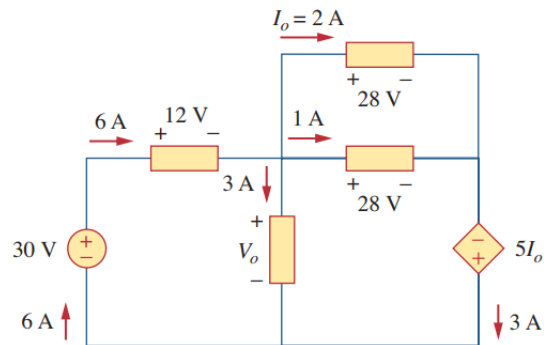


## Problem 1.20

Find  $V_o$  and the power absorbed by each element in the circuit of Fig. 1.31.



**Figure 1.31**  
For Prob. 1.20.

### Solution

To get the power for a circuit element, multiply the voltage and current through it. The current is negative if it flows out of the element through the positive end.

$$p_{\text{independent voltage source}} = (30 \text{ V})(-6 \text{ A}) = -180 \text{ W (emitted)}$$

$$p_{\text{left } 12 \text{ V}} = (12 \text{ V})(6 \text{ A}) = 72 \text{ W (absorbed)}$$

$$p_{\text{middle } V_o} = (V_o)(3 \text{ A}) = 3V_o \text{ W (absorbed)}$$

$$p_{\text{right } 1 \text{ A}} = (28 \text{ V})(1 \text{ A}) = 28 \text{ W (absorbed)}$$

$$p_{\text{right } 2 \text{ A}} = (28 \text{ V})(2 \text{ A}) = 56 \text{ W (absorbed)}$$

$$p_{\text{dependent voltage source}} = (5 \times 2 \text{ V})(-3 \text{ A}) = -30 \text{ W (emitted)}$$

Use the fact that the sum of power in this circuit is zero (law of conservation of energy) to solve for  $V_o$ .

$$\sum p = (-180 + 72 + 3V_o + 28 + 56 - 30) \text{ W} = (3V_o - 54) \text{ W} = 0$$

Therefore,

$$V_o = 18 \text{ V} \quad \Rightarrow \quad p_{\text{middle } V_o} = 3V_o = 54 \text{ W}.$$