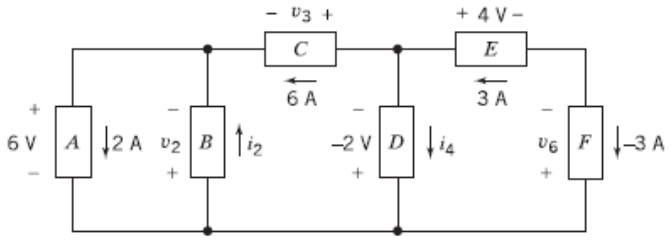
ECE241
HW #2
SOLUTION

Problems from "Introduction to Electric Circuits", Svoboda and Dorf, 9th ed. Pages 92-101.

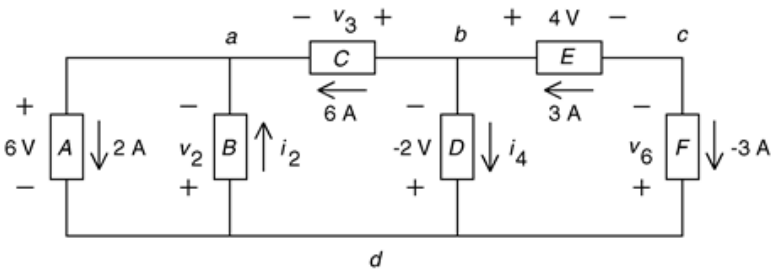
1) P 3.2-2
2) P 3.2-6
3) P 3.2-7
4) P 3.3-16
5) P 3.4-18

SOLUTIONS:

P 3.2-2 Determine the values of i_2, i_4, v_2, v_3, and v_6 in Figure P 3.2-2.



Solution:



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

Apply KCL at node *b* to get $3 = i_4 + 6 \Rightarrow i_4 = -3$ A

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

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

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

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

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

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

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

$$-(6)(2) - (-6)(-4) - (-4)(6) + (-2)(-3) + (4)(3) + (2)(-3) = -12 - 24 + 24 + 6 + 12 - 6 = 0$$

P 3.2-6 Determine the power supplied by each voltage source in the circuit of Figure P 3.2-6.

Answer: The 2-V voltage source supplies 2 mW and the 3-V voltage source supplies –6 mW.

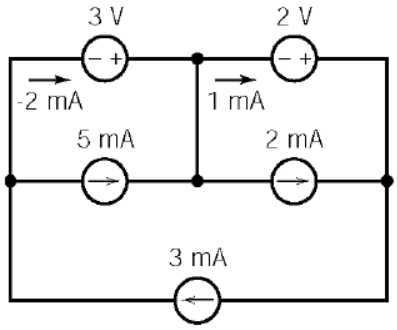
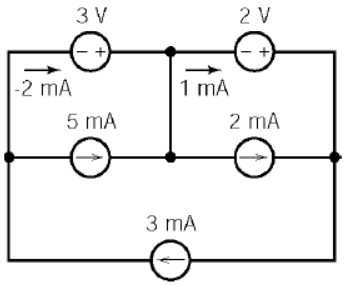


Figure P 3.2-6

Solution:



$$P_{2\text{V}} = +\left[2\times\left(1\times10^{-3}\right)\right] = 2\times10^{-3} = 2\text{ mW}$$

$$P_{3\text{V}} = +\left[3\times\left(-2\times10^{-3}\right)\right] = -6\times10^{-3} = -6\text{ mW}$$

P 3.2-7 What is the value of the resistance R in Figure P 3.2-7?

Hint: Assume an ideal ammeter. An ideal ammeter is equivalent to a short circuit.

