

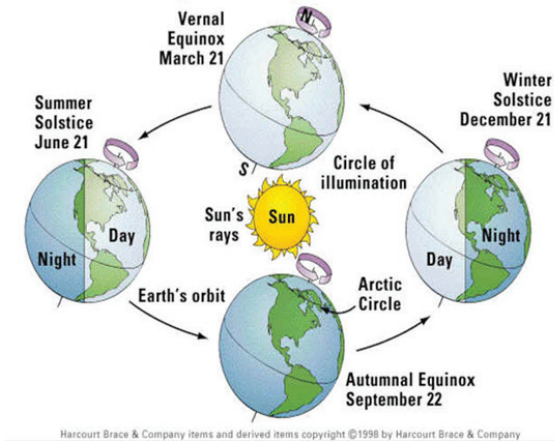
Motion of the Earth

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Student Reading

When you go outside at night and look up, you can see millions of stars. There are so many that it is hard to count them all. Our galaxy, which is called the Milky Way Galaxy, is home to our solar system. Inside our solar system, we have one Sun and eight planets. The Earth is one of the planets. All the planets travel around the Sun. We call this trip around our Sun a revolution. The Earth has a tilt to its axis of $23 \frac{1}{3}$ degrees. This tilt and the revolution together create the seasons on our globe, the Earth. When we tip towards the Sun in the summer season, the more direct rays of the Sun strike, producing warming in the Northern Hemisphere. When we are tilted away from the Sun, in the winter season, the Sun's less direct rays strike in the Northern Hemisphere. This causes cooling for the winter seasons in the Northern Hemisphere. The Southern Hemisphere and Northern Hemisphere have opposite seasons.

Seasonal changes in temperature



Earth also rotates. Rotation is the spinning of a planet on its axis. Due to the rotation of the earth, daytime and nighttime occur. It takes 24 hours for one Earth rotation to occur. When one side of the Earth faces the Sun, it is daytime there and nighttime on the other side of the Earth. The shape of the Earth is like a flattened ball. Both ends of the Earth are slightly flattened, and we call these areas the North Pole and the South Pole.

About $\frac{1}{4}$ of the earth is made of land or continents and about $\frac{3}{4}$ of the surface of the Earth is made-up of water (oceans, lakes, rivers, streams). The atmosphere is made up of more than 70 percent nitrogen. In fact, oxygen only makes up about 24 percent of our atmosphere and the remaining percentage is a combination of other gases.

For the following two activities you will need 1 large batch of modeling dough per group. The following recipe provides the appropriate quantity (3 lbs per group).

Modeling Dough Recipe

- 4 cups flour
- 2 cups salt
- 4 cups water
- 8 tablespoons oil
- 8 tablespoons cream of tartar

Mix flour, salt and oil, and slowly add the water. Cook over medium heat, stirring until dough becomes stiff. Turn out onto wax paper and let cool. Knead the modeling dough with your hands until of proper consistency. Use as is, or divide into balls and add a few drops of food coloring.

VOCABULARY:

- Axis
- Milky Way Galaxy
- Northern Hemisphere
- Revolution
- Rotation

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MATERIALS:

Three lbs. of modeling dough

Plastic knives

Plastic table cloth

Instruction sheet

Planet name worksheets

Activity 1: Size of the Moon

Using your group's modeling dough, determine how big the Moon would be compared to the Earth. Share your ideas with the other groups in a class discussion about the size of the Earth and Moon.

- 1 Using all the modeling dough, cut the modeling dough into five equal-size pieces.
- 2 Now cut each of the five pieces into ten equal pieces, creating about fifty equally sized balls.
- 3 Save one of the pieces and gather the rest of the 49 parts into a ball. The smallest one represents the Moon while the more massive represents the Earth.

Are you surprised?



Activity 2: The relative size of the solar system

Cut out the planets' names and tape each name to a sheet of paper. Place the papers in the correct order from the sun.

Place the modeling dough on a piece of paper or plastic table cloth. Make sure the area is cleared and that you can easily work with the modeling dough. Follow the list of instructions below.

This activity demonstrates the different scale sizes of the planets in our solar system. Follow the steps outlined to see the relative size of each planet. Start with a big 3-pound ball of modeling dough. Just a note that Pluto is no longer considered a planet, but a dwarf planet. Pluto is included in this activity to show relative size.

