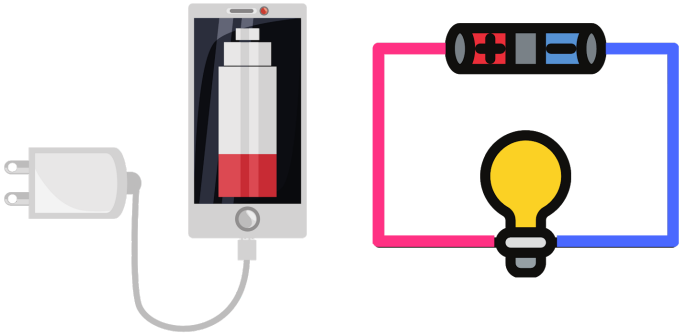
What's the science behind circuits?

What is a circuit?

A loop that ***electrons*** (electrical current) can travel through.

Examples of circuits:



The wires on these circuits are ***metal conductors*** (any material that allows an electrical current to flow through). If the wire was made of an ***insulator*** (any material that does NOT allow an electrical current to flow), then the lightbulb would not work.


Copper


Silver


Gold


Steel


Sea Water

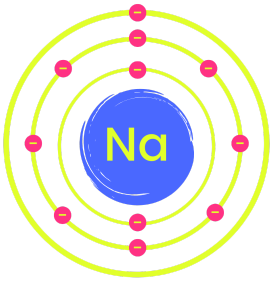
What do all of these electrical conductors have in common?

All the electrical conductors are either a ***metal*** or ***have a metal in them***! Sea water has a lot of salt (NaCl) which is made of the ions Sodium and Chloride. Sodium is an ***alkali metal*** and therefore the electrical energy can travel through it, making sea water an electrical conductor.

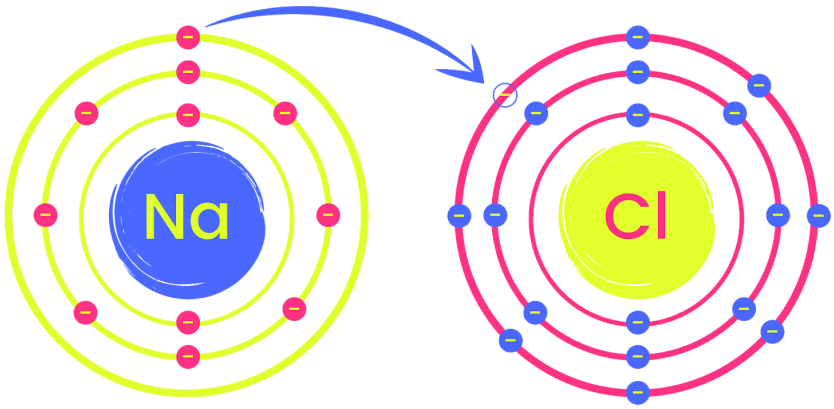
This is why you don't want to swim during a storm.
The water can act as a circuit to your body if a power source [lightning] hits.

Why are metals electrical conductors?

Metals usually have 1 to 3 electrons on the outside of the atom (these electrons are called valence electrons). The metal Sodium (Na) in salt has one **valence electron**.



Since metals have so few electrons in their outside shell, they can give away those electrons very easily. In salt, the Chloride ion takes the Sodium's 1 valence electron when they separate. Once this happens, the sodium (Na) becomes slightly ***positively charged***, and the chloride (Cl) becomes ***negatively charged***.



The battery in circuits also has a positively charged end and a negatively charged end. This is called ***polarity***. This is why the positive wire must be connected to the positive terminal, and the negative wire must be connected to the negative terminal.

The positive and negative charge of the salt allows the electrons of the battery to continue travelling through the salt, therefore making the salt dough conductive.

BIG IDEA:

Metals will make for good conductors while nonmetals will typically be good insulators.