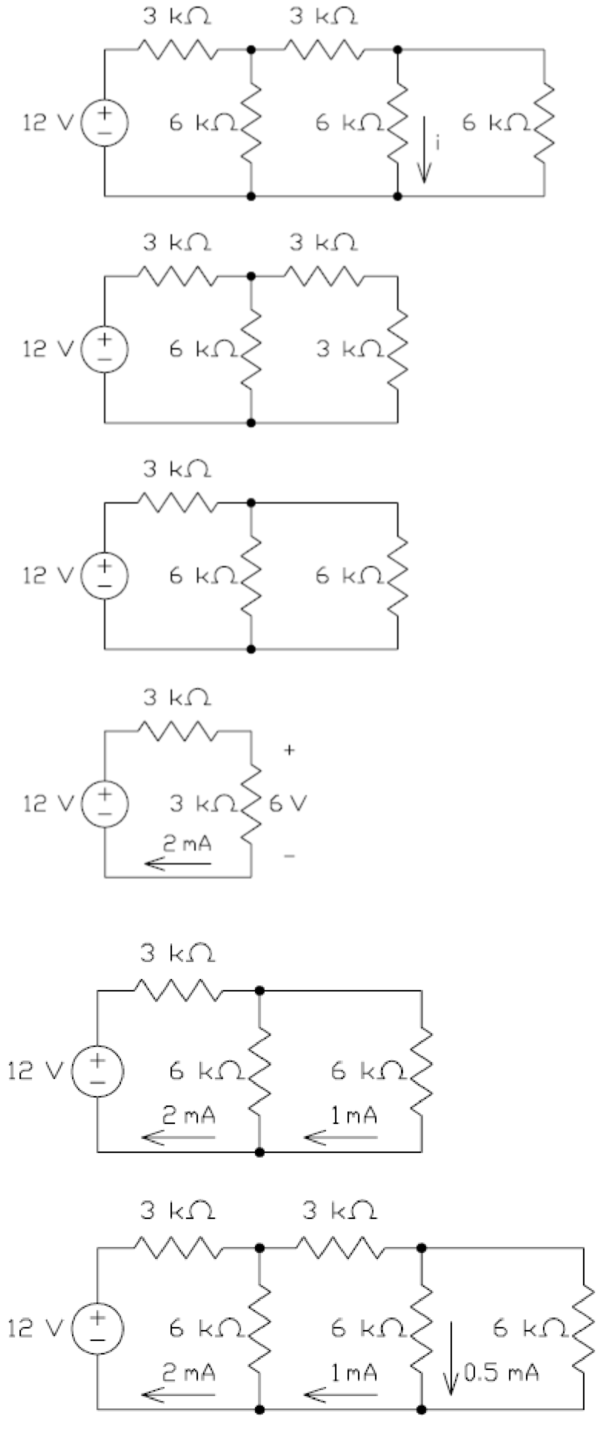
and $R_1 = 6\Omega$, $v_o < 13$ V gives $i_s < 3.47$ A

So any $\underline{3.15 \text{ A} < i_s < 3.47 \text{ A}}$ keeps $9 \text{ V} < v_o < 13$ V.

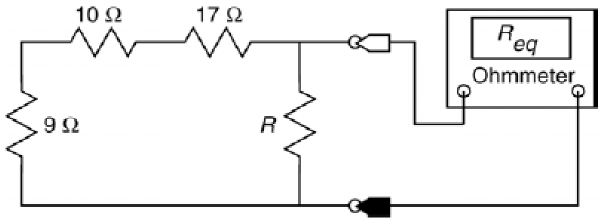
P3.7-6



P3.7-9


3 kΩ
3 kΩ
12 V
6 kΩ
6 kΩ
6 kΩ
i
3 kΩ
3 kΩ
12 V
6 kΩ
3 kΩ
3 kΩ
12 V
6 kΩ
6 kΩ
3 kΩ
12 V
3 kΩ
6 V
2 mA
3 kΩ
12 V
6 kΩ
6 kΩ
2 mA
1 mA
3 kΩ
3 kΩ
12 V
6 kΩ
6 kΩ
6 kΩ
2 mA
1 mA
0.5 mA

P3.7-12

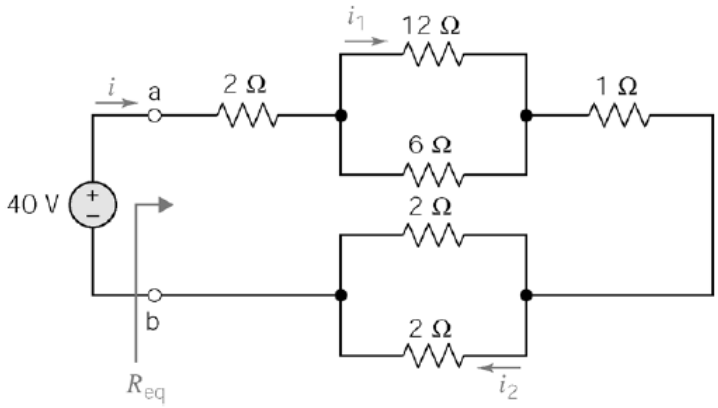


$$9+10+17=36\ \Omega$$

a.) $\dfrac{36(18)}{36+18}=12\ \Omega$

b.) $\dfrac{36\,\mathrm{R}}{36+\mathrm{R}}=18 \quad\Rightarrow\quad 18\,R=(18)(36) \quad\Rightarrow\quad R=36\ \Omega$

P3.7-14



$$R_{eq}=2+1+\ (6\|12)+(2\|2)=\ 3+4+1=\underline{8\ \Omega}$$

$$\therefore i=\frac{40}{R_{eq}}=\frac{40}{8}=\underline{5\ \mathrm{A}}$$

$$i_1=i\left(\frac{6}{6+12}\right)=(5)\left(\tfrac{1}{3}\right)=\underline{\tfrac{5}{3}\ \mathrm{A}} \quad \text{from current division}$$

$$i_2=i\left(\frac{2}{2+2}\right)=(5)\left(\tfrac{1}{2}\right)=\underline{\tfrac{5}{2}\ \mathrm{A}}$$