- 1 Divide the entire ball of modeling dough into 10 equal parts.
 - a Combine 6 parts together and put them on the Jupiter page
 - b Similarly combine 3 parts and put them on the Saturn page
- 2 Cut the remaining part into 10 equal parts
 - a Take 5 parts and combine them with the ball on the Saturn page
 - b Combine 2 parts and put them on the Neptune page
 - c Combine 2 parts and put them on the Uranus page
- 3 Cut the remaining part into 4 equal parts
 - a Take 3 parts and combine them with the ball on the Saturn page

Student Information:

The following two activities are from: ASTRONOMY from the GROUND UP; an Educational Collaboration of ASP, NOAO & ASTC funded by the National Science Foundation

(By Dennis Schatz (Pacific Science Center): *Worlds In Comparison 2008 Astronomy from the Ground Up*, Astronomical Society of the Pacific, 390 Ashton Ave, San Francisco, CA 94112)

Activity 2: *continued*

- 4 Cut the remaining part into 10 equal parts
 - a Put 2 parts on the Earth page
 - b Put 2 parts on the Venus page
 - c Take 4 parts and combine them with the ball on the Uranus page
- 5 Combine the remaining 2 parts and cut into 10 equal parts
 - a Put 1 part on the Mars page
 - b Take 4 parts and combine them with the ball on the Neptune page
 - c Take 4 parts and combine them with the ball on the Uranus page
- 6 Cut the remaining part into 10 equal parts
 - a Put 7 parts on the Mercury page
 - b Take 2 parts and combine them with the ball on the Uranus page
- 7 Cut the remaining part into 10 equal parts
 - a Take 9 parts and combine them with the ball on the Uranus page
 - b Put 1 part on the Pluto page



Mercury

Venus

Earth

Mars

Jupiter

Saturn

Uranus

Neptune

Pluto

Teacher Information

Classroom Demonstrations

Demonstration 1:

Follow the reading exercise with a demonstration regarding the seasons of the Earth. Choose a medium size ball for the Earth, a flashlight for the Sun. Model the revolution of the Earth around the Sun. Shine a flashlight directly onto the Northern Hemisphere when it is tilted towards the Sun, showing the angle of the sunshine and intensity. Show how this angle shifts and the area of the light gets bigger moving towards the winter season.

Observations 1:

Begin to track the Sun's altitude in the sky daily or weekly. Use a clear plastic bowl or celestial dome. Place a paper under the dome with an x in the exact center. Take the celestial dome outside on a sunny day to find the altitude of the Sun. Place an overhead projector pen at the location on the globe where the shadow makes a dot on the X inside the bowl. Mark this point on the celestial dome and label it with the time and date. Notice where the Sun is in the sky with the students daily/weekly. You should be able to track the Sun going lower in the sky during the winter and moving higher in the sky during the Spring and Summer.

Ask the students to look up at the ceiling while spinning. They should describe what they see. Is it the ceiling that is turning? Have them explain why the ceiling appears to spin. Share with the students that this is similar to the Earth's motions. The Earth is moving giving the appearance of the daily rising and setting of the celestial objects in the daytime and nighttime sky.

Lunar Phases:

Take a projection light and shine it onto a golf ball super-glued to a golf tee. Face the light and hold the ball slightly above the head. Note the shadow and the light. Begin turning around facing away from the light while holding the golf ball up above the head and notice the growing amount of light on the ball until it is fully lit up with your back to the light (this whole side is considered to be waxing or growing) and then continue around the circle, watching the amount of light wane. Discuss the four main positions.

New York State Standards

Communicating, comparing and contrasting, creating models, gathering and organizing data, generalizing, identifying variables, inferring, interpreting data, making decisions, manipulating materials, measuring, observing, predicting

Standard 1:

Scientific Inquiry Key Idea 1: s1.3

Scientific Inquiry Key idea 3: s3.2a, s3.3a, s3.4a, s3.4b

Standard 1 engineering Design: t1.1, t1.4b

Standard 4: Key Idea 1

Standard 6: models key Idea 2

Standards 6: Magnitude and Scale, Key Idea 3