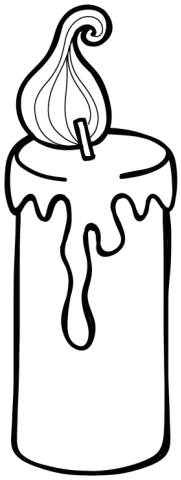
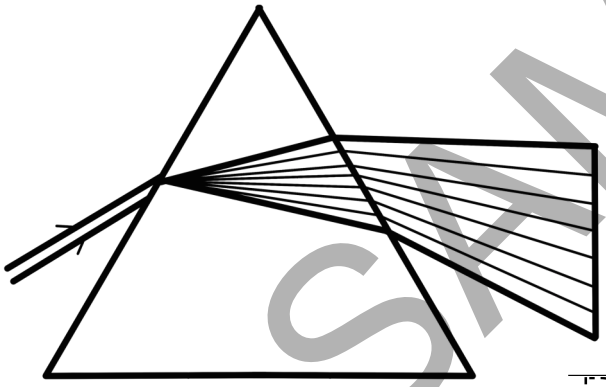
LIGHT

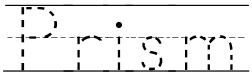


It would be impossible to have life as we know it without light. Light is one of the most basic types of energy. We see it when the sun is shining, when we turn on a lamp, or when we burn a candle. Plants use sunlight to make the food they need to grow. We also use it in ways we can't see, in machines like X-rays, microwaves, and radios.

Light travels through air, water, and even space. It moves in a straight line until something stops it. When an object stops it, it absorbs some of the light and bounces the rest back. Then that light travels until it hits something, and so on. When the light reaches our eyes, we can see. Light is made up of both waves and particles. We can learn about these waves when we study light as it goes through something called a **prism**.



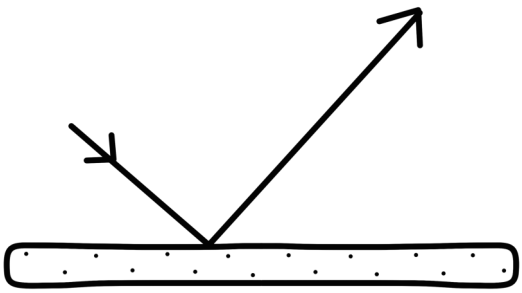
Even though light usually looks white, it's actually made up of light with different wavelengths, some long and some short. Each wavelength is a different color. When we shine light through a prism, the prism breaks it down into its different wavelengths, or colors.

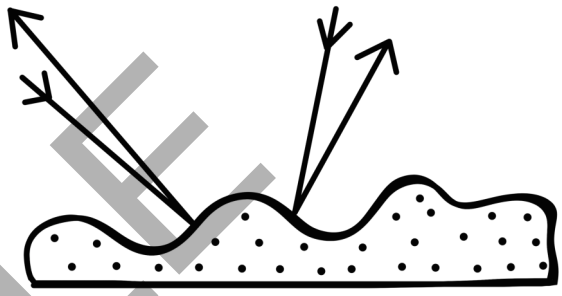


This is why objects have color. When light hits something we see as black, the object absorbs most of the colors of light and sends very little light back. When light hits a white object, it only absorbs a tiny bit of light and sends most of the light back to us. When we see a red object, like an apple, it's because the apple absorbed all the colors of light except the red wavelengths. It sends the red light back to us, so we see red. When an object bounces light back to us, we call it either reflection or refraction. Let's see what makes those two terms different.

REFLECT

When light hits an object, and the object scatters the light and bounces it back to us, it's called **reflection**. We can see that when light hits a smooth surface like a mirror or even when it hits a rough surface like a wall. The light hits it and is bounced straight back to us.

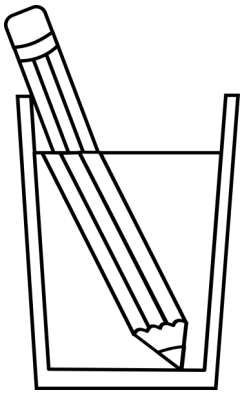




Reflection

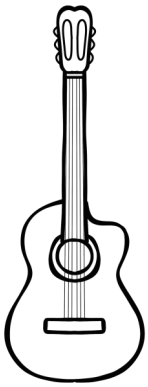
REFRACT

Sometimes, the light is bent before it bounces back to us. If you put a pencil in a cup of water, it looks like it is bent. It's not actually the pencil that is bent but the light. When the light moves from the air to the water, it changes speed and appears to bend. That is called **refraction**.



Refraction

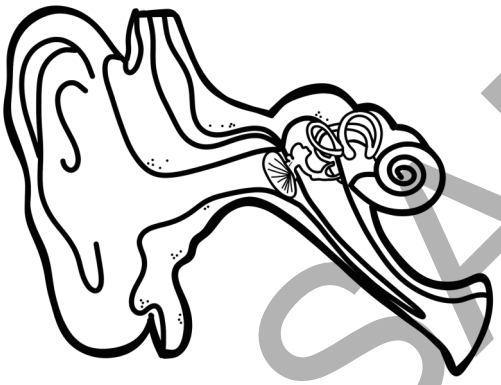
SOUND



Sound is a type of energy that comes from something that vibrates, or moves back and forth. If you pluck a string on a guitar, the string moves back and forth very quickly. The vibration of the string makes the air around it move. That movement is called **sound waves**.

We can't see sound waves, but you can imagine what they look like if you picture tossing a pebble into a pond. The pebble causes ripples of water to move out in all directions. Those ripples are a little bit like sound waves.

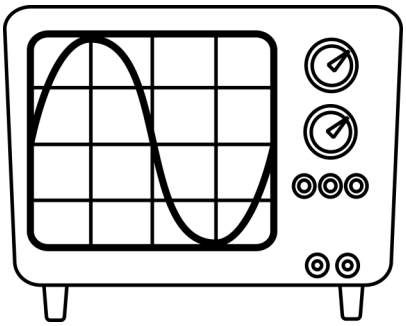
Unlike heat and light, sound has to have air in order to move. If you were somewhere without any air, like outer space, you could not hear sounds.



On earth, when sound waves reach our ears, they make our eardrums vibrate. This vibration is turned into signals our brains can understand, which allows us to hear what is going on around us.

Sound waves

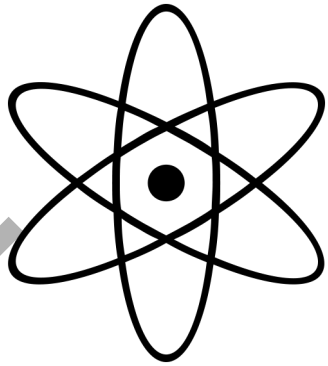
A sound wave has two parts, peaks and troughs. The peaks are the high points of the wave; the troughs are the low parts between the waves. How high or low those peaks and troughs are, and how fast or slow they move, determines a lot of things about what we hear.



ELECTRICITY

Electricity is another type of energy. To understand electricity, we need to understand a little bit about how it moves, and it starts with **atoms**.

Everything you can see in the world is made up of atoms. Atoms are far too tiny to see without a powerful microscope, but life couldn't exist without them. Even for as tiny as they are, atoms are made up of even smaller parts, one of which are **electrons**. Electrons surround the center of the atom, and they usually stay close to their atoms. But, sometimes they move from one atom to the next to the next. That movement is called an electric current.



