P 1.12 Assume we are standing at box A looking toward box B. Then, using the passive sign convention $p = vi$, since the current i is flowing into the + terminal of the voltage v. Now we just substitute the values for v and i into the equation for power. Remember that if the power is positive, B is absorbing power, so the power must be flowing from A to B. If the power is negative, B is generating power so the power must be flowing from B to A.

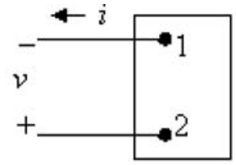
[a] $p = (20)(15) = 300$ W   300 W from A to B

[b] $p = (100)(-5) = -500$ W   500 W from B to A

[c] $p = (-50)(4) = -200$ W   200 W from B to A

[d] $p = (-25)(-16) = 400$ W   400 W from A to B

P 1.13 **[a]**



$p = vi = (-20)(5) = -100$ W
Power is being delivered by the box.

[b] Leaving

[c] Gaining

P 1.19 **[a]** $0\text{ s} \le t < 1\text{ s}$:

$v = 5\text{ V}; \quad i = 20t\text{ A}; \quad p = 100t\text{ W}$

$1\text{ s} < t \le 2\text{ s}$:

$v = 0\text{ V}; \quad i = 20\text{ A}; \quad p = 0\text{ W}$

$2\text{ s} \le t < 3\text{ s}$:

$v = 0\text{ V}; \quad i = 20\text{ A}; \quad p = 0\text{ W}$

$3\text{ s} < t \le 4\text{ s}$:

$v = -5\text{ V}; \quad i = 80 - 20t\text{ A}; \quad p = -400 + 100t\text{ W}$

$4\text{ s} \le t < 5\text{ s}$:

$v = -5\text{ V}; \quad i = 80 - 20t\text{ A}; \quad p = -400 + 100t\text{ W}$

$5\text{ s} < t \le 6\text{ s}$:

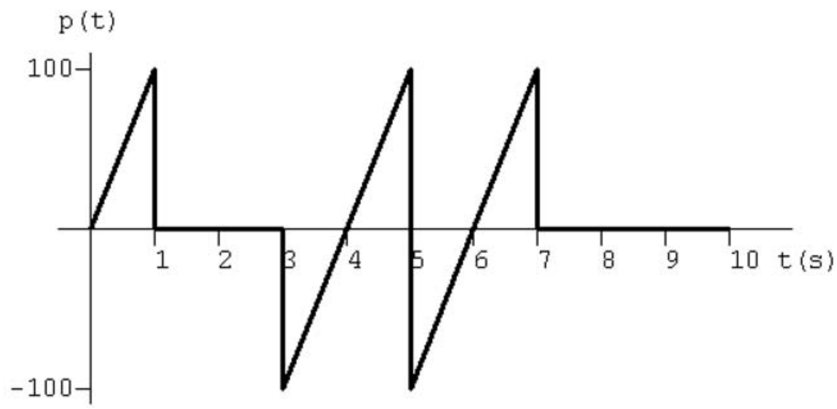
$v = 5\text{ V}; \quad i = -120 + 20t\text{ A}; \quad p = -600 + 100t\text{ W}$

$6\text{ s} \le t < 7\text{ s}$:

$v = 5\text{ V}; \quad i = -120 + 20t\text{ A}; \quad p = -600 + 100t\text{ W}$

$t > 7\text{ s}$:

$v = 0\text{ V}; \quad i = 20\text{ A}; \quad p = 0\text{ W}$



[b] Calculate the area under the curve from zero up to the desired time:

$$w(1) = \tfrac{1}{2}(1)(100) = 50\text{ J}$$

$$w(6) = \tfrac{1}{2}(1)(100) - \tfrac{1}{2}(1)(100) + \tfrac{1}{2}(1)(100) - \tfrac{1}{2}(1)(100) = 0\text{ J}$$

$$w(10) = \tfrac{1}{2}(1)(100) - \tfrac{1}{2}(1)(100) + \tfrac{1}{2}(1)(100) - \tfrac{1}{2}(1)(100) + \tfrac{1}{2}(1)(100) = 50\text{ J}$$

P 1.26 We use the passive sign convention to determine whether the power equation is $p = vi$ or $p = -vi$ and substitute into the power equation the values for v and i, as shown below:

$$p_a = -v_a i_a = -(-18)(-51) = -918 \text{ W}$$

$$p_b = v_b i_b = (-18)(45) = -810 \text{ W}$$

$$p_c = v_c i_c = (2)(-6) = -12 \text{ W}$$

$$p_d = -v_d i_d = -(20)(-20) = 400 \text{ W}$$

$$p_e = -v_e i_e = -(16)(-14) = 224 \text{ W}$$

$$p_f = v_f i_f = (36)(31) = 1116 \text{ W}$$

Remember that if the power is positive, the circuit element is absorbing power, whereas is the power is negative, the circuit element is developing power. We can add the positive powers together and the negative powers together — if the power balances, these power sums should be equal:

$$\sum P_{dev} = 918 + 810 + 12 = 1740 \text{ W};$$

$$\sum P_{abs} = 400 + 224 + 1116 = 1740 \text{ W}$$

Thus, the power balances and the total power developed in the circuit is 1740 W.

P 2.4 Since we know the device is a resistor, we can use the power equation. From Fig. P2.4(a),

$$p = vi = \frac{v^2}{R} \qquad \text{so} \qquad R = \frac{v^2}{p}$$

Using the values in the table of Fig. P2.4(b)

$$R = \frac{(-8)^2}{3.2} = \frac{(-4)^2}{0.8} = \frac{(4)^2}{0.8} = \frac{(8)^2}{3.2} = \frac{(12)^2}{7.2} = \frac{(16)^2}{12.8} = 20\,\Omega$$