Transfer of Energy in Collision

Reflect

Energy can be moved from place to place by moving objects through sound, light, or electric currents. Most energy must have a medium through which to travel. The transfer of this energy changes the way objects behave, and it also transforms into new types of energy. Anywhere you have matter and atoms, you will find energy traveling. In fact, you use the flow of electricity to transform into other types of energy every day.

potential energy: the energy possessed by an object as a result of its position

When objects are sitting still, they have potential energy. Without a collision, the objects will not move. The collision of atoms can create light, sound, and heat. Some energy of motion changes to sound energy when one object strikes another. For example, my hand has kinetic energy that transfers to the matter in your front door when I knock on it. The force of my hand moves that energy into the door and the energy traveling through the door travels into the air on the other side. When that air is disturbed, a compression wave is created and we hear the sound traveling through the air as a knock. This is also the same basic idea that we use to cause sound to come from a speaker. Instead of my hand hitting the door, electricity moves the speaker membrane, causing vibrations that send compression waves that we hear as sound. Energy cannot be destroyed, so when the energy of an object is disturbed by a collision from the matter surrounding it, the energy must flow into other matter. The harder the collision, the louder the sound.

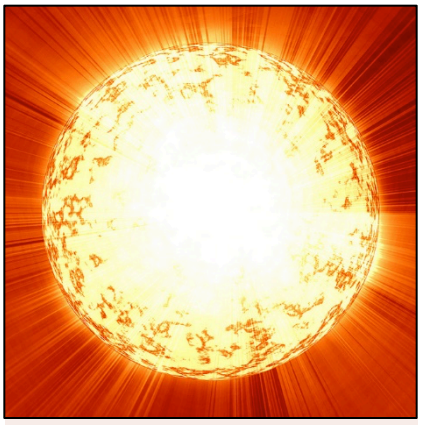
collision: a forceful impact when energy is transferred from one object to another

kinetic energy: the energy possessed by an object as a result of its motion

These electricity lines are carrying energy from one place to another.

In fact, energy transfer disrupts the matter around it so much that it can produce sound, even when that is not its purpose. Look at the picture of the electrical transmission lines to the right. They are carrying electricity between the power plant and a city. You may have noticed that when you are near them, you can hear a humming sound. That humming sound is caused by electricity moving through the lines and disturbing the air around the outside of the wires. If the electricity stops flowing through them, you will not hear the hum anymore.

Reflect

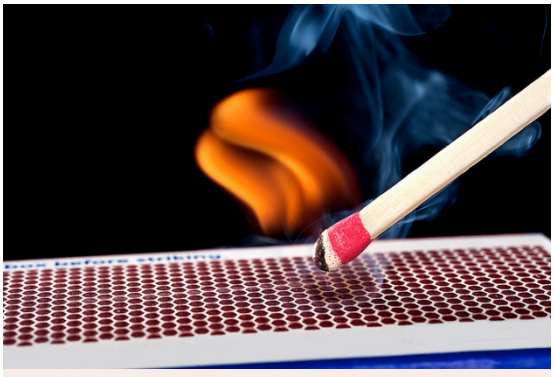


The Sun's energy travels to Earth in light waves.

Energy can be moved from place to place by light. You experience this energy movement when you grow plants in sunlight or when you lay out in the grass and get warm on a sunny day. The heat from the Sun is evidence that its energy is being transferred to our planet through those waves of energy. Energy can also move information in the form of light. We use fiber optic cables, buried in the ground, to transfer data signals to homes and businesses. Light travels in waves and does not disturb the air around it. Because the air is not disturbed when light travels through it, light does not cause sound waves.

Every fiber in the fiber optic cable carries pulses of light.

When objects are sitting still, they have potential energy. Without a collision, the objects will not move, and their energy will not change from potential to kinetic. The collision of moving matter into objects at rest will cause a transfer of energy between the two objects. The transfer of energy between two objects can transform into heat. Look at the picture of the matchstick (lower right). You will see rough bumps on the match box. The bumps provide a rough surface for the match to run across. Kinetic energy from moving the match transfers to the bumps and transforms into heat.

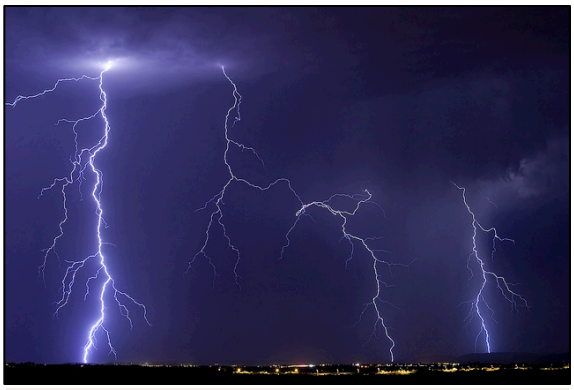


The rough bumps on the box are a source of friction for the matchstick.

