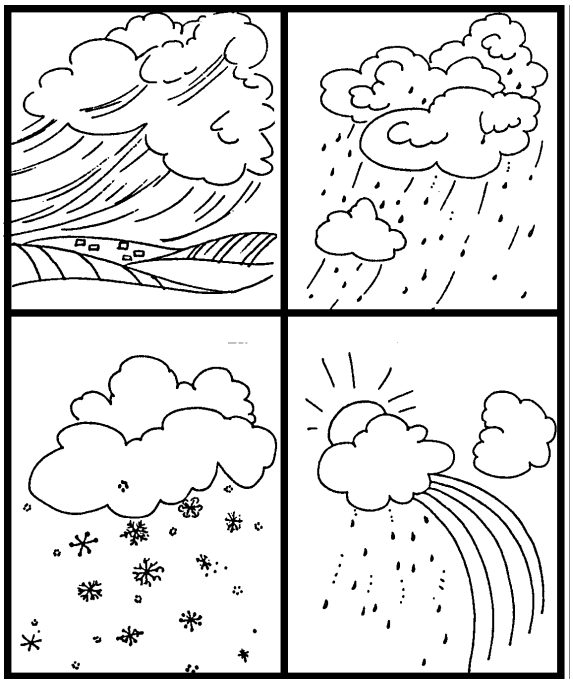
Water Cycle

The Earth's Gift

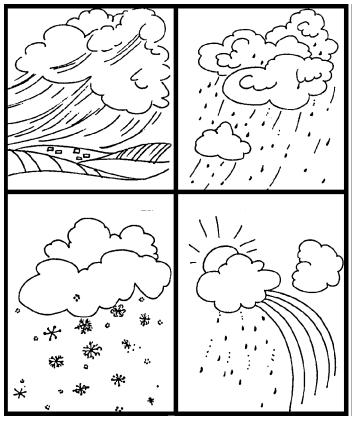
SIXTH GRADE

OCEANS



1 WEEK
LESSON PLANS AND
ACTIVITIES

WATER CYCLE
OVERVIEW OF SIXTH GRADE



WATER

WEEK 1.

PRE: *Evaluating components of the water cycle.*
LAB: *Experimenting with porosity and permeability.*
POST: *Discovering the major waterways.*

OCEANS

WEEK 2.

PRE: *Exploring ocean movements.*
LAB: *Experimenting with the ocean's movements.*
POST: *Comparing the different reasons for ocean movements.*

ATMOSPHERE

WEEK 3.

PRE: *Discovering the jet stream.*
LAB: *Tracing atmospheric winds.*
POST: *Discovering different air masses in the United States.*

WEATHER

WEEK 4.

PRE: *Comparing weather map patterns.*
LAB: *Comparing satellite photos with weather maps.*
POST: *Researching books for weather information.*

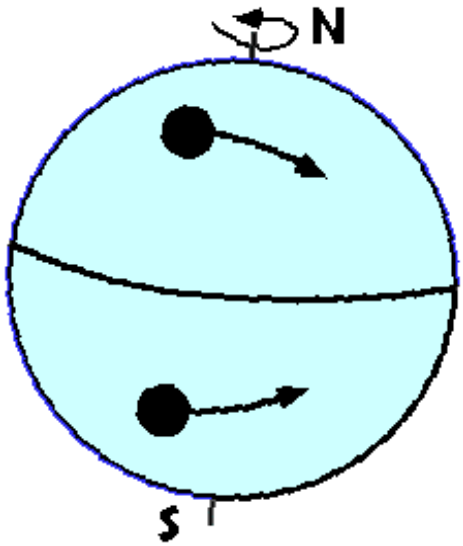
WATER CYCLE - OCEANS (6)

PRE LAB

Students record how their toilet bowl flushes.

OBJECTIVES:

1. Exploring the movement of oceans.
2. Discovering Coriolis motion.



VOCABULARY:

Coriolis
ocean
rotation

MATERIALS:

worksheet

BACKGROUND:

The rotation of the Earth affects the outer portions of the Earth. The effect on the oceans is a steady and continuous reaction, which causes the general direction of the ocean's motion. This is called the Coriolis Motion, whereby water is deflected to the right in the Northern Hemisphere and deflected to the left in the Southern Hemisphere, as shown on the diagram above.

The Coriolis Motion is named after the French mathematician, Gustave Gaspard Coriolis (1792-1843). The Coriolis Motion is a visible effect of the Coriolis Force caused by a rotating sphere. In the Northern hemisphere the wind tends to rotate counterclockwise (as seen from above) as it approaches a low pressure area. In the Southern hemisphere the wind rotates clockwise around pressure areas.

