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Electricity

Reviewed 2025

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Electricity

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Table of Contents


Hi, I’m Mike Rawn, and I will be your learning guide through this module!

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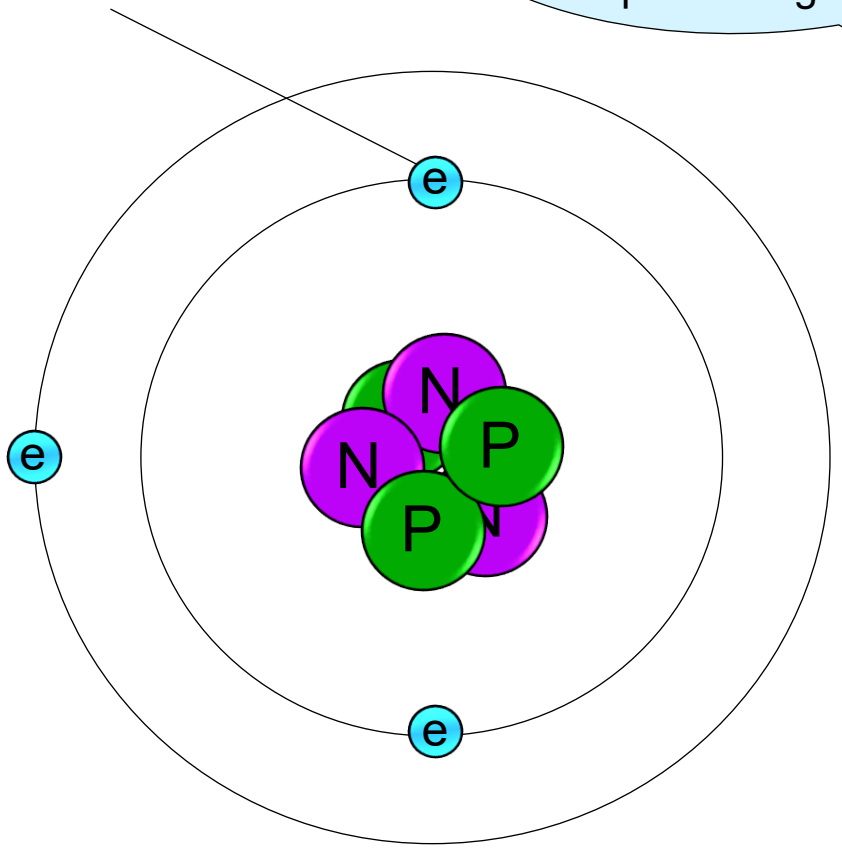
Electrons

Every single item in the whole world is made up of tiny, tiny things called atoms. Electrons are part of these tiny atoms, moving around the nucleus of the atom.

In this module, we will explore the key role electrons play in both static electricity and current electricity—the kind that powers light bulbs and electronic devices.



Static electricity

Static electricity is the build-up of electric charge on the surface of objects.

Static electricity usually happens when two different materials are rubbed together, causing electrons to move from one material to the other material. This movement creates the build-up of charge.

A static shock happens when that build-up of charge is suddenly released.

Fun Fact: Lightning is a giant spark of static electricity in the sky!

Have you ever been shocked?

That is the result of static electricity!

ESD (Electrostatic Discharge)

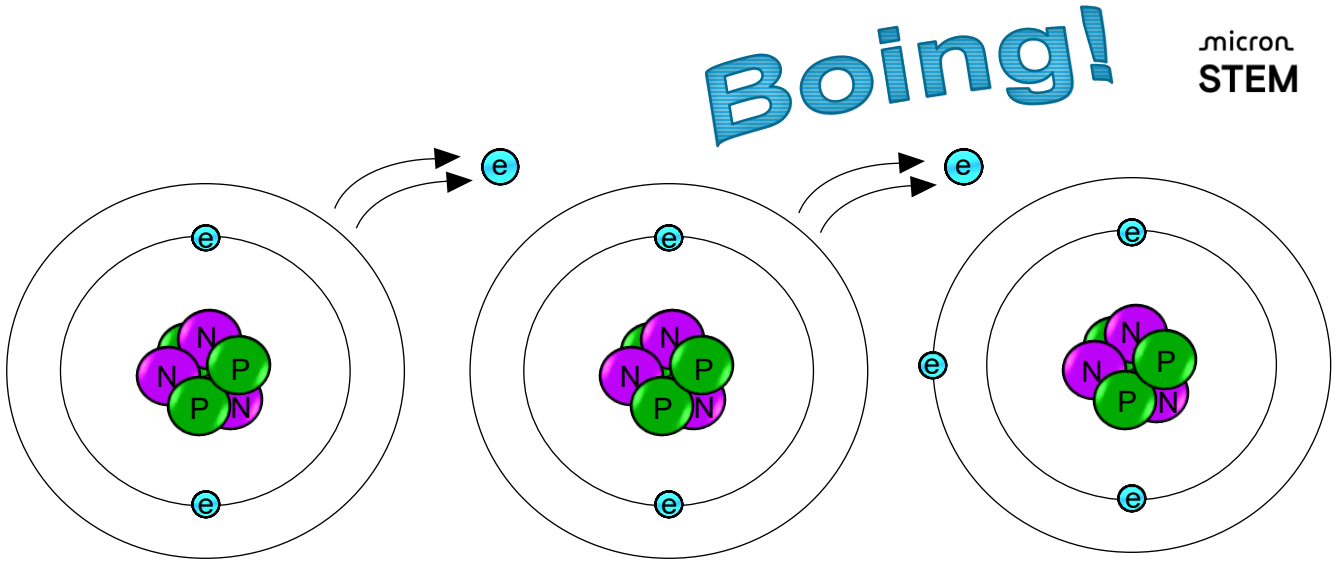
Think about a time when you walked across a carpet and then touched a metal doorknob. Did you feel a little shock? That's ESD! Here's how it works:

Building Up Charge: As you walk on the carpet, your body picks up extra tiny particles called electrons from the carpet. These electrons have a negative charge.

Releasing the Charge: When you touch the metal doorknob, the extra electrons on your body quickly jump to the doorknob. This sudden movement of electrons is what causes the shock you feel.

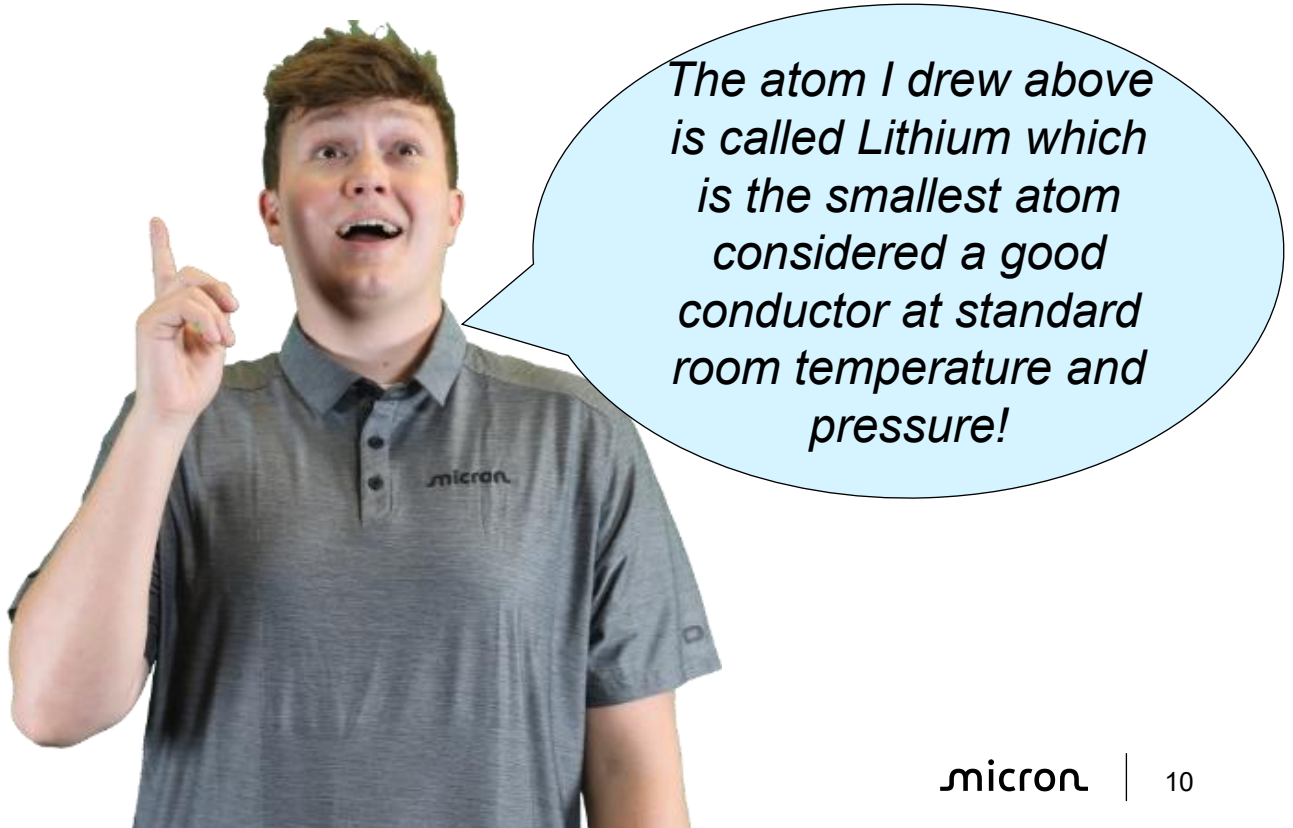
ESD can be harmful to electronic components. At Micron, people that work near memory chip fabrication must wear special suits that are designed to prevent the buildup and discharge of static electricity.

