

Wonderful Weather

Category: Earth Science, Meteorology

Type: Class Experiment (30 min)

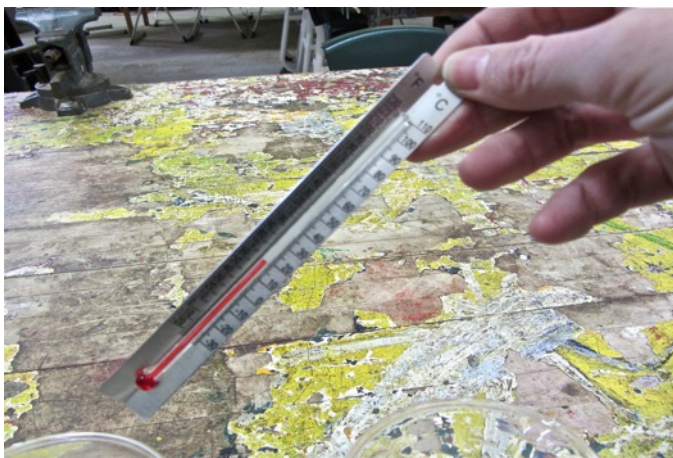
Materials:

2	Glass jars
1	Thermometer
1	Small foil tray
1	Handful of ice
4	Bottles with matching mouths
	Red food dye
	Blue food dye
1	Hot plate
1	Saucepan
	Water



Video: <http://youtu.be/Ofzgatg17Lg>

How To:



Experiment 1. Measuring Temperature:
Take a thermometer and using the °F side,
measure the temperature in the room.



Fill a jar with ice cold water, place the
thermometer in the water and watch how the red
line moves. Record the temperature.



Fill a second jar with hot water. Place the thermometer in the jar and record the temperature.



Experiment 2. Making Rain: Fill a glass jar About 1/3 full with boiling hot water.



Place the foil tray on top of the jar. The hot water represents the ocean or lake being heated by the sun.



Fill the tray with ice. This represents a cloud in the sky. Leave the tray sitting in the jar for approximately 5 minutes.



Lift the tray out of the water and look at the bottom of the tray. Shake it to make it rain!



Experiment 3. Convection: Place a drop or two of blue food dye in two bottles. Fill with hot water. Fill two more bottles with red food dye and hot water.



Place one blue bottle on a plastic tray.



Quickly flip over the red bottle and place it sitting in the blue bottle. Use a bit of paper to cover the mouth as you flip it over, then yank it out again so the two colors of water come together. What happens to the different colored waters?



Next, place the other red bottle on the bottom and quickly place the other blue bottle on top.



What happened this time?

Fine Points:

- For the foil trays you can buy a foil muffin tray and cut out the individual dishes. Hot glue the sharp edges.
- Be careful when experimenting with the glasses that contain boiling water!
- For the convection experiment medium hot water works fine and is safer. Also, if the water is too hot it will melt the plastic bottles.
- For young kids, have an adult help when placing the red “hot” bottle into the blue “cold” bottle.

Objectives:

During this activity students will:

1. Learn to measure and record temperature.
2. Understand the different stages in the water cycle.

3. Understand how air moves.

Concepts Involved:

- Changes in temperature can be measured.
- The water cycle involves evaporation, condensation, precipitation and collection.
- Convection is a hot fluid moving upward in a cooler fluid.
- The movement by convection of hot and cold air creates wind.

Focus Questions:

1. What do you think are clouds made of?
2. Where do you think rain comes from?
3. What do you think makes the wind blow?

Elaboration:

Measuring temperature: Temperature is an important quantity to measure. Temperature gives information as to how much heat energy is present in a certain place at a certain time. Thermometers are used to measure temperature. If you look around at home you will see different ways that thermometers are used. The thermometer in the oven measures the temperature inside it so you don't burn your cookies, and if you have ever been sick a thermometer may have been used to check your temperature.

The most common type of thermometers and the one used in schools are bulb thermometers. The basic concept at work in a thermometer is that most materials take up more space and expand as they are heated. This means that we can use the amount of their expansion to measure a difference in temperature. Mercury used to be the material of choice but due to its toxic nature has been replaced with a dyed red alcohol (ethanol.) If you examine a thermometer you can see that it is made of glass, with a small hollow bulb at one end and a thin capillary opening running through the length of its center. This capillary is so thin that even subtle shifts in the overall volume of ethanol, due to temperature changes, produce a noticeable movement of surface of the liquid in the thermometer.