It is also referred to as the Coriolis Effect, which refers to the changing motion dependent from where you look. An example that you can use to illustrate this is that when a ball is thrown to someone from a merry-go-round the ball moves in a straight line but because the merry go round is moving, the ball appears to travel in a curved path if you are looking above.

The Coriolis Motion is a difficult phenomena to fully understand, but it is important for children to realize the influence of a rotating sphere on the motion in the ocean.

PROCEDURE:

1. It is a wise old tale that states that toilets flush to the right in the northern hemisphere and to the left in the southern hemisphere. Theoretically there should be some influence on the water, but the shape of the bowl and where the water emerges

influences the movement more. This tale should be easy to test. Before you start your discussion on the movement of the oceans, have students go home and look at what direction their toilet bowls flush. If there is more than one bathroom, have them record whether the bowl is facing east, south, west, or north. Remind students not to waste water.

2. Have students record the results as a homework assignment and then tabulate the results on the board in the following manner:

NAME	BOWL FACES	DIRECTION OF MOTION
Jon	north	left to right
Sue	west	left to right

3. Discuss the results of the class. It will probably be a collection of insignificant data, but it is the idea of asking the students to test a statement. Discuss that theoretically, the motion of the Earth should make the bowls in the north go left to right and in the southern hemisphere the bowls would flush right to left . On the equator, theoretically the bowls will flush 50% one way and 50% the other way. However, the force caused by the rotating sphere is so small in a toilet bowl, students will probably not see the effect. But it is a way for students to start thinking about the Earth rotating and its effect on the oceans.

WATER CYCLE - OCEANS (6)

HOW DOES YOUR TOILET BOWL FLUSH?

RIGHT TO LEFT (COUNTERCLOCKWISE) OR LEFT TO RIGHT (CLOCKWISE)

Ask people at your house to tell you the direction of the water as they flush the toilet bowl (right to left or left to right). Record at least 15 flushes. Please do not waste water just to see how it flushes.

1. How many times did it go counterclockwise? _____

2. How many times did it go clockwise? _____

WATER CYCLE - OCEANS (6)

LAB

Students experiment with a model of the Coriolis effect.

OBJECTIVES:

1. Discovering the Coriolis effect.
2. Experimenting with the ocean's movements.

VOCABULARY:

convection
Coriolis
topography
wind

MATERIALS:

lab sheet
beakers
hot plate
hot and cold salt water
food coloring
nail or pin
cardboard

BACKGROUND:

This lab focuses on the movement of ocean water, which is a difficult principle to explain and understand. Although wind, the movement of the Earth, and the differences between hot and cold water are the major factors that determine the direction of the ocean currents, topography and salinity also play a part. This lab only looks at two factors: the movement of the Earth and the differences between hot and cold water.

The differences between hot and cold water can cause movement. Warm water rises and as it cools it gets heavier and sinks. This motion is called a convection cell. In the oceans there are many areas that have cold water, especially in the polar areas. This cold water moves along the bottom of the oceans until there is an opportunity to rise, and when this occurs it is called upwelling. The reasons for water rising are numerous. Emphasize that there is motion caused by this temperature difference.

The Coriolis Motion occurs as the Earth rotates, creating a movement in the ocean. In the northern hemisphere water particles move to the right; in the southern hemisphere water particles move to the left. This lab is meant to introduce the concepts, and not for the students to fully understand the complex mechanisms that are occurring.

PROCEDURE:

1. EXERCISE I. Complete the demonstration using the hot and cold sea water as shown on the student's lab sheets. Let the students record what is happening in their lab manual. Point out that there are many factors that influence the movement of the water. This "convection" caused by heat, is just one way.

2. EXERCISE II.

A. Place cardboard base on table top.

B. Place piece of heavy construction paper in middle of base.

C. Firmly place nail or pin through center of construction paper (being careful not to allow nail head to come through).

D. Fill medicine dropper with water.

E. Turn nail upside down (head facing table) and spin like a top with the construction paper spinning on top of heavy cardboard base.

G. As the construction paper is spinning, the second partner will drop 1-3 drops of water as close to the nail as possible.

3. Have the students change the direction of the spin and record what happens. This demonstrates that a moving "sphere" deflects particles because of the motion. This is the same thing on the Earth, except the water can't just "fly" off.