Electricity and electrons



Electrons have a negative charge

- Most electrons stay attached moving around the nucleus of their own atom, but in some special materials called conductors, some of their electrons can easily move from one atom to the next.
- As electrons move from one atom to another, they generate an **electric current**.
- **<u>Electricity</u> is the movement of <u>electrons</u>**



What items in your classroom use electricity?

Conductivity

What does it mean for a material to be conductive?

- It means that current runs through the material easily. The electrons in conductive materials are loosely bound.

Materials that conduct electricity are called *Conductors*

- What type of materials are good conductors?
  - Silver, copper, gold, aluminum, or other metals.

Materials that do not conduct electricity are called *Insulators*

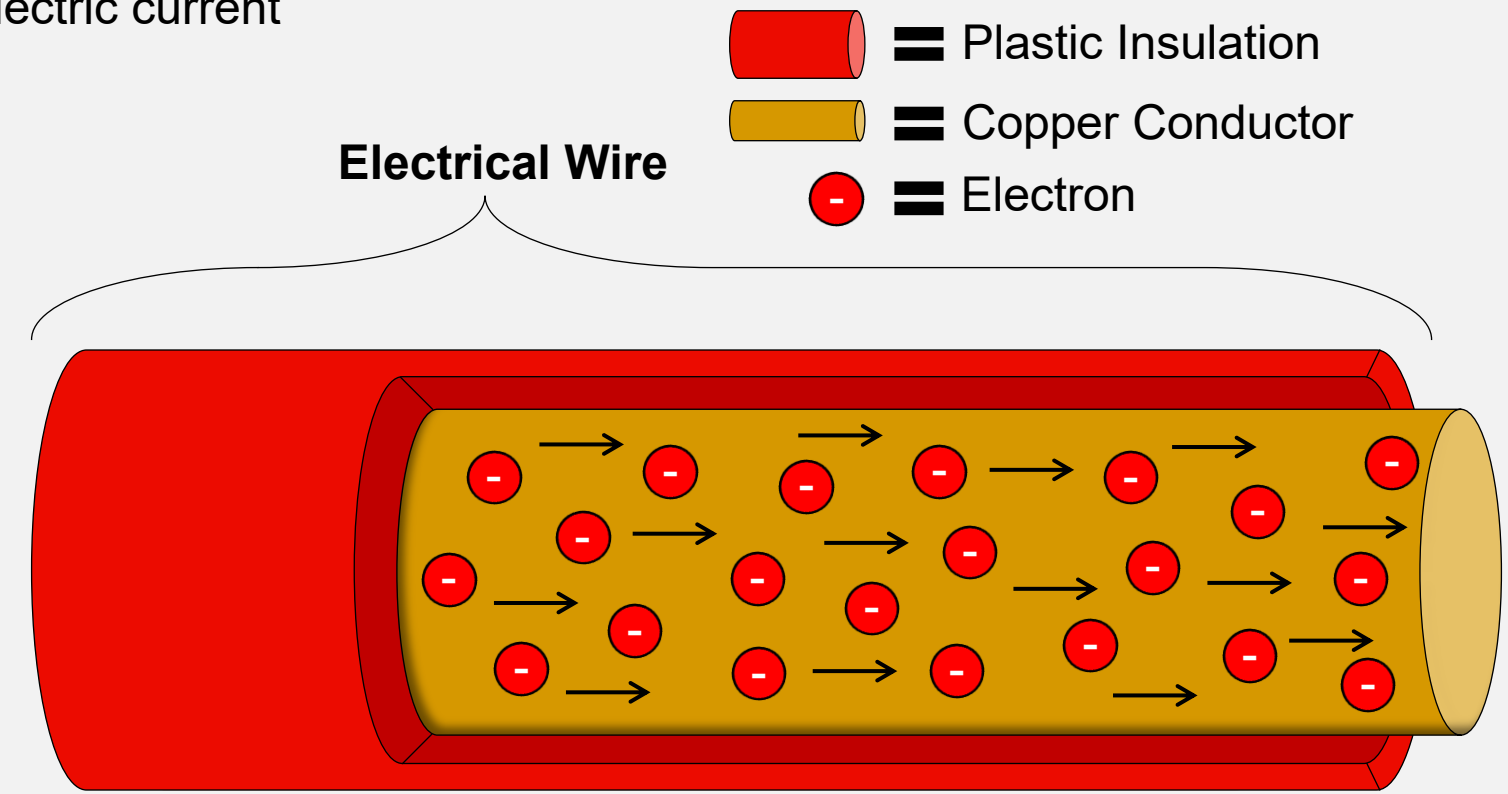
- The electrons in insulating material are tightly bound.
- What types of materials are good insulators?
  - Rubber, plastic, wood, paper, glass, and others

Current

What does the word *current* mean?

