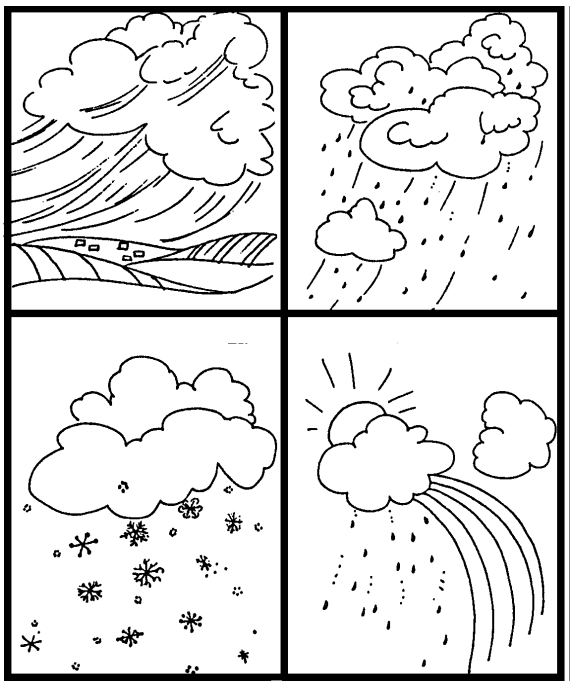
Water Cycle

The Earth's Gift

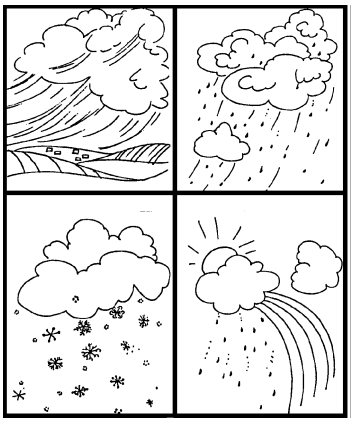
FOURTH GRADE

ATMOSPHERE



1 WEEK
LESSON PLANS AND
ACTIVITIES

WATER CYCLE
OVERVIEW OF FOURTH GRADE



WATER

WEEK 1.
PRE: *Comparing different reservoirs of water.*
LAB: *Experimenting with surface tension and capillary action.*
POST: *Discovering why icebergs float.*

OCEANS

WEEK 2.
PRE: *Comparing fresh and salt water.*
LAB: *Discovering that salt water is an electrolyte.*
POST: *Distinguishing bodies of salt water.*

ATMOSPHERE

WEEK 3.
PRE: *Discovering the affect of air pressure.*
LAB: *Comparing how substances heat up.*
POST: *Exploring how wind is created.*

WEATHER

WEEK 4.
PRE: *Exploring different weather fronts.*
LAB: *Comparing satellite photos and weather maps.*
POST: *Discovering weather and climate patterns of California.*

WATER CYCLE - ATMOSPHERE (4)

PRE LAB

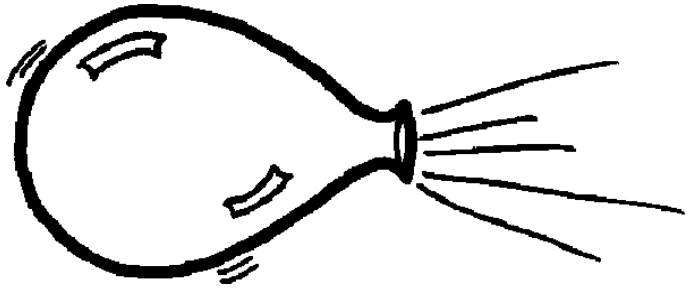
Students demonstrate that air is strong.

OBJECTIVES:

1. Exploring how the atmosphere and hydrosphere interact.
2. Discovering the effect of air pressure.

VOCABULARY:

aerodynamic
atmosphere
hydrosphere
weather



MATERIALS:

jar
balloon
Bernoulli pipe
puddle jumper

BACKGROUND:

The atmosphere is almost invisible to the majority of people. Most young children do not even realize that air is a "thing." The atmosphere is very powerful especially if you consider that weather is caused by the many interactions of temperature, moisture, pressure, and wind. Ancient people had a difficult time trying to figure out exactly what was in the atmosphere. In the fourth grade, emphasis is on how the elements of temperature, pressure, and wind interact.