Answer: $R = 4\ \Omega$

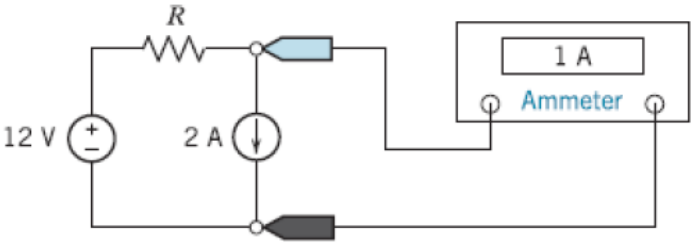
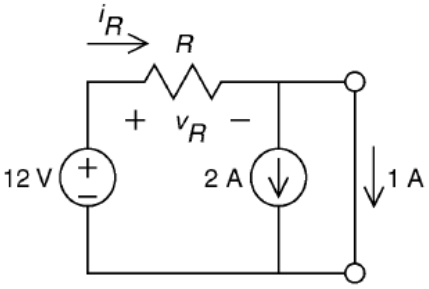


Figure P 3.2-7

Solution:



KCL: $i_R = 2+1 \Rightarrow i_R = 3\text{ A}$

KVL: $v_R + 0 - 12 = 0 \Rightarrow v_R = 12\text{ V}$

$$\therefore\quad R = \frac{v_R}{i_R} = \frac{12}{3} = 4\,\Omega$$

P3.3-16

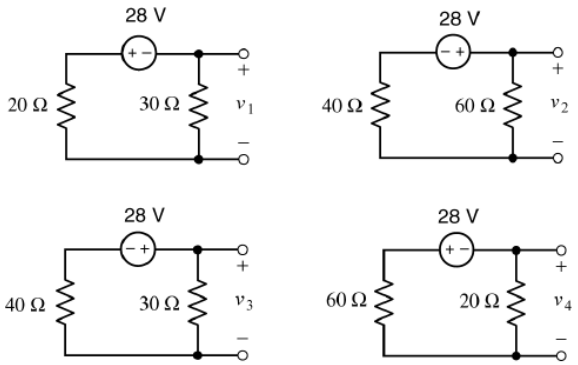


Figure P3.3-16

P3.3-16. Figure P3.3-16 shows four similar but slightly different circuits. Determine the values of the voltages v_1, v_2, v_3 and v_4.

Solution: Using voltage division:

$$v_1 = -\left(\frac{30}{20+30}\right)28 = -16.8 \text{ V}, \quad v_2 = -\left(\frac{60}{40+60}\right)28 = 16.8 \text{ V},$$

$$v_3 = \left(\frac{30}{40+30}\right)28 = 12 \text{ V} \quad \text{and} \quad v_4 = -\left(\frac{20}{60+20}\right)28 = -7 \text{ V}$$

P3.4-18

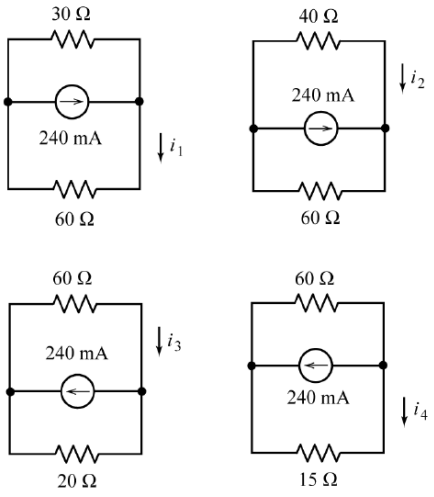


Figure P3.4-18

P3.4-18. Figure P3.4-18 shows four similar but slightly different circuits. Determine the values of the currents i_1, i_2, i_3 and i_4.

Solution:
Using current division:

$$i_1 = \left(\frac{30}{30+60}\right)240 = 80 \text{ mA}, \quad i_2 = -\left(\frac{60}{60+40}\right)240 = -144 \text{ mA},$$

$$i_3 = \left(\frac{20}{60+20}\right)240 = 60 \text{ mA} \quad \text{and} \quad i_4 = -\left(\frac{60}{60+15}\right)240 = -192 \text{ mA}$$