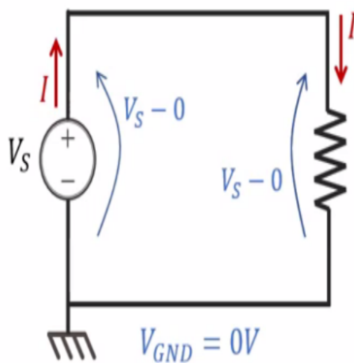


The concept of power stems from the concept of Energy and we know that energy is neither created nor destroyed. It stands to reason therefore that if we add up power produced and power dissipated in a circuit we should get zero!



The power dissipated in the resistor is

$$P_R = V_S I$$

It is positive because voltage and current arrows are in opposite directions.

The power produced by the source is

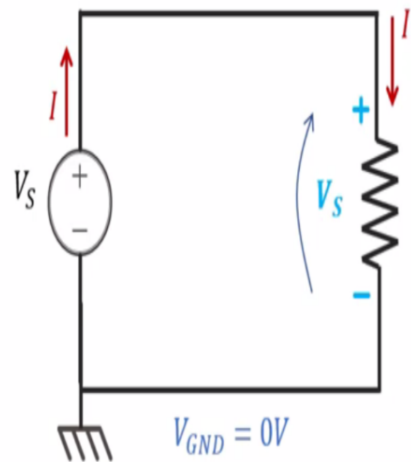
$$P_S = -V_S I$$

It is negative because voltage and current arrows are in the same direction.

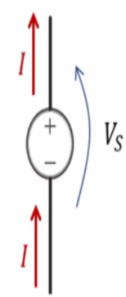
The total power in the circuit adds up to zero

$$P_R + P_S = 0$$

In some textbooks, the points of higher and lower voltage are indicated using a plus and a minus sign, as shown below. I am personally not a fan of this notation and would strongly encourage you to stick with arrows to indicate the polarity of the voltage.



Again assuming that we use conventional current, when it comes to a voltage source, voltage and current arrows must point in the same direction.



This is because the voltage source is internally doing work to keep the voltage difference between its positive and negative terminal constant. It can only achieve this by continually pushing positive charges from the negative terminal up to the positive one. The flow of charges though it (i.e. the current) must thus be directed from the point of lower to the point of higher potential.

We may use the same formula as before to calculate the power BUT, since the arrows are in the same direction now, we must add a negative sign!

$$P = -V_S I$$

Note that, by convention, the power produced by a source is negative.