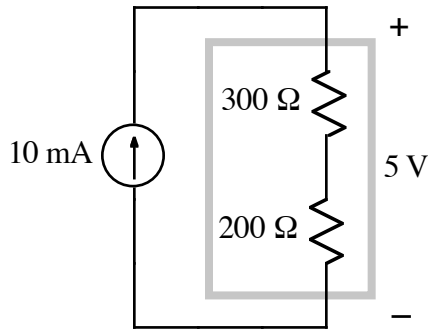
HOMEWORK #2 solution

EX:



Find the total power dissipated by the components inside the box.

SOL'N: The power for the box is given by the voltage drop across the box multiplied by the current flowing into the box.

$$p = iv$$

The voltage drop across the box is shown to be 5 V. follows by taking a voltage loop consisting of the voltage source and the box. Equivalently, we may simply argue that components in parallel have the same voltage drop. Thus, the voltage drop across the box is 3V (with the + sign at the top of the box and the – at the bottom of the box).

The current in components in series must be the same. It follows that 10 mA flows into the box and through the two resistors.

The power is the product of the voltage of 5 V and the current of 10 mA:

$$p = 5\text{ V} \cdot 10\text{ mA} = 50\text{ mW}$$

NOTE: The power dissipated by the 300 Ω resistor is i^2R.

$$i^2 \cdot 300\ \Omega = (10\text{ mA})^2 \cdot 300\ \Omega = 30\text{ mW}$$

The voltage across the 300 Ω resistor is given by Ohm's law:

$$10\text{ mA} \cdot 300\ \Omega = 3\text{ V}$$

The power dissipated by the 200 Ω resistor is i^2R.

$$i^2 \cdot 200\ \Omega = (10\text{ mA})^2 \cdot 200\ \Omega = 20\text{ mW}$$

The voltage across the 200 Ω resistor is given by Ohm's law:

$$10\text{ mA} \cdot 200\ \Omega = 2\text{ V}$$

Note that the powers dissipated by the components inside the box sum to give the total power dissipated.