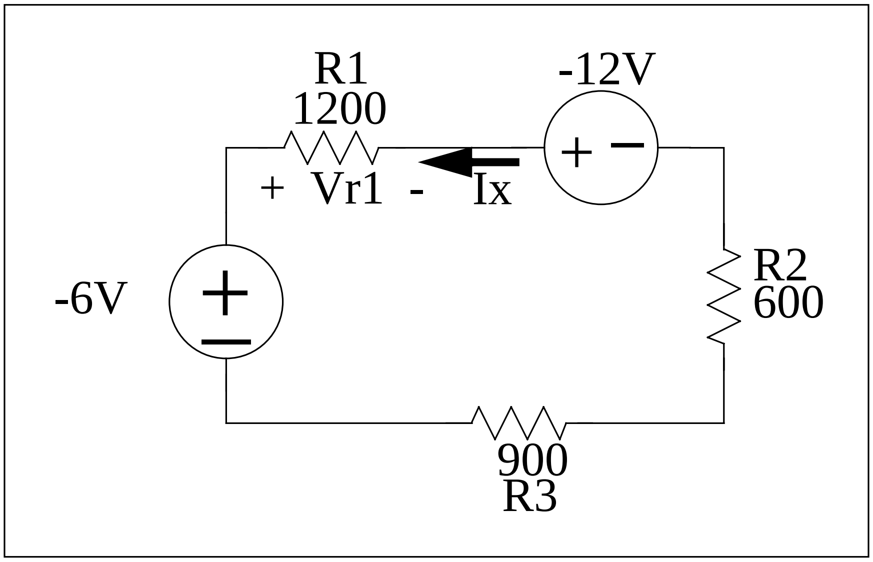
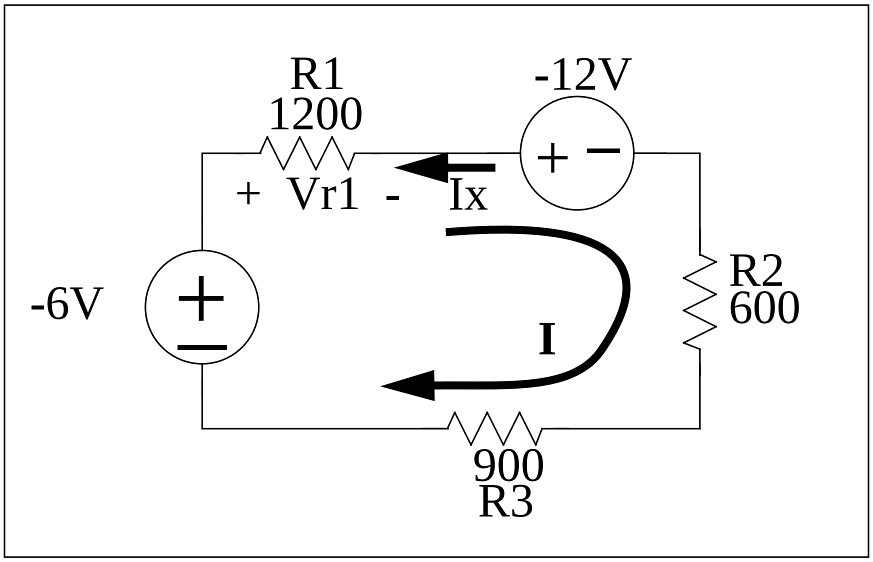
## KVL Analysis again

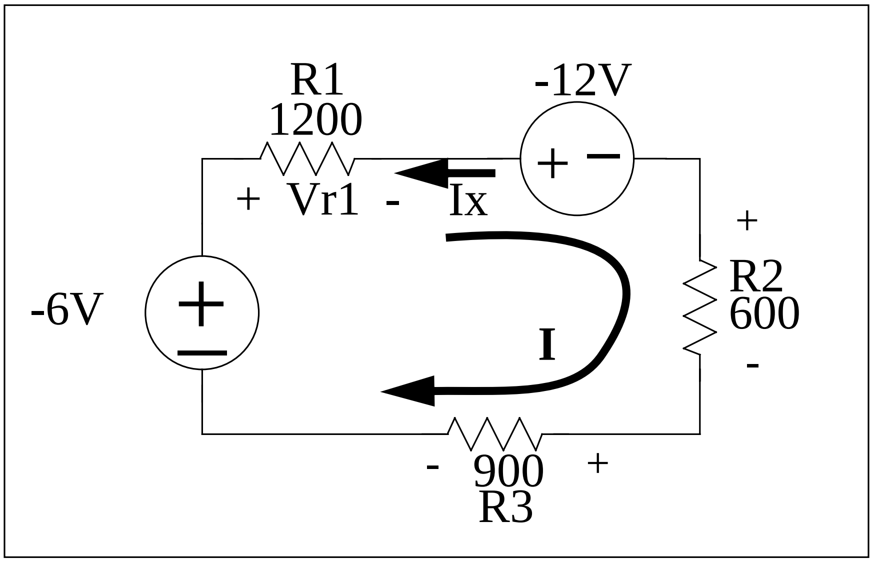
In the circuit below, determine the current Ix, the voltage Vr1 and the power dissipated in the -6 volt source.




