**Science Explorers Fall 2017**

**Week 2 - The Science of Storms**

**Goal:**

Students will learn about the science phenomenon that cause storms to occur, specifically how thunderstorms are formed, how lightning occurs and why/when rain falls.

**Introduction:**

Use video to introduce the main science concepts we will be exploring today - convection, electricity, evaporation, condensation, precipitation

<https://www.youtube.com/watch?v=XkP3MAMvfxE> - How do thunderstorms form?

<https://www.youtube.com/watch?v=h-0gNl5f4BU> - The science of lightning

**Activity 1 - Thunderstorm activity (Convection)**

***When warm and cold air masses meet, a thunderstorm can grow***

*Source:* [*https://www.earthsciweek.org/classroom-activities/make-thunderstorm*](https://www.earthsciweek.org/classroom-activities/make-thunderstorm)

**Materials (per group)**

* One clear plastic container, shoebox size
* Red food coloring
* Ice cubes made with water dyed with blue food coloring

**Instructions**

1. Fill container ⅔ full with room temperature water.
2. Let the water sit for 30 seconds until completely still.
3. Place a blue ice cube at one end of the plastic container.
4. Add two drops of red food coloring to the water at the opposite end of the plastic container. Be careful not to disturb the water.
5. Observe where the red and blue food coloring goes.

**Discussion**

1. Where did the red go? What temperature of air mass does the red represent?
2. Where did the blue go? What temperature of air mass does the blue represent?
3. What is convection? How does this experiment show is the meaning of convection?

It's all about convection! The cold water sinks while the warmer red water rises, or stays higher than the blue. Convection is the action of warm air rising and cold air sinking. You probably guessed that the blue water represents a cold air mass and the red water represents the warm, unstable air mass. A thunderstorm is caused by unstable air and convection plays an important part. A body of warm air is forced to rise by an approaching cold front. Other things can cause warm air to rise, like a mountain slope.

A strong updraft of warm moist air is formed and lifted by the approaching cold front. Speeds in an updraft can be as fast as 90 miles per hour! The air cools as it rises, condenses, and forms cumulus clouds. When condensation occurs, heat is released and helps the thunderstorm grow.

At some point, condensation high in the cloud (now in the form of water droplets and ice) falls to the ground as rain. A cold downdraft forms as the rain falls.

**Activity 2- Rain in a Jar (Evaporation and Condensation)**

***Rain forms when warm, moist air moves upwards to colder temperatures, condenses and forms clouds.***

*Source:* [*http://www.weatherwizkids.com/experiments-make-rain.htm*](http://www.weatherwizkids.com/experiments-make-rain.htm)

**Materials**

* Glass jar
* Plate (Styrofoam plate)
* Hot water
* Ice cubes

**Instructions**

1. Pour about two inches of very hot water into the glass jar (college students should do this part).
2. Cover the jar with the plate and wait a few minutes before the next step (about 3 minutes).
3. Put the ice cubes on the plate.
4. Observe what happens in the jar.

**Discussion**

1. What did you see after the ice was placed on the plate? What do you think is happening to the water in the jar?
2. What do you think caused the water to drip back down from the top like it did?

The cold plate causes the moisture in the warm air, which is inside the jar to condense and form water droplets. This is the same thing that happens in the atmosphere. Warm, moist air rises and meets colder air high in the atmosphere. The water vapor condenses and forms clouds. When the clouds become saturated and cannot hold any more water, precipitation forms and falls to the ground. Briefly explain that evaporation is the conversion of water to moist air due to high temperatures.

**Activity 3 - Lightning activity (Static Electricity)**

***Lightning is formed by the attraction between negative charges in the air and positive charges in the ground, which is called static electricity.***

*Source:* [*https://www.earthsciweek.org/classroom-activities/lightning*](https://www.earthsciweek.org/classroom-activities/lightning)

*NOTE: This activity may not work very well if the room is not dark.*

**Materials (per group)**

* Foam plate
* Thumbtack
* Pencil with new eraser
* Aluminum pie pan
* Small piece of wool fabric



**Instructions**

1. Push the thumbtack through the center of the aluminum pie pan from the bottom.
2. Push the eraser end of the pencil into the thumbtack (the pencil acts as a handle to lift the pan).
3. Put the foam plate upside down on a table. Rub the underside of the plate with the wool for one minute (rub hard and fast).
4. Pick up the pie pan using the pencil “handle” and place on top of the upside-down plate.
5. Touch the pie pan with your finger. If you feel anything when you touched the pan, try rubbing the plate again.
6. Try turning the lights out before touching the pan. Do you see anything when you touch the pan?

**Discussion**

1. What happened when you touched the metal pie pan? What caused that to happen? Did you see anything when you touched the pan?
2. Do you think this is how lightning is really formed?
3. What about thunder? We usually hear thunder when we see lightning. What causes thunder then?

It's all about static electricity! Lightning happens when the negative charges (electrons) in the bottom of the cloud (and your finger) are attracted to the positive charges (protons) in the ground (and the pie pan). The resulting spark is like a mini bolt of lightning.

The accumulation of electric charges has to be great enough to overcome the insulating properties of air. When this happens, a stream of negative charges pours down towards a high point where positive charges have clustered due to the pull of the thunderhead.

The connection is made and the protons rush up to meet the electrons. It is at that point that we see lightning and hear thunder. A bolt of lightning heats the air along its path causing it to expand rapidly. Thunder is the sound caused by rapidly expanding air.

**Conclusion:**

Have kids complete the worksheet provided that reviews the science concepts learned and how it relates to weather.