Making rain: This experiment focuses on the water cycle, which is the continuous movement of water on Earth. There are various stages of the water cycle; four main ones are evaporation, condensation, precipitation and collection. Evaporation is when the water in rivers, lakes, oceans and even puddles turns from the liquid state to the gas or vapor state. Evaporation happens faster with heat and radiation from the sun, but it will happen at any temperature. When water liquid turns into water vapor it goes in to the air. You can't see water vapor, but you can feel it sometimes as humidity, or dampness in the air.

Condensation is the process of water vapor in the air getting cold and turning back into a liquid. Water condenses into tiny droplets on tiny specks of dust and smoke present in the atmosphere. These droplets form clouds. Precipitation happens when the water droplets in clouds are too big to stay floating in the atmosphere, so they begin to fall. This water falls back to earth as rain, sleet, hail or snow. The water that falls collects on earth in rivers, lakes and oceans, or soaks into the ground to form ground water.

Water on the surface evaporates back in to the sky again and the cycle continues. In the experiment above, the warm water in the glass represents a lake or ocean heated by the sun. The hotter the water is and the more direct sun it receives, the faster it can evaporate. (Naturally, most lakes and oceans are not that hot, but we wanted the experiment to work quickly!) The foil tray with ice represents cold air, as

the steam from the warm water rises it hits the cold foil and condenses. When enough water has condensed on the tray it can be lifted and shaken to make rain.

Convection experiment: This is designed to look at how air moves. Air moves in a manner similar to water so water is used in the model. In the first part of this experiment when the hot water was placed on top of the cold water, the colors did not mix and stayed in their respective bottles. In the second part the hot water was placed on the bottom and the cold on top, the hot water moved up and the cold water moved down, and the colors mixed. This shows that air is affected by changes in temperature, and that warm air moves up and cold air moves down. When one area of air heats up more than another area that is next to it, the difference in temperature creates wind. The warm air rises and cool air moves in to replace it. This movement of air is called wind.

Links to k-12 CA Content Standards:

Grades k-8 Standard Set Investigation and Experimentation:

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

Grades k-12 Mathematical Reasoning:

1.0 Students make decisions about how to approach problems:

1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.

1.2 Determine when and how to break a problem into simpler parts.

2.0 Students use strategies, skills, and concepts in finding solutions:

1.1 Use estimation to verify the reasonableness of calculated results.

1.2.2 Apply strategies and results from simpler problems to more complex problems.

1.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

3.0 Students move beyond a particular problem by generalizing to other situations:

3.1 Evaluate the reasonableness of the solution in the context of the original situation.

3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.

3.3 Develop generalizations of the results obtained and apply them in other circumstances.

Grade Kindergarten Standard Set 3. Earth Sciences

Earth is composed of land, air, and water. As a basis for understanding this concept:

3.a. Students know characteristics of mountains, rivers, oceans, valleys, deserts, and local landforms.

3.b. Students know changes in weather occur from day to day and across seasons, affecting Earth and its inhabitants.

Grade 1 Standard Set 3. Earth Sciences.

Weather can be observed, measured, and described. As a basis for understanding this concept:

3.a. Students know how to use simple tools (e.g., thermometer, wind vane) to measure weather conditions and record changes from day to day and across the seasons.

- 3.b. Students know that the weather changes from day to day but that trends in temperature or of rain (or snow) tend to be predictable during a season.
- 3.c. Students know the sun warms the land, air, and water.

Grade 5 Standard Set 3. Earth Sciences

Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept:

- 3.a. Students know most of Earth's water is present as salt water in the oceans, which cover most of Earth's surface.
- 3.b. Students know when liquid water evaporates, it turns into water vapor in the air and can reappear as a liquid when cooled or as a solid if cooled below the freezing point of water.
- 3.c. Students know water vapor in the air moves from one place to another and can form fog or clouds, which are tiny droplets of water or ice, and can fall to Earth as rain, hail, sleet, or snow.

Grade 5 Standard Set 4. Earth Sciences

Energy from the Sun heats Earth unevenly, causing air movements that result in changing weather patterns. As a basis for understanding this concept:

- 4.a. Students know uneven heating of Earth causes air movements (convection currents).
- 4.b. Students know the influence that the ocean has on the weather and the role that the water cycle plays in weather patterns.
- 4.c. Students know the causes and effects of different types of severe weather.