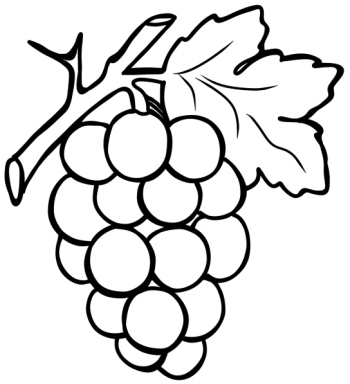
Atoms and electrons

If you've ever seen lightning, you've seen a LOT of electrons move from one place to another. They leave a cloud and hit the ground. Lightning generates a huge amount of energy, but since we don't know when or where lightning will strike, we can't harness it and put it to use. Today, people create electricity in many different ways by turning different forms of energy into electricity. Once electricity is created, we have to have a safe way to use it. Electricity can be very dangerous, so you should never experiment with electricity without an adult present.

Just like with thermal energy and heat, some materials allow electrons to move more easily from one atom to another than others. And, just like with thermal energy, these materials are called conductors and insulators. A copper wire allows electrons to move freely. Rubber does not. So when a copper wire is surrounded by rubber, the electrons can move through the wire but not jump off the wire and shock a person.

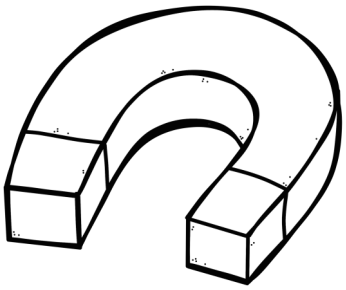
So now we know where electricity comes from—the electrons of atoms—and how it moves along a conductor. The next thing we need to see is how we direct an electric current so we control where the electricity goes and put it to work.

The last type of energy we're going to look at is chemical energy. Chemical energy is stored in the electrons of atoms and has to be converted into other types of energy we can use.



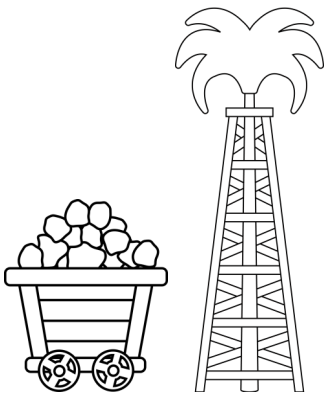
Your body does this every day. It breaks down the food you eat and releases chemical energy. Then your body converts that energy into what your body needs.

Your vehicle probably also uses chemical energy to get the power it needs to move. As a vehicle burns gasoline, the chemical energy is released and converted into the other types of energy your car needs to operate.

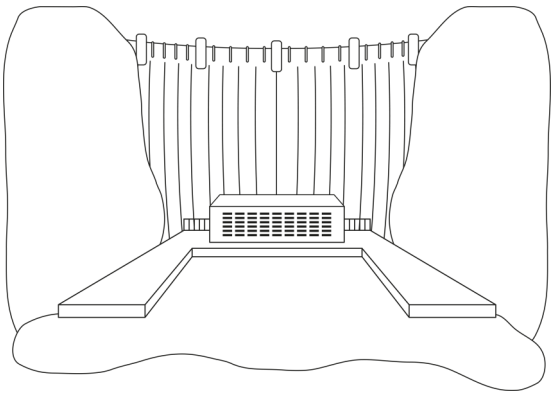


There are many different ways to generate electricity. We generate electricity using fossil fuels, water, sunlight, heat, wind, and by splitting apart atoms. Let's see some of the ways we convert different types of energy into electricity.

Fossil-fueled steam electric power **plants** generate most of the electric power in the world. These plants burn coal, oil, or natural gas, which produces heat. The heat turns water in a boiler to steam. The steam is superheated and driven through a huge turbine at high pressure. The turbine is a machine with wheels and blades like a fan. It turns a shaft, that turns part of a generator, which generates electricity.



Fossil-fueled plant



A **hydroelectric plant** also generates electricity by using a turbine to operate a generator that produces electricity, but instead of fossil fuels, a hydroelectric plant uses water stored behind a dam.

Hydroelectric plant