When we discuss air pressure, we don't usually realize that air presses on every side of an object. Air exerts its force in all directions equally. Only in a vacuum, where there is no air, is an object free from pressure.

Air pressure is real. In our atmosphere air moves in part because of unequal heating of land and water that creates air currents. The rotating Earth also causes movement. The important concept to emphasize is that air is a real substance, that interacts with the hydrosphere and land (lithosphere) to create different weather patterns.

PROCEDURE:

Review with students that air is a substance that has properties. Either do the demonstrations suggested below or have the students preform them. The activities emphasize that air pressure is all around us and we can use its "magic" if we understand

it.

1. Blow up a balloon and ask students how to make the balloon fly. Hopefully the students will realize that just releasing the unknotted tip will let the balloon propel backwards. Why? The air is released and the force of the air propels the balloon forward. [For every action, there is a reaction.]

2. A simple experiment to illustrate that air exerts a pressure is to place a balloon in an empty jar. Blow into the balloon and inflate it in the jar. Notice that the balloon will swell out until it touches the glass sides. A few more puffs, and it becomes an easy matter to lift the jar with the air of the balloon.

The air pressure inside the balloon exerts its force in all directions, pressing the walls of the balloon so tightly against the glass jar that it cannot easily be pulled free unless some air is released from the balloon.

3. How can you make the little ball in the Bernoulli pipe stay afloat? Blow into the pipe. Just a stream of air increases the pressure below and makes the ball look like it is floating. You have increased the air pressure below the ball, which keeps the ball afloat.

4. Can air be captured to help machines fly? Yes, take for instance the puddle jumper. If you curl the base away from your body and release it, notice that the puddle jumper acts like a helicopter for a while. The design of the toy's wings helps to direct the air under the wood to help keep it afloat.

WATER CYCLE - ATMOSPHERE (4)

LAB

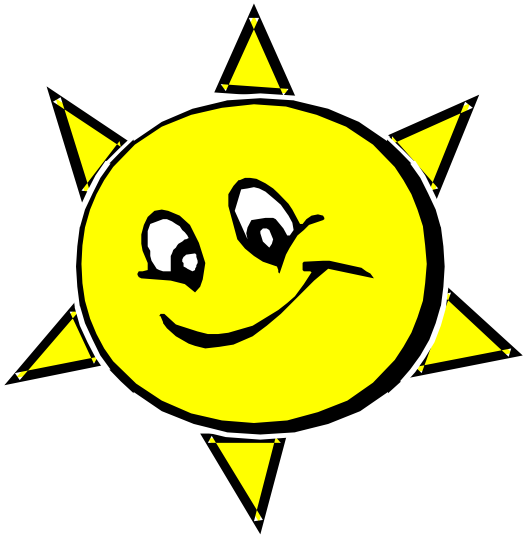
Students heat up land and water.

OBJECTIVES:

1. Comparing how substances heat up.
2. Exploring how air currents are influenced by air pressure.

VOCABULARY:

high pressure
low pressure
molecules
temperature



MATERIALS:

soil
dark sand and light sand
water and salt water
thermometers
styrofoam cups
cafeteria trays
clock
sunlight (or heat lamps)

BACKGROUND:

The direction of air movement, is in part, controlled by air pressure. Warmer areas tend to have a low pressure (warmer air is less dense, molecules are farther apart, hence low pressure) and cooler areas tend to have high pressure (cooler are more dense or compact).

High pressure is usually associated with dry weather because as air sinks and warms, water in the air will evaporated. Low pressure is usually associated with moist weather because as air rises and cools, water vapor tends to condense.

Under the same solar radiation (temperature), different substances will heat up differently. Oceans heat up slowly, but cool very slowly. Land heats up quickly, but then cools quickly. This causes a difference in air pressure which in turn causes wind. Breezes can be caused by conditions created by this changing heat.

Air that is warmed exerts less pressure on the ground causing a low pressure region. Air that is cooled is denser, causing a high pressure region. Remember that cold, cool, warm, and hot are relative terms. The movement of air is greatest from high pressure to low pressure when the temperature differential is the greatest.