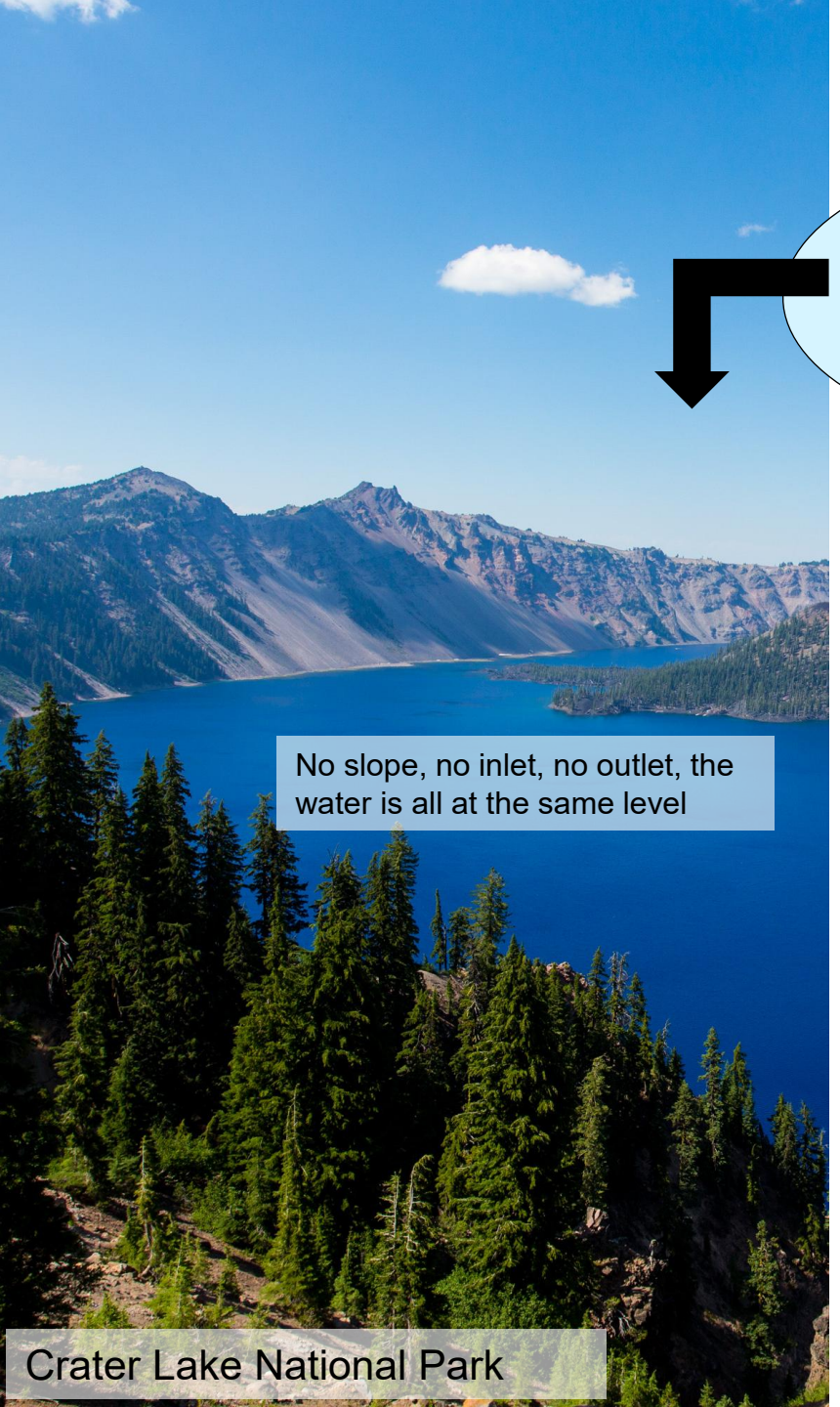
- A current is defined as something that flows.
- You have probably observed a current of water in a river or a stream.
- The flow of electrons through conductive material is known as an electric current.

Electric current



Water current

Water Current

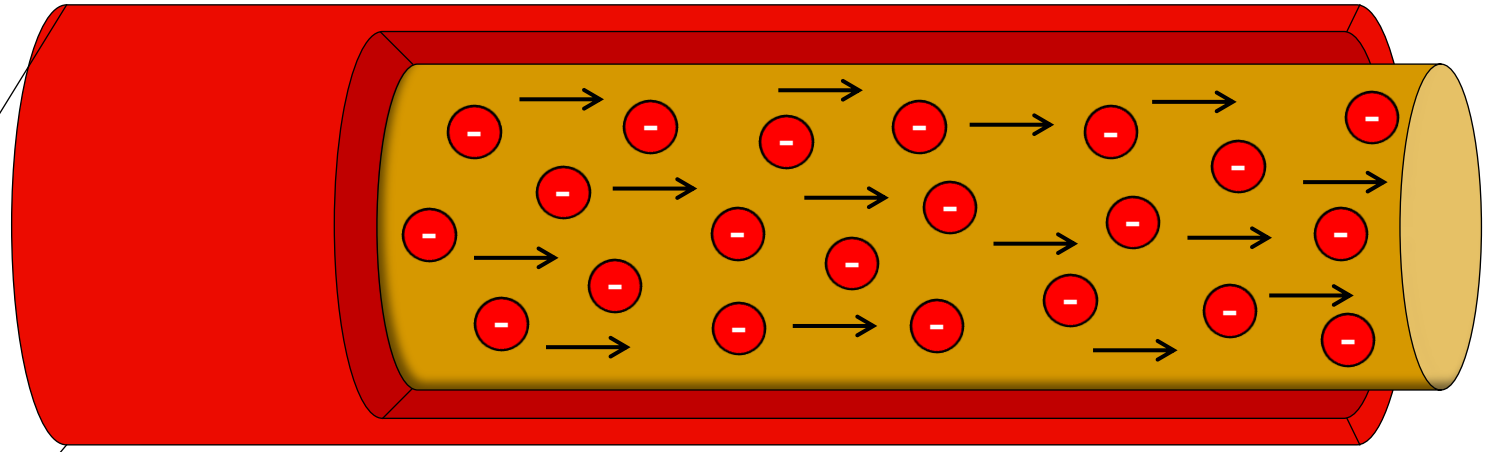


And why don't we see such water current in this lake?

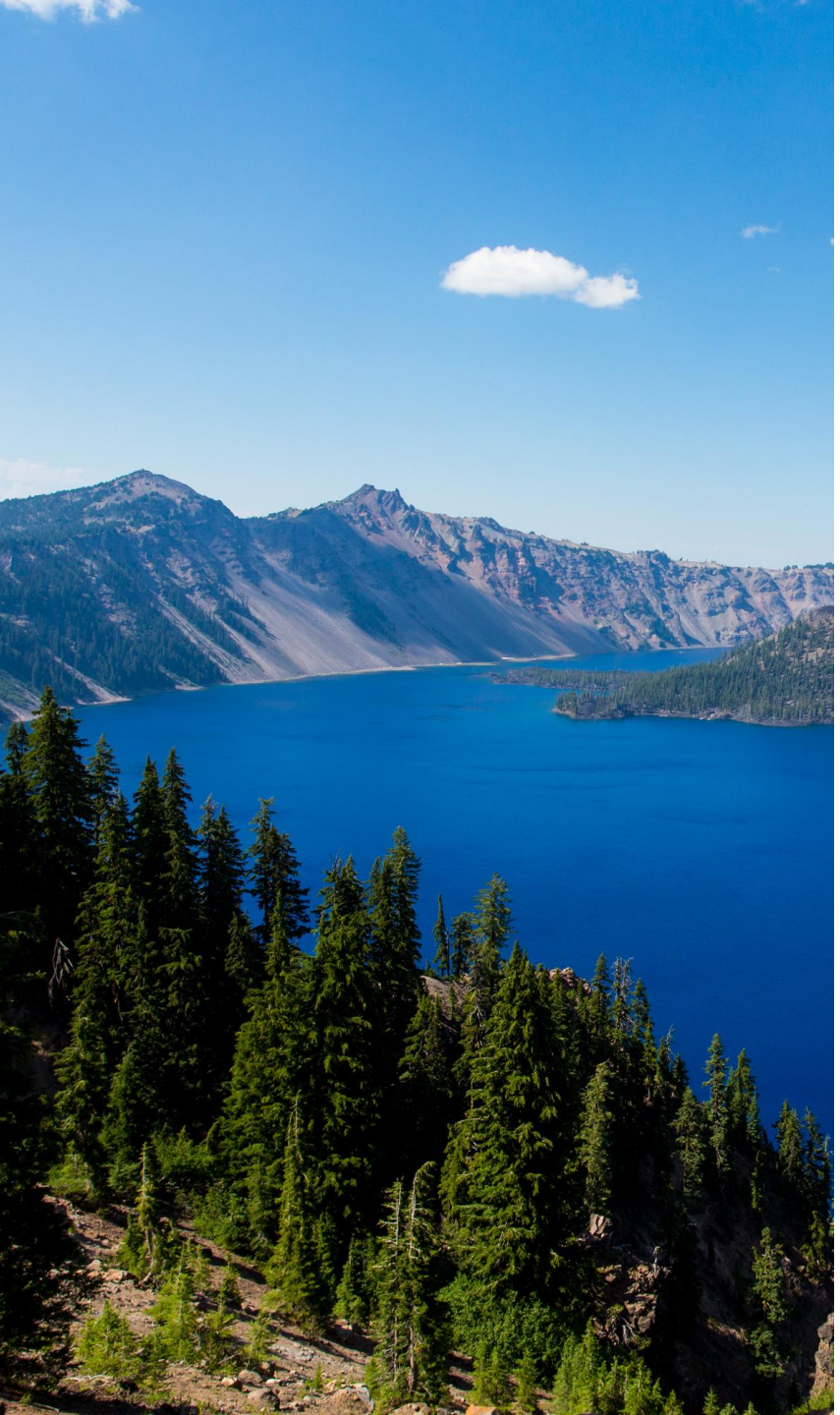
Why do we see water current in this river?

