

Units in circuits

What is **Current**?

Current is a measure of electric flow rate. We measure it in Coulombs / Second or Amps. Think of a coulombs as buckets moving down a belt. In this example, current measures how fast our belt is moving, measured in buckets per second.

What is **Voltage**?

Voltage is a measure of electric potential. We measure it in Joules / Coulombs or Volts. In our previous example we can think of this as how much water is in each bucket. Where Joules would be our water and Coulombs would be the bucket.

What is a **Joule**?

A Joule is a unit of energy. Its the stuff we can use to do useful things.

Equivalent resistors:

When two resistors sit in **series** we can add up there resistances to get an equivalent resistor. This mean that if you measure at either end of both resistors you would get the same exact reading as with a single resistor with the summed resistances.

$$R_1 + R_2 = R_{\text{equiv}}$$

For resistors in **parallel** we need to use this formula:

$$1 / R_{\text{equiv}} = 1 / R_1 + 1 / R_2.$$

Why does this formula make sense?

It has to do with the path of least resistance. If we have multiple options we don't all need to crowd one resistors so we need to expend less effort to get to the other side.

Important equations

$V = IR \rightarrow$ **Ohms law**

This states Voltage in across a resistor is equal to the resistance of that resistor time the current passing through it.

This equation is extremely useful as we can also use it to get the current or resistance if we know the other two variables.

$$P = IV$$

Power output is equal to current times Voltage. Dimensional analysis shows this makes sense.

$$V = V * R_1 / R_{\text{total}} + V * R_2 / R_{\text{total}} \dots + V * R_n / R_{\text{total}} \rightarrow \text{Kirchoffs voltage law}$$

We can find the voltage differential across any resistor if we know the input current and the total resistance across our circuit. We can think of this like your mom giving you a hundred dollars to go shopping at the grocery store. The more “products” (resistors) there are the less of that money you are willing to spend on any individual good. Meanwhile the more expensive products are going to take more of your money than the cheaper ones.

$I_{\text{node}} = I_1 + I_2 + \dots + I_n = 0$, Where each I is the input to a $I_{\text{node}} \rightarrow$ **Kirchoffs current law**

This just means that all current that goes into a node must exactly match all current the leaves a node. Current is a conserved quantity. Draw diagram.

Electric components:

What is a **button**?

From a circuits perspective a button is just a switch. Lets look at how this looks on a diagram.

What is a **Diode**?

A Diode is a one way circuit. If current travels in one directions in behaves like a wire but in the other direction it acts like an infinite resistor.

What is a **potentiometer**?

A potentiometer or variable resistor is a clever device the allows use to vary it's resistance, lets look at a diagram to see how it works.

What is a **Photoresistor**?

A photoresistor is a special type of resistance that changes it strengths based on light exposure.