The heat caused by friction ignites the substance on the match, and it results in an exothermic reaction. The heat is a byproduct of the energy transfer between the two. If you listen closely, you can hear the sound created by this transfer. You will also hear the sound when the match ignites.

What Do You Think?

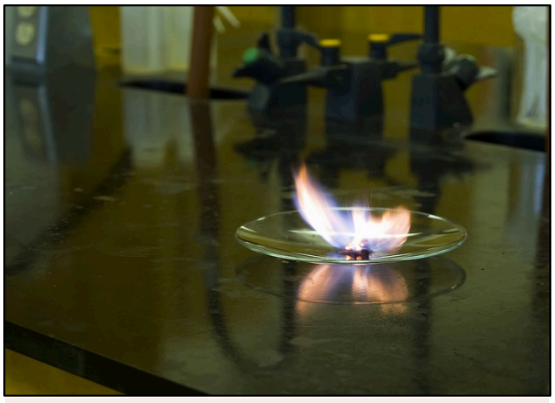
What is happening to all of the matter found in the sky during a thunderstorm? Lightning is a naturally occurring jolt of electricity that flows between clouds and the ground. This flow of energy (in the form of electricity) transforms into light that we can see for miles. Lightning also transforms into heat that can scorch the ground where it strikes. When lightning bolts crackle through the sky, they push air out of the way. When the air collapses back together in a collision, we hear thunder. The thunder you hear during a storm is caused by the lightning transferring energy to all of the air around it.



Lightning bolts light up the sky during a thunderstorm.

Look Out!

A beautiful fireworks show lights up the night sky.



An exothermic reaction is demonstrated in the laboratory.

exothermic: a chemical reaction that releases heat

The light, sound, and heat created from energy transfers can be beautiful. These energy transfers can also be very dangerous. When energy is transferred to some materials, an exothermic reaction occurs. Large amounts of heat and light can be released during exothermic reactions. Extremely large bursts of color and bright light from a fireworks show are examples of an exothermic reaction. Chemists create the different colors of light in a fireworks show by mixing different elements together. Lighting the fuse of a firework transfers thermal energy to the firework and starts the reaction. In addition to light and heat, sound occurs as this energy is released. Have you ever had to cover your ears at a fireworks show because the explosions were so loud?

Try Now

In the table below, take a moment to think about the energy transfer that is occurring. Then, decide if each one would transfer energy between two objects. Finally, decide if sound, light, or heat would be created in the energy transfer.

Your World Real-life energy transfers:	Energy Transfer What kind of energy is being transferred?	Sound, Light, Heat? Is sound, light, or heat produced?
The lights in your classroom are turned on.		
A fan's blade spins inside its case to move the air in the room.		
Beautiful rain falls during a thunderstorm.		
Marshmallows are being roasted over a campfire.		
A mirage appears on the open highway in front of your car in the summer.		

Connecting With Your Child

Energy Transfer at Home

This activity will help you explore the transfer of energy between objects with your child.

The materials you will need include a roll of aluminum foil, tape or glue, a ruler, a pizza box, and hot dogs. You may use any type of food that can be heated safely outside on a sunny day.

1. Cover the inside of the pizza box with aluminum foil. Tape or glue the foil in the box so that it does not fall during cooking. Make sure the shiniest side of the foil is facing into the box and not toward the cardboard.
2. Place the box in a very sunny spot outside and prop the lid open partially with the ruler.
3. Place the hot dogs on the foil inside the box and observe them as they cook in the solar oven.

How did the position of the box and its lid help to cook the food? The transfer of light and heat into the hot dogs cooked the food. Changing the location of the lid angle will help you reflect more sunlight onto the hot dogs. The more reflective surfaces you have, the more light will be radiated on to your food. Also, adding a heat-absorbing color to the outside of the box (such as black paper or paint) will create an even hotter solar oven. It is important to note that your solar oven will get hot, so you will need an oven mitt to safely handle a heated oven that has been in the sun for long periods of time.

Here are some questions to discuss with your child:
1. Which types of energy cooked the food?
2. What transformed into the heat the oven used?
3. Did sound occur in your oven? Why or why not?
4. How could we change our oven to cook other types of food?
5. How could we change our oven to be more efficient?