Water current flows in a river because upstream is at a higher elevation than downstream/there is a slope. Gravity pulls water downhill. Upstream, the water has higher **gravity potential** than downstream.

Electrical Wire

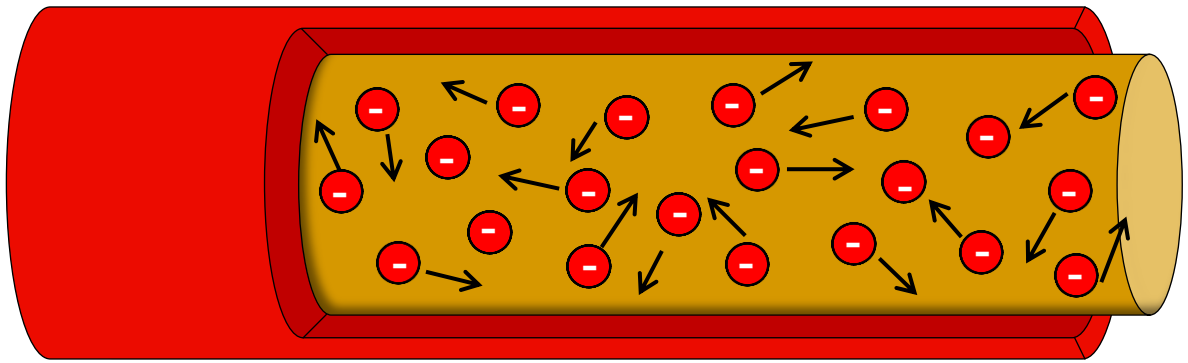


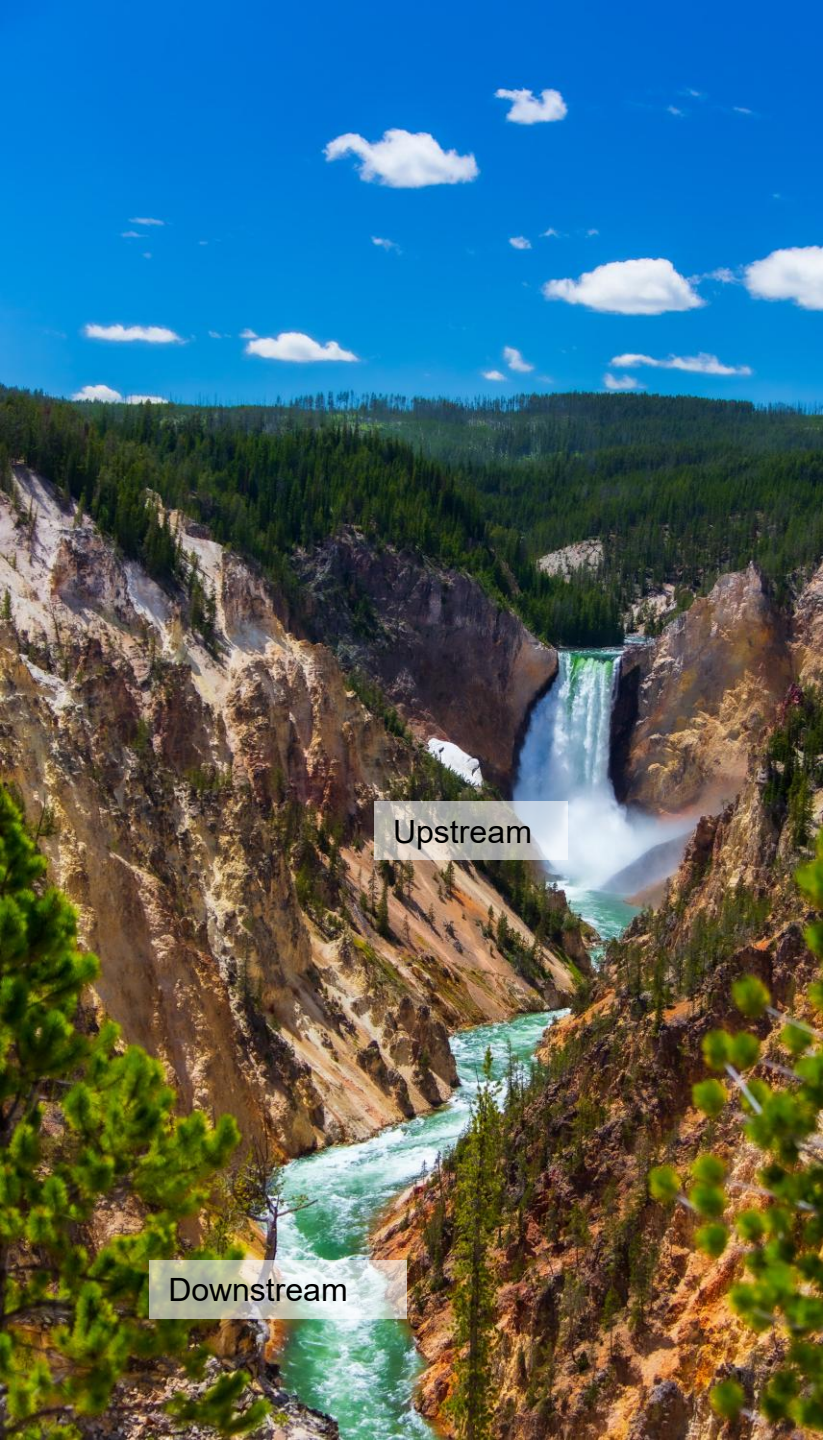
So, if water current flows because upstream is at a higher elevation than downstream... what makes electric current flow in conductors?