PROCEDURE:

The lab exercise is to prove to students that certain substances will heat up more quickly than others. In your discussion you might want to review that heat makes molecules of a substance move faster.

Emphasize with students that wind is caused in part, when there is an unbalance in the heating of the earth. They should conclude that water takes longer to heat up, and also longer to cool down. Light sand reflects more heat than dark sand, so it takes longer to heat up. Salt water takes more heat to warm up than fresh water. Review that the different surfaces on earth (water, ice, soil, and rock) heat at different rates and cause different air pressures.

Heat lamps work quickly in the classroom. If you are using sunlight this activity may require more time.

1. Put the materials listed in the student's lab sheet in a tray or cup. You can easily substitute or add objects. Make sure there is enough material so the thermometer's reading is accurate.

2. Place a thermometer into each of the materials listed. Emphasize with students that each thermometer is the same distance below the surface.

3. Students should record the starting temperature of each of the materials in students data table.

4. Students should place their tray in the sunlight (heat lamp) for 10 minutes and record the temperature in their data table.

5. Bring the trays inside (or turn off the heat lamp) and let them cool for 10 minutes before students record the temperatures.

WATER CYCLE - ATMOSPHERE (4)

PROBLEM: Do different substances heat up and cool down at different rates?
PREDICTION: _____
_____

MATERIALS: soil, dark sand, light sand, water, salt water, thermometers, styrofoam cups, cafeteria trays, clock, sunlight (or heat lamps)

PROCEDURE:
1. Fill each of the cups 1/2 full with the materials listed below.
2. Place a thermometer into a cup 1/2 full of each of the materials listed. (Try to make sure each one is the same distance below the surface) and place all of your group cups on a tray.
3. Record the starting temperature of each of the materials in your data table.
4. Place your tray in the sunlight (heat lamp) for 10 minutes and record the temperature in your data table.
5. Bring the trays inside (turn off the heat lamp) and let them cool for 10 minutes before your record the temperatures.

DATA TABLE

	starting temperature	after 10 min. heating	after 10 min. cooling
soil			
dark sand			
light sand			
water			
salt water			

CONCLUSION:

1. Which one heated the fastest? _____ slowest? _____
2. Which one cooled the fastest? _____ slowest? _____
3. What happens to the air above a substance as it heats up?
_____
4. What would happen if a substance that heated up fast was next to a substance that heated very slow? _____

WATER CYCLE - ATMOSPHERE (4)

Students use a worksheet to learn about sea breezes.

POST LAB

OBJECTIVES:

1. Comparing the differences of air temperature.
2. Exploring how wind is created.

VOCABULARY:

atmosphere
front
sea breeze
wind

MATERIALS:

worksheet

BACKGROUND:

Land and water retain heat differently. Water retains heat much longer than land, although it takes a longer time to heat up. Land cools and heats up more quickly than water. Day and night causes a large change on land, but not in water. The larger a body of water is the longer it takes to heat and cool.

The Sun beating down on the coastal land heats the land and the air over it more quickly than it heats the ocean and its overlying air. Circulation is started when a "sea breeze" of cool air sweeps in from the ocean, pushing up the air warmed by the land which then rises (less dense) and streams out toward the ocean. Air cooled by the sea sinks and flows landward to fill the area of low pressure created by the warm land, causing onshore breeze. At night, the land loses its heat more rapidly than the water. The air above it is chilled, while the ocean air is relatively warm. The colder air now sweeps from the land to the water, producing the "land breeze."

Winds are also created when warm air rises and cool air falls. When you hear the terms cold front or warm fronts they are generally talking about a mass of air with the same temperature. A front is when two masses of air meet. When 2 different masses of different temperature meet, it creates a different type of weather.

