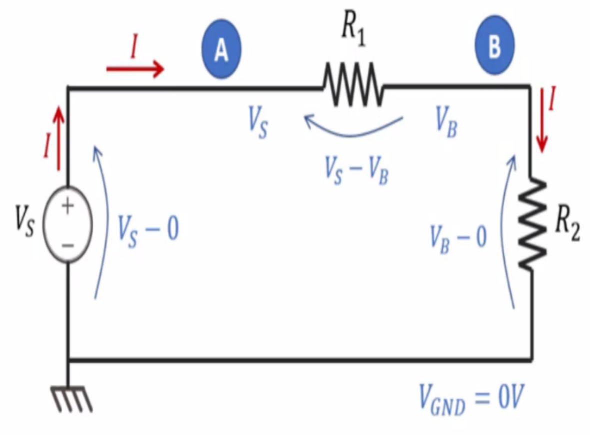
To indicate a voltage difference across a circuit element, we usually draw an arrow pointing to the point of higher potential, as shown.

Note that we use conventional current which is the rate of flow of positive charges.

Since, as they flow through a resistor, charges lose potential energy, the voltage at point B is lower then the voltage at point A. The voltage and current arrows will therefore point in opposite directions for every resistor.



When it comes to our power supply however, voltage and current arrows are in the same direction!

The concepts which underpin this difference are pivotal in circuits analysis and will be discussed in the next few slides.

Voltage, Current & Power in Electric Circuits (1)

When carrying out circuit analysis, it is essential to draw voltage and current arrows for each circuit element and do so in a sensible and consistent manner.

There are two main types of circuit elements that we may encounter:

- Passive elements (e.g. resistors, capacitors, inductors)
- Active elements (e.g. sources, transistors, amplifiers)

In the Linear Circuits unit, we will only be concerned with passive elements and a specific type active elements termed *sources*. Batteries and power supplies are example of DC voltage sources for instance.

In order to understand the difference between these two types of elements we must introduce the concepts of energy and power.

Voltage, Current & Power in Electric Circuits (2)

Elements like resistors, absorb energy. They take some of the potential energy of charges flowing through them and transform it into heat. An element that absorbs energy is termed a *passive element*.

Often in electric circuits we prefer to talk about energy per unit time which we term *power* (P).

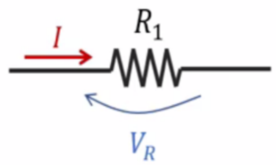
$$P = \frac{\Delta E}{\Delta t}$$

So we define passive elements as elements that absorb power.

Conversely we define sources as elements that are able to produce power (and supply it to passive elements).

Voltage, Current & Power in Electric Circuits (3)

If use conventional current, i.e. we assume that electric current is the flow of positive charges, then we have seen how the arrow representing the voltage drop across a resistor is in opposite direction to the current through it.



The power dissipated in the resistor may then simply be calculated as:

$$P = V_R I$$

Note that, by convention, the power absorbed or dissipated by an element is a positive quantity.