No current

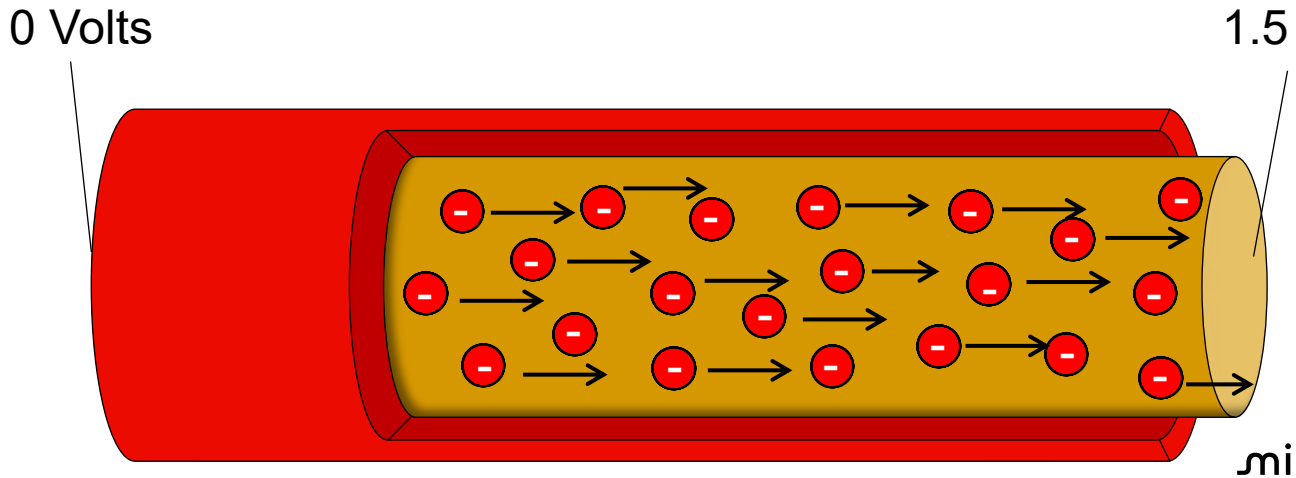
- Let's start talking about what happens when there is no noticeable current
- In the lake we don't see water current because there is no upstream at a higher gravity potential than downstream
- Similarly, when no potential is applied across a conductor, we see that the electrons move around randomly, but they don't flow in one particular direction - so no net electric current is produced



