HOME SCIENCE TOOLS
THE GATEWAY TO DISCOVERY

Young Science Explorers
Science fun for 4 to 9-year-olds!

May 2009 – Thunderstorms

What causes those bright streaks of lightning and loud roars of thunder? Finding out what's going on in the sky to cause thunderstorms might help you enjoy them more!

Thunderstorm Science Projects

Project 1 – Air Currents

Have you ever heard that hot air rises? That's true! The moving of warm and cold air causes *currents*. Air currents are what cause different kinds of weather, like thunderstorms! We can't see the moving air, but do you think colored water might act the same way? Do this experiment to find out! **Make sure you have an adult help you with the hot water and the knife.**

What You Will Need:

- Large glass jar or beaker
- Small cup or beaker (it needs to fit inside the jar)
- Food coloring
- Knife
- Plastic wrap
- Rubber band
- Water
- Tongs
- An adult to help

What To Do:

1. Ask an adult to fill the small cup or beaker with very hot (almost boiling) water and add several drops of food coloring. Stretch the plastic wrap smoothly over the cup and seal it with the rubber band. (The plastic wrap will puff up--this is because the air above the water is heating up and expanding!)
2. Fill the jar almost full with cold water from the tap.
3. Use a pair of tongs to set the cup of hot water in the bottom of the jar.
4. Have an adult slice open the plastic wrap with the knife and watch what happens to the colored water!

What's Happening?

Air is made up of lots of tiny ***molecules***. As air heats up, its molecules start to move faster and farther apart from each other, making the air thinner and lighter. This closeness of molecules to each other is called *density*. Warm air is less dense than cold air. The warm air floats up through the cooler air, which is heavier and thicker, or more dense. Then, as the warm air rises it starts to cool off and its molecules move more slowly and closer together and it sinks again. This is called *convection*. When the air moves up and down, it forms *currents*.

The same thing happens in the jar of water. The hot water is less dense than the cold water surrounding it, so it rises to the top of the jar. What happens as the colored water gets to the top? It stays there for a little while and then moves back down towards the bottom of the jar as it cools down. The colored water starts to mix with the clear water as it cools.

Convection happens in the ***atmosphere*** - the layer of air in the sky above the ground. When convection currents happen in the atmosphere, big clouds are formed. Sometimes those clouds turn into thunderstorms. Then, when the warm air cools down again, it starts to sink and breaks up the thunderstorm.

Project 2 – Can You See Static Electricity?

Lightning makes a big streak of light across the sky. In this experiment, you can create a small spark of light that acts similar to lightning, and find out how lightning happens!

What You Will Need:

- Aluminum pie plate
- Piece of wool (you can use a wool scarf or sweater)
- Styrofoam plate
- Pencil with a good eraser
- Thumbtack

What To Do:

1. Set the pie plate upside down on the table and have an adult push the thumbtack through the center. Pick up the pie plate and turn it over. Push the eraser onto the point of the thumbtack.
2. Put the Styrofoam plate upside down on the table and rub the piece of wool back and forth over it very quickly for about a minute.
3. Using the pencil as a handle, pick up the pie plate and set it on top of the Styrofoam plate (the plate will stick to it!).
4. Touch the pie plate with one finger, making sure that you don't touch the pie plate or the Styrofoam plate to anything else until after you touch it.

What's Happening?

When you rubbed the wool over the Styrofoam plate, you created ***static electricity***. The Styrofoam plate became covered with negative charges when you rubbed it with the wool. The pie plate had a positive charge, so when you set it on top of the Styrofoam plate, some of the

negative charges from the Styrofoam plate were attracted to the positive charges on the pie plate, making the two plates stick together. Then, when you touched the pie plate with your finger, some more of the negative charges "jumped" from the pie plate to your finger because your finger had a positive charge that the negative charges were attracted to. The "jump" happened so fast that all you could see was a tiny spark of light. You probably also felt a small shock and heard a crackling sound. If you didn't see a spark, try doing the experiment again in a dark room (the spark still might be too small to see, though, so you may only be able to hear and feel the static electricity).

Static electricity is the same stuff that makes your hair stand up during a pillow fight or shocks your fingers when you touch a cold door handle. You might also be able to see sparks or hear crackles of static electricity on your bed covers at night. That is because some materials, like fleece or wool, collect static electricity, then the negative and positive charges between your blankets and sheets meet up and make tiny sparks and crackling sounds.

Static electricity is not quite like normal electricity. It can't flow by itself, so it sticks to an object until it can be transferred to something else, like from a pillow to your hair. Since negative and positive charges will always try to get closer to each other, static electricity can sometimes "jump" from one object to another and make a spark. Sometimes the spark will be too small to see, but you can almost always at least hear a crackle. Lightning happens in exactly the same way. Usually, a negative charge from a thundercloud is trying to find a positive charge to meet up with, and it will "jump" from the cloud towards a positive charge on the ground or in another part of the cloud. When it happens, instead of seeing a small spark, you see a big flash of lightning because the charges have more force (they are much stronger) than the static charges in this experiment.

Fun Facts

- Even though thunder is caused by lightning, you can always see lightning before you can hear thunder because light travels to your eyes faster than sound travels to your ears.
- Most thunderstorms stretch for a distance of about 15 miles and last for about 30 minutes.
- Thunder and lightning are most common during Spring and Summer, but they have been known to happen during snowstorms, too!
- A person who studies the weather is called a meteorologist.