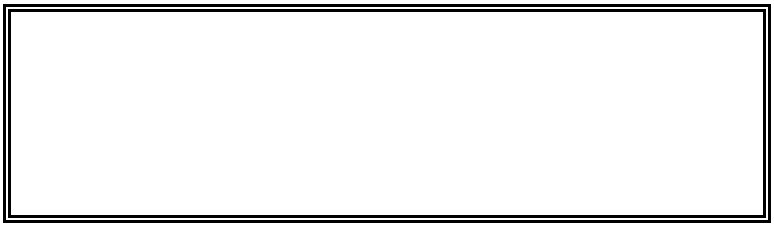
WATER CYCLE - OCEANS (6)

PROBLEM: What causes the circulation of water in the oceans?
PREDICTION:

_____

EXPERIMENT I.
MATERIALS: beakers, hot plate, hot and cold sea water, food coloring

PROCEDURE: Instructor has filled the beaker with hot sea water, pour some cold seawater (mixed with food coloring) slowly into the hot sea water. Draw what happens.



Why does the water move this way?

_____

EXPERIMENT II.
MATERIALS: heavy paper disk (with a hole punched in the center), medicine dropper, stick with a base (to hold paper in place)

PROCEDURE: Insert the nail through the paper disk until the paper rests flat on the base of the stick. Spin the disk of paper and at the same time that it is spinning, squeeze 1-2 drops of water near the center of the disk. Draw what happens. In what direction did the water go? Why? Spin the disk in the other direction. What happens?

_____
_____

RIGHT TO LEFT	LEFT TO RIGHT

CONCLUSION: What factors influence the movement of water?

_____

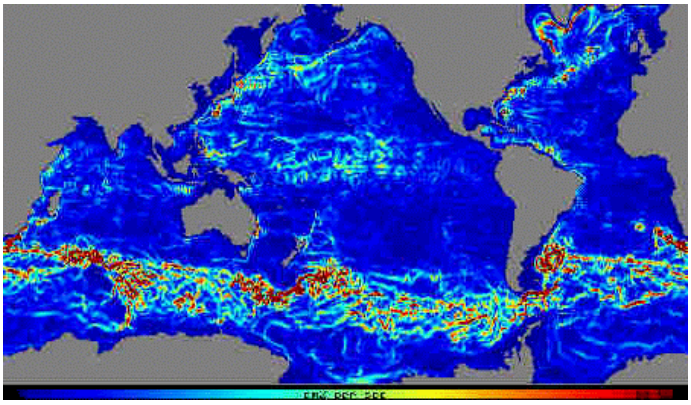
WATER CYCLE - OCEANS (6)

POST LAB

Students use a worksheet to look at ocean currents.

OBJECTIVES:

1. Comparing the different reasons for ocean movements.
2. Simplifying a map with complicated data.



VOCABULARY:

Coriolis
currents

MATERIALS:

worksheet
crayons
Inflatable World Globes
Hydrographic Physiographic Globe

BACKGROUND:

The motion in the oceans is important to help predict global weather matters. But how the oceans travels is very complicated. Not only does the surface move, but there are many different layers in the ocean that sometimes move in different direction. Density and temperature can create water masses that move as a unit. Within each water masses it can be full of nutrients to sustain biological life or sometimes it is nutrient poor that cannot sustain biological life. This can cause the food chain to be either prosperous or could have devastating results.

Movement is very difficult to understand, especially when children think that when they stop, there is no movement. Wrong! Ask the children to think of themselves as Martians, looking at the Earth through their spaceship. As they look at this blue planet called Earth, they notice that polar bears and penguins look like they are standing still (acting cool), but people especially those that live near the equator are moving around very quickly, about 1000 miles per hour! But do the people feel like they are moving that fast? Of course not, but the Earth is moving along its axis, a particle near the axis moves slower than a particle along the equator, which has a longer distance to travel. Hence, the Martian would see polar bears (who live only near the north pole) and penguins who live only near the south pole) as moving very slowly. This movement causes motion on the crust of the Earth, but because the ocean is a liquid it responds more quickly than the solid Earth and is one of the main reasons we have currents.

The different relative movement on the Earth causes what is called the Coriolis Motion. The Coriolis effect is a major overlay on the pattern, and this has to do with

deflection of particles because of this motion. The classic example that you can perform with your children is to have them throw a ball to a person when they are on merry-go-round. The ball will be thrown straight, but will appear to be deflected to the people on the merry-go round. This is an analog to the movement of water in our oceans. In the northern hemisphere this deflection is to the right and in the southern hemisphere this deflection is to the left.

Coriolis does not alone explain movements, but other factors not related to movement such as density of water, wind and local submarine topography need to be included. The main idea here to convey to your students is that oceans have water flowing within the main body, kind of rivers within the oceans, flowing in the direction that other factors as mentioned above control. If your students can understand that water does move in the oceans, and that this movement can bring water from one side of the ocean to another, they may be able to visualize this warming of the east Pacific.

PROCEDURE:

1. This exercise reinforces the concept that the surface waters of the oceans move. Emphasize that the oceans do not just "sit" still, but are moving all the time.

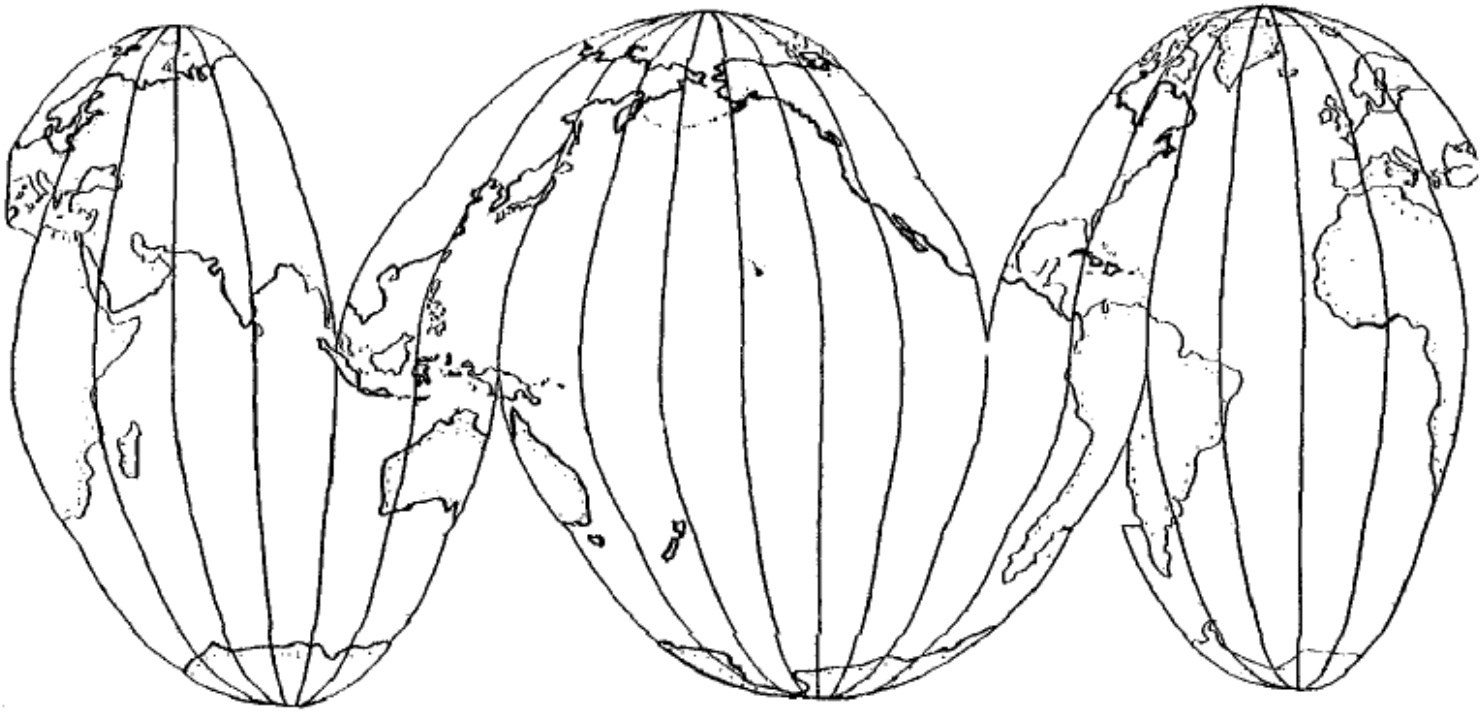
2. Have the students label the continents and oceans on the lab sheet. Notice that this map shows more of the oceans. It may be difficult for students to find the continents, so having a globe available would assist students in finding the different areas.

3. Have students try to simplify the surface currents on the blank map. Tell them to substitute a larger arrow for several of the smaller ones. Although this is a tedious process, it gets them learning about the ocean's movement. Make sure the students do this in pencil, there will be lots of erasing.

4. Someone in the class will probably ask, "What makes the currents move?" At the elementary school level you can answer simply that the movement of the Earth as it spins around on its axis while orbiting the Sun creates movement. Added complications to the currents include: A) wind B) differences water height (example: the Atlantic Ocean is higher than the Pacific Ocean near the Panama Canal) and c) topography. There are several other factors, but at this stage of the educational game, don't worry about it.

5. Students may want to know how tides play a part. Tides are caused by the gravitational attraction of the Moon and Sun. The attraction actually bulges the water, almost like a pulse. Certain times of the month the attraction is greater and some less. Tides however don't change the major direction of the movement of oceans.

WATER CYCLE - OCEANS (6) POST



SURFACE CURRENT
OF
THE OCEANS