

RISING AIR



Related Subject: Climate and Weather

Group Size: 10-15

Length of Activity: 30 minutes

Objective:

Show participants that rising air is essential in the formation of clouds and precipitation.

Overview

Through an experiment with hot and cold water, participants will see warm water rising due to thermal buoyancy or the same principal behind hot air balloons.

Materials and Supplies (variation 1)

For each pair of students you will need:

- One rectangular clear plastic container approximately 5" x 12"
- Warm water with red food coloring
- Room temperature water
- Ice cubes made with blue food coloring and water
- Pencils and paper

Preparation

In advance, make ice cubes out of blue dyed water

Procedure

Fill the plastic container 2/3 full of room temperature water.

Show a globe of the earth and talk about the oceans being connected into a 'one world' ocean.



Let the water sit for 30 seconds or until it is completely still.

Place a blue ice cube at each end of the plastic container, representing the poles.

Add two drops of warm water with red food coloring to the center of the plastic container. Explain that the sun warms the oceans, but more intensely at the equator, hence the warm water in the center. Be careful not to disturb the water.

Using the red and blue pencils to draw what you see happening.

Materials and Supplies (variation 2)

- Large clear jar or small aquarium
- smaller jar, or platform for the bottles to rest on
- two small bottles*
- red and blue food coloring
- hot and cold water

* must fit inside the large jar - food coloring bottles or vanilla extract bottles work well

Preparation

Ahead of time, make sure that the sizes of the bottles will fit and balance on the platform (see picture below).



Procedure:

Fill the large jar/aquarium with tap water. Create your platform by submerging and centering it at the bottom of the large jar/aquarium.

Mix ice water and about 5 drops of blue food coloring into one small bottle.

Mix hot water and about 5 drops of red food coloring into the other bottle.

Carefully submerge the bottles into the large jar/aquarium and rest them on the platform. The cold water will descend and

the hot water will rise, continuing for several minutes.

Discussion

Where did the red go?

How about the blue?

Water is flowing from one position to another while heat is being transferred. The cold, blue water sinks, while the warmer, red water rises.

The red water stays higher than the blue.

What does this have to do with weather?

What type of air mass does the red water represent? Red water represents a warm air mass.

How about the blue? Blue water represents a cold air mass.

How does this relate to a cloud?

How does this relate to a thunderstorm?

Explanation:

A thunderstorm is caused by unstable air. A body of warm air is forced to rise by an approaching cold front. A strong, persistent updraft of warm moist air is formed. The approaching cold front helps build the updraft into a cumulus cloud. Speeds of an updraft have been recorded at 90 miles per hour. When the warm air rises and meets the cold air, it condenses (releases latent heat). The heat helps fuel the thunderstorm. The next stage is when the cumulus cloud has grown into a cumulonimbus cloud rising above 30,000 feet. Then a downdraft forms, bringing cold air and precipitation down to the Earth's surface.

More explanation:

When fluids (liquids and gases) are heated, they expand and therefore become less dense. Any object or substance that is less dense than a fluid will float in that fluid, so hot water rises (floats) in colder water.

When fluids are cooled, they contract and therefore become more dense. Any object or substance that is more dense than a fluid will sink in that fluid, so cold water sinks in warmer water. Hot air rises and cold air descends for exactly the same reason.

Sources: <http://www.abc.net.au/science/learn/demonstrations/>
<http://school.discoveryeducation.com/lessonplans/programs/oceans/>

National Science Education Standards:

NSES K-4:

Science as Inquiry (4ASI)

Abilities necessary to do scientific inquiry (4ASI 1)

Understandings about scientific inquiry (4ASI 2)

Physical Science (4BPS)

Properties of objects and materials (4BPSI 1)

Position and motion of objects (4BPSI 2)

Light, heat, electricity, and magnetism (4BPS 3)

Earth and Space Science (4DESS)

Objects in the sky (4DESS 2)

Changes in earth and sky (4DESS 3)

NSES 5-8:

Science as Inquiry (8ASI)

Abilities necessary to do scientific inquiry (8ASI 1)

Understandings about scientific inquiry (8ASI 2)

Physical Science (8BPS)

Properties and changes of properties in matter (8BPS 1)

Motions and Forces (8BPS 2)

Transfer of energy (8BPS 3)

Earth and Space Science (8DESS)

Structure of the earth system (8DESS 1)

NSES 9-12:

Science as Inquiry (12ASI)

Abilities necessary to do scientific inquiry (12ASI 1)

Understandings about scientific inquiry (12ASI 2)

Physical Science (12BPS)

Structure and properties of matter (12BPS 2)

Conservation of energy and increase in disorder (12BPS 5)

Earth and Space Science (12DESS)

Energy in the earth system (12DESS 1)