Silly Science

- What did one lightning bolt say to the other lightning bolt? (Answer: You’re shocking!)
- What did the lightning bolt say to the old tree? (Answer: Hang on to your bark, this will be no ordinary spark!)

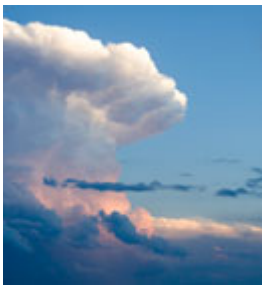
Way Cool Websites

- Check out these ways to stay safe during a thunderstorm.
- This map shows the number of thunderstorms that each part of the United States gets each year.

- You can watch videos of cumulonimbus thunderclouds forming here and here. (Note: these videos have been sped up, so the clouds move faster than they do when you see them in the sky.)

Teacher Tidbits

Thunderclouds



You have probably experienced thunderstorms before. They include a lot of rain, strong wind, really loud thunder, and bright strikes of lightning. How do all of those things happen? To understand how a thunderstorm is formed, it is important to know that *warm air rises* and *cool air falls*. Thunderstorms form when a section of cold air pushes a section of warm air up, or when a warm temperature on the ground (especially on a hot summer day) heats the air above it. The moisture in the warm air forms a cloud as it rises up and reaches the cooler air. The type of cloud that forms is called a **cumulus** cloud. Cold air enters the cloud from the sides and starts to move downward, but at the same time, the warm air keeps moving up and the cloud gets bigger and turns into a **cumulonimbus** cloud. Then, ice crystals form at the top of the cloud and start falling down through the cloud. The ice usually melts and starts to fall from the cloud as rain, or sometimes hail. Soon thunder and lightning start, too. After about 30 minutes, the cold drafts of air moving downwards pull the storm cloud apart and the rain, thunder, and lightning slow down and then stop completely after about an hour.

Thunder & Lightning

All things are made up of *matter* and matter is made up of tiny pieces called ***molecules***. Sometimes molecules cause objects to have electrical charges. Some things have negative charges and some have positive charges. You may remember from learning about magnets that opposite charges (a positive and a negative) are attracted to each other and like charges (two positives or two negatives) repel, or try to get away from each other. It is the same for electrical charges. When you run across carpet, then touch a doorknob, your hand might get a little shock. That was static electricity, which can also make your hair stand on end, or a balloon stick to the wall. This happens because the positive charges of one object attract the negative charges of the other.

Lightning also happens because of static electrical charges. In a thundercloud, there are lots of positive and negative charges. Most of the positive charges are at the top of the cloud and the negative ones are at the bottom. The ground has a positive charge, so the negative charges in the cloud and the positive charges on the ground are attracted to each other and pull towards each other. (Sometimes charges are attracted to other charges in other parts of the cloud instead of the ground.) When they get close enough, they will meet somewhere between the cloud and the ground and cause a flash of light, called lightning. That bright flash of light that you see, although it lasts less than a second, has a lot of electrical charge! Lightning makes a crooked path, moving away from things that block its way through the sky, like wind or rain. Sometimes charges are also attracted to other electrical charges in other parts of the clouds or else on the ground. The strong electrical charge that is

in a bolt of lightning causes a shock that can hurt humans and animals and damage objects like trees and buildings when it strikes.

Thunder is a result of lightning. The lightning super-heats the molecules in the air around it and makes them expand, or move apart from each other. This causes vibrations that are the sounds we hear. Even though the sound of thunder begins with the lightning, we see the lightning before we hear the thunder because it takes longer for sound to travel than for light. So the light reaches our eyes before the sound goes to our ears.

More About Storms

Thunderstorms can be very dangerous because of lightning and strong wind. You should always seek shelter right away if you think a storm is coming; don't wait until it starts raining or you see lightning or hear thunder. Those things mean the storm has already started and it is dangerous to be outside. The best place to be is indoors, but if you cannot be inside a house or building, a car is the next safest place. Severe thunderstorms can easily destroy things because of the pouring rain, lightning, and very strong winds. They can also turn into tornadoes if the conditions are right. Tornadoes are like severe thunderstorms, but even more dangerous because they move very quickly and strike small areas, which means all of the power of the tornado hits in one smaller area instead of being spread out. They easily destroy buildings, trees, cars, and more.

Another type of storm is a hurricane. Hurricanes are formed a little differently than thunderstorms. They usually form over oceans and move towards land, bringing very strong wind, lots of heavy rain, and huge waves that quickly cause flooding. Hurricanes can cause a lot of damage and often destroy towns and cities that are along the coast of an ocean.

Ice storms, blizzards, and gales are other types of storms that are all caused by warm and cool air moving around in the ***atmosphere***.

Science Words

Molecules – very tiny pieces that all things are made up of. Molecules can have negative or positive charges.

Atmosphere – the layer of air that surrounds the Earth. This is where changes in the weather happen.

Static Electricity – when negative and positive charges build up and then jump toward each other (because opposite charges are attracted). When you run across carpet, then touch a doorknob, your hand might get a little shock. That was static electricity. It can also make your hair stand on end, or a balloon stick to a wall.

Printable Worksheet

Use the worksheet below to help kids visualize what happens when lightning strikes. Remind them that it can strike from the cloud to the ground or an object on the ground, to other clouds, or even other parts of the cloud. Use the plus and minus signs to reinforce that opposite charges attract to form lightning.

Draw bolts of lightning from the thundercloud to the objects on the ground, to the other clouds, or to other parts of the thundercloud. Color the page.

(Hint: remember that opposite charges attract to make lightning strike!)