Assume a reference direction for the unknown current..



Now, assign the voltage references




Now apply Kirchoff's voltage law to the single closed path. Starting at the negative terminal of the -6 Volt source:

$$6 + V_{r1} - 12 + V_{r2} + V_{r3} = 0$$

For the resistors, Ohm's law states that:

$$V_{r1} = I * 1200 = 1200I$$
$$V_{r2} = I * 600 = 600I$$
$$V_{r3} = I * 900 = 900I$$

Doing the Ohm' law substitution into our KVL equation, we obtain:

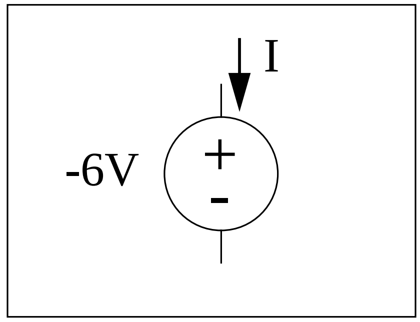
$$6 + 1200I - 12 + 600I + 900I = 0$$

Solving for I we get:

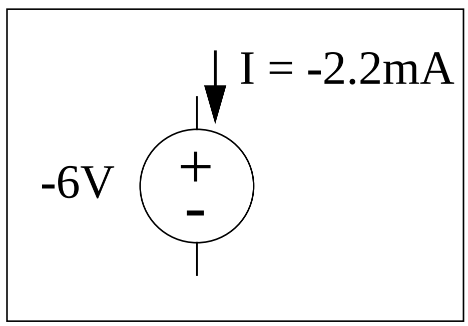
$$2700I = 6$$

I = 2.22mA and therefore <u>Ix = -2.22mA</u> (I and Ix references are opposite)

To compute the power dissipated in the -6 volt source we draw the setup picture for the passive sign convention:




Since the current direction we initially chose is in opposition to the direction that we must show current flowing to the compute power dissipation, so we must change the sign of the magnitude.

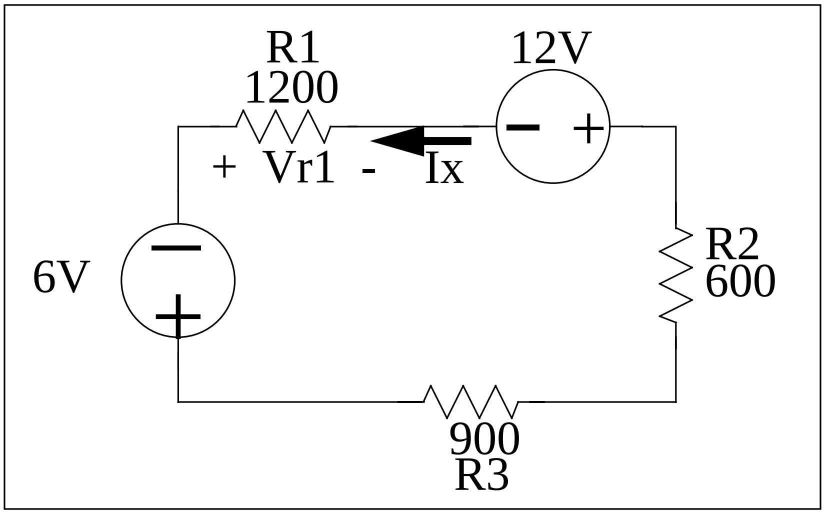



Thus, computing the power dissipation we get:

$$P_{-6v} = -6 * -.0022 = 13.3mW$$

The positive power dissipation indicates that the -6 volt source is actually dissipating power, not generating it.

Lets make a quick intuitive check. Remembering that we can reverse the polarity of voltage sources by changing the sign of the voltage, we could redraw the circuit like this:




We can see that the 12 volt source is in opposition to the 6v source. Since the 12 volt source is the larger one, it "wins" forcing current to flow out of the positive terminal of the 12 volt source. The effective resultant voltage applied to the circuit is 6v, with the current flows clock-wise. Since Ix is shown flowing the opposite way, we know that Ix must be negative.(and it is!)

Since all elements in the circuit are in series, we may simply sum the resistors and directly compute current flowing in the circuit.

I = 6/(1200 + 600 + 900) = 2.22mA (this agrees with our other result)