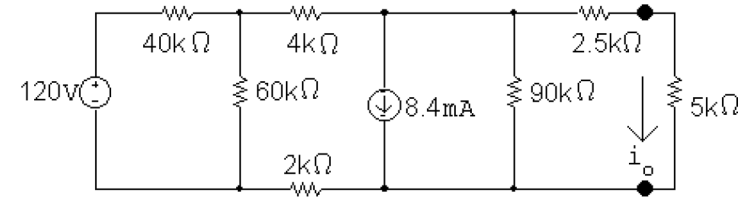
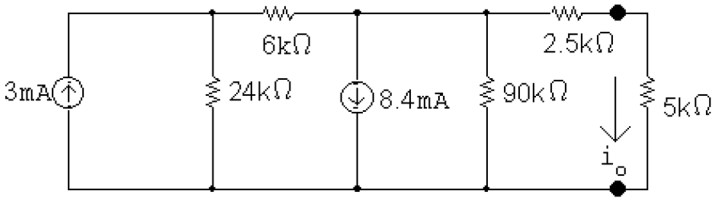
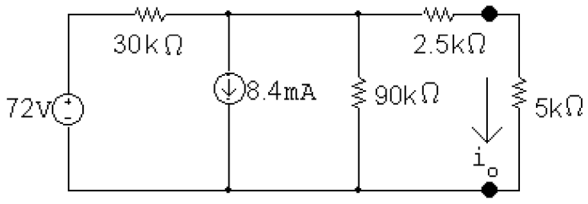
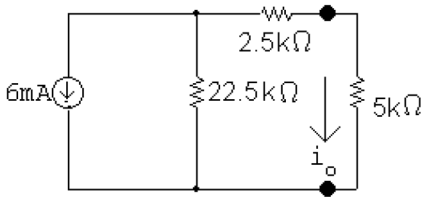
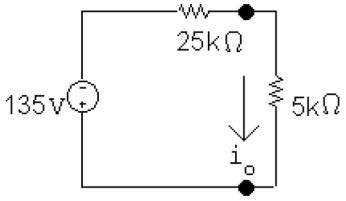
P 4.56 **[a]**





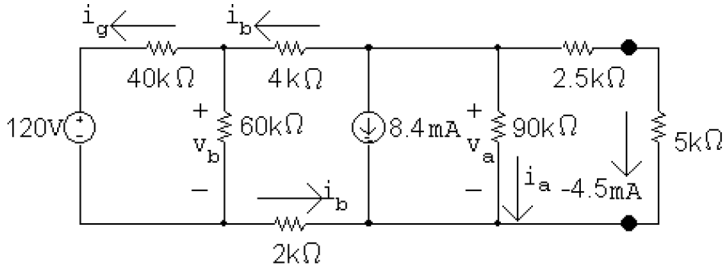






$$i_o = -135/30{,}000 = -4.5 \text{ mA}$$

[b]



$$v_{\mathrm{a}} = (7500)(-0.0045) = -33.75 \text{ V}$$

$$i_{\mathrm{a}} = \frac{v_{\mathrm{a}}}{90{,}000} = \frac{-33.75}{90{,}000} = -0.375 \text{ mA}$$

$$i_{\mathrm{b}} = -8.4 \times 10^{-3} + 0.375 \times 10^{-3} + 4.5 \times 10^{-3} = -3.525 \text{ mA}$$

$$v_{\mathrm{b}} = (6000)(3.525 \times 10^{-3}) - 33.75 = -12.6 \text{ V}$$

$$i_g = \frac{-12.6 - 120}{40{,}000} = -3.315 \text{ mA}$$

$$p_{120\mathrm{V}} = (120)(-3.315 \times 10^{-3}) = -397.8 \text{ mW}$$

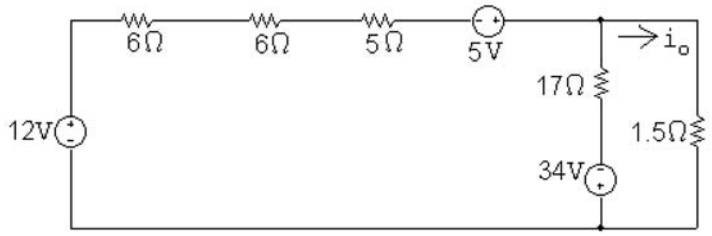
Check:

$$p_{8.4\mathrm{mA}} = (-33.75)(8.4 \times 10^{-3}) = -283.5 \text{ mW}$$

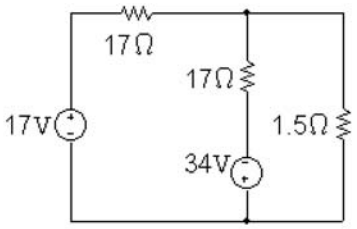
$$\sum P_{\mathrm{dev}} = 397.8 + 283.5 = 681.3 \text{ mW}$$

$$\sum P_{\mathrm{dis}} = (40{,}000)(-3.315 \times 10^{-3})^2 + \frac{(-12.6)^2}{60{,}000} + \frac{(-33.75)^2}{90{,}000}$$
$$+(6000)(-3.525 \times 10^{-3})^2 + (7500)(-4.5 \times 10^{-3})^2$$
$$= 681.3 \text{ mW}$$

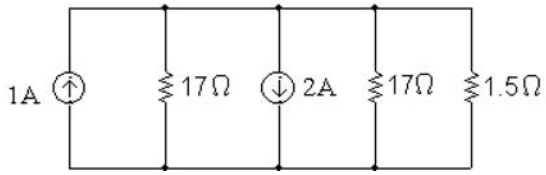
P 4.58 **[a]** Applying a source transformation to each current source yields



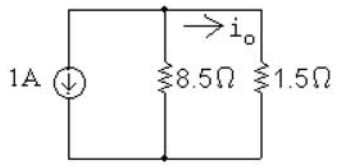
Now combine the 12 V and 5 V sources into a single voltage source and the 6 Ω, 6 Ω and 5 Ω resistors into a single resistor to get



Now use a source transformation on each voltage source, thus

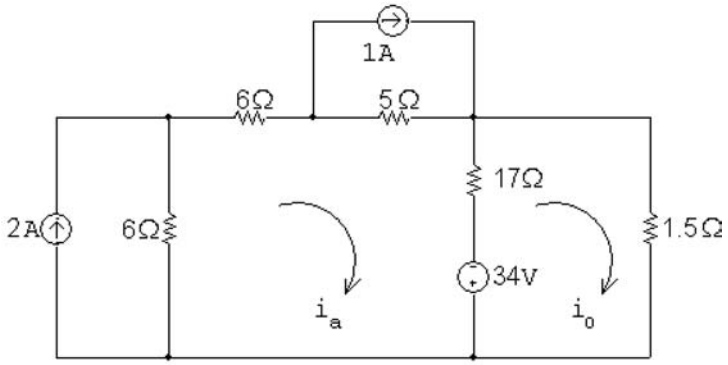


which can be reduced to



$$\therefore \quad i_o = \frac{8.5}{10}(-1) = -0.85 \text{ A}$$

[b]



The mesh current equations are:

$$6(i_\text{a} - 2) + 6i_\text{a} + 5(i_\text{a} - 1) + 17(i_\text{a} - i_o) - 34 = 0$$

$$1.5i_o + 34 + 17(i_o - i_\text{a}) = 0$$

Put these equations in standard form:

$$i_\text{a}(6 + 6 + 5 + 17) + i_o(-17) = 12 + 5 + 34$$

$$i_\text{a}(-17) + i_o(1.5 + 17) = -34$$

Solving, $\quad i_\text{a} = 1.075 \text{ A}; \quad i_o = -0.85 \text{ A}$