The San Francisco area in California is famous for its fog. Many people in the area do not even realize why the fog comes into town. The story has to do with sea breezes. East of San Francisco the land gets very hot. The cold Pacific water is to the west. As the land heats up, the wind moves the fog quickly into San Francisco. It is very dramatic because there are coastal mountains that prevent the fog from going through most of the areas, so the fog rolls in through the Golden Gate bridge. Many people have never seen

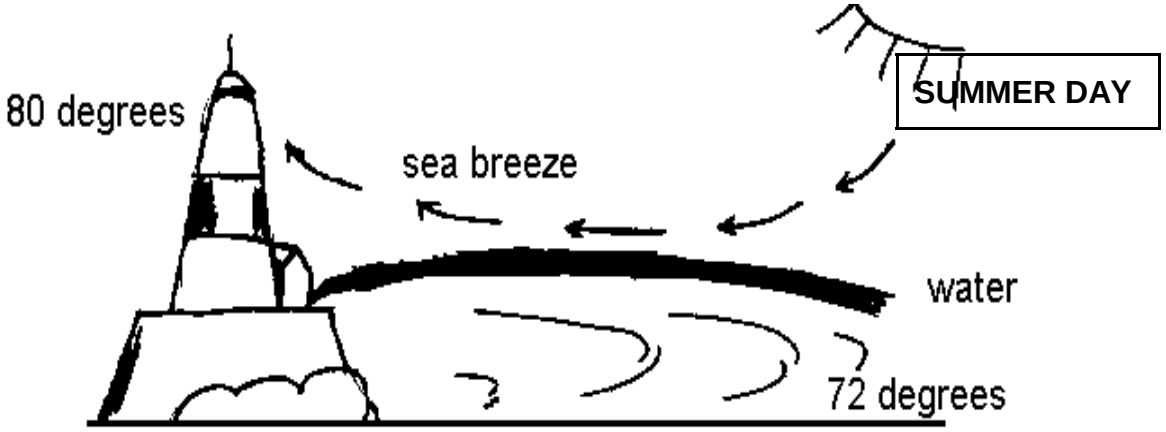
such a sight!

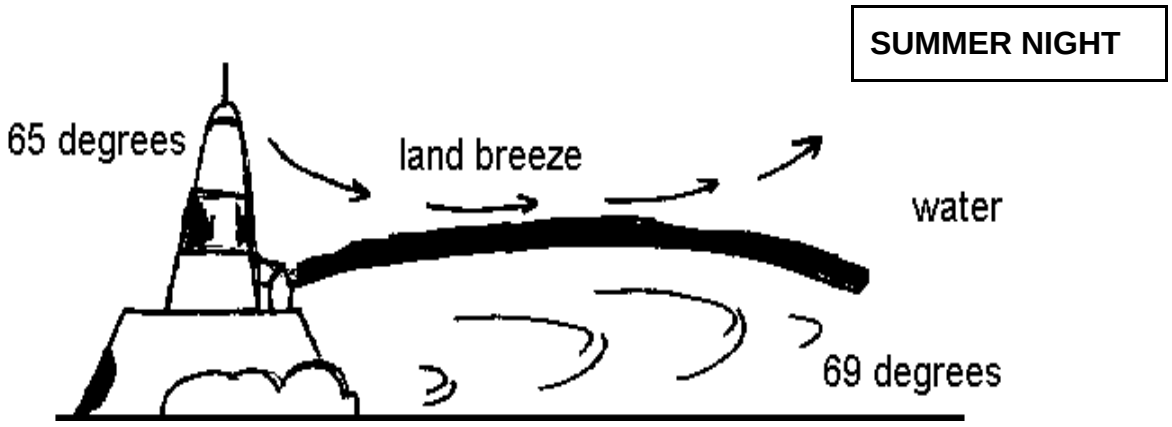
PROCEDURE:

1. Give students a worksheet and go over each of the diagrams. You may want them to color the water blue, so it stands out better. The answer to the question is on the diagram. Make sure students notice the difference of temperature, which is the driving force behind the sea and land breezes.

2. You may want students to discuss the difference of living near a coast and living inland.

WATER CYCLE - ATMOSPHERE (4)
POST





HERE ARE THE FACTS! DURING A SUMMER DAY, WIND BLOWS FROM THE WATER TO LAND; DURING THE NIGHT, WIND BLOWS FROM THE LAND TO WATER. WHY DO YOU THINK THIS HAPPENS IF THE CONDITIONS IN THE PICTURE ABOVE EXIST?

_____
_____
_____
_____
_____
_____