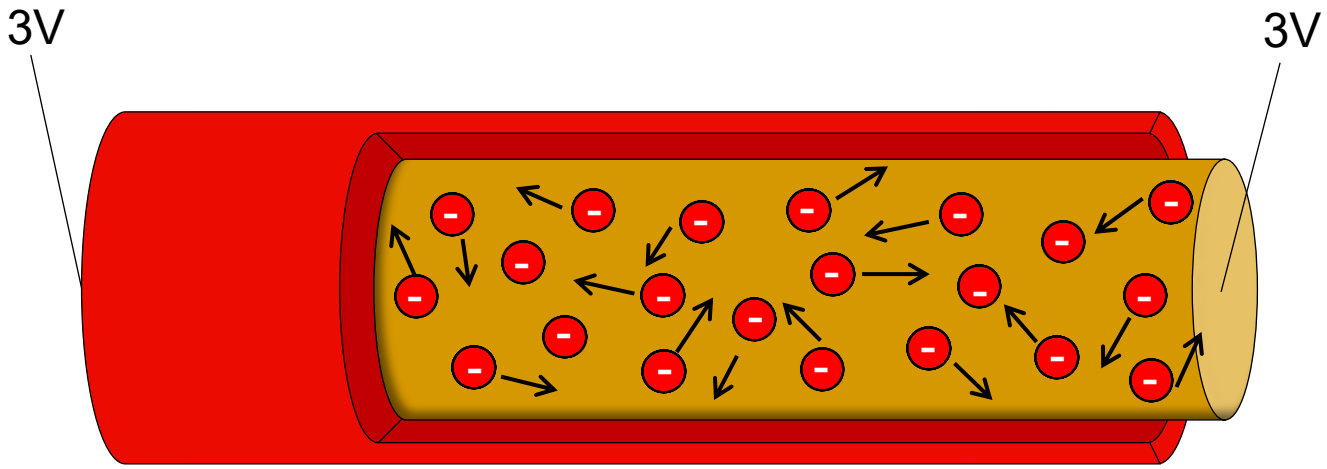


Current

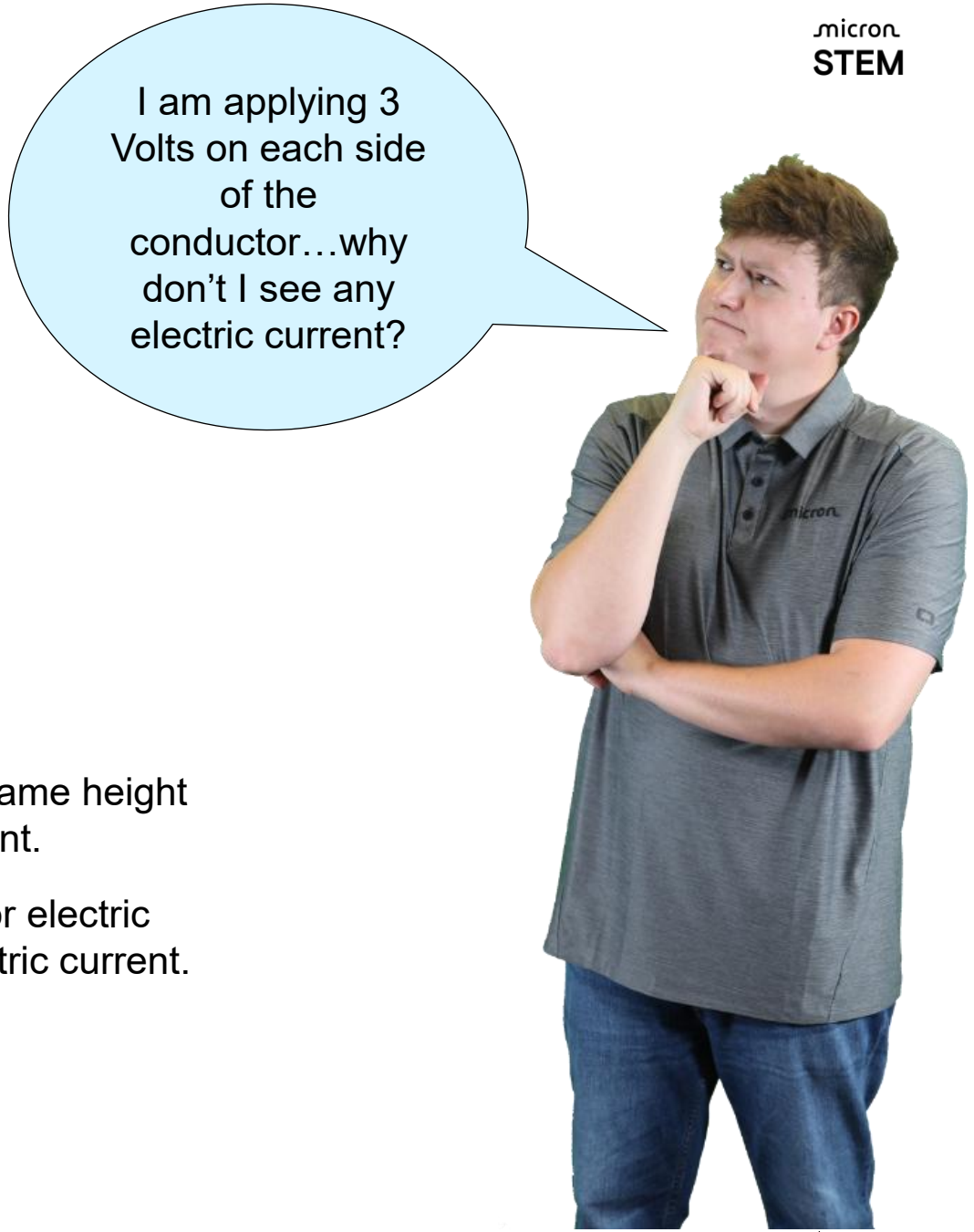
- In order to generate a net electric current in a conductor we need to apply a specific type of potential – different than the gravity potential needed to generate water current in a river.
- To generate electric current through a conductor we apply voltage.
- Voltage is the difference in **electrical potential** between two points, and it is measured in Volts (V).
- For example, we apply 0 V on one side of the conductor and 1.5 V on the other side. The voltage difference is what makes charges in a conductor move in the same direction. In the case of electrons, they will move towards the higher voltage.
- Electric current is the flow of electric charge through a conductor per unit of time. Electric current is commonly measured in Amperes (A) also referred as “amps”.



Voltage



- Remember the picture of Crater Lake: when the water is all at the same height (all at the same gravity potential), there is no noticeable water current.
- Similarly, if the two sides of the conductor are at the same voltage or electric potential, then there is no voltage difference, so there is no net electric current.



Activity Stations

- Static Electricity
- Lemon Battery
- Circuits

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