Guiding Questions Activity 6

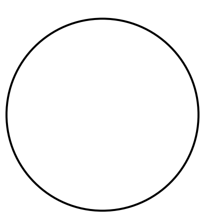
- What are your ideas about gravity?

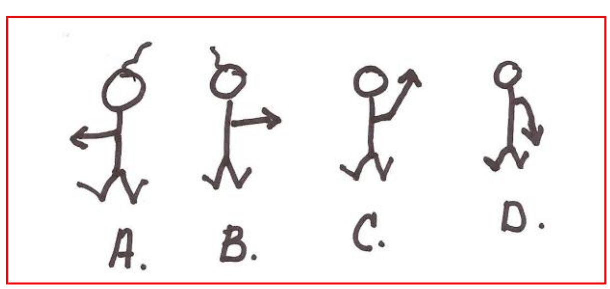
Round?

Flat?

Begin this discussion by reminding students of the earlier work they did concerning how people viewed their world. Remind them of the beliefs of the ancient Greeks and the early Chinese and Egyptians.
Looking at the above pictures, you might ask them why the Earth appears flat in one picture and has a sphere shape in the other? Lead students to understand the Earth appears flat simply because we are looking at only a small part of it. Photos taken from space show the Earth as having a spherical shape. Look for photos from space at:
http://earth.jsc.nasa.gov/sseop/efs/query.pl

Draw a circle on the board. Tell students to pretend the earth is glass. Ask them which way they would look in a straight line to see people in countries like China or India?



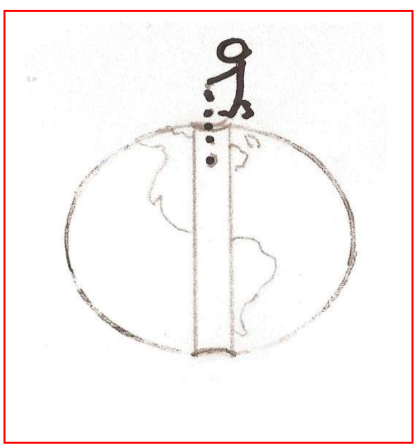


The answer, of course is D downward.

Next draw another circle on the board. This time add some stick figures at various places around the Earth. Each stick figure is dropping SuitSat2.

Instruct a student to go up to the board and draw a line showing the path of SuitSat2 from the person's hand to where it finally stops.

Tell your students that a tunnel was dug all the way through the Earth from pole to pole. Have a student(s) go up to the board and draw a line from the person's hand showing the complete path of SuitSat2..



You will find that most students will follow Aristotle's idea that all things fall to their "natural resting place" in the center of the Earth. But Isaac Newton's idea that "down" is always toward the greater mass would result in SuitSat2 falling faster and faster and only slowing up once it passes the center. At that point the greater mass of the Earth is behind it so it will move back towards the center point. It would continue to fall back and forth between the two poles until air resistance finally would slow it down and eventually it would settle in the exact center of Earth.

Draw another circle on the board. This time draw a stick figure at the north pole. Show the figure tossing SuitSat2. Ask students what path would SutSat2 take? Have someone go up to the board and draw the path and explain why he/she believed it to be the correct path. Suggest that the figure is able to toss SuitSat2 even harder. What would happen to SuitSat2? Tell them to pretend the figure had superhuman strength. Ask the students to describe the path of SuitSat2. Ask what would the figure have to do to get SuitSat2 to orbit the Earth? To escape Earth?

Modified and adapted from Earth, Moon, and Stars, Lawrence Hall of Science, University of California, Berkeley

- **Which will hit the ground first: a feather or a hammer?**

Students may remember from an earlier study that Aristotle lived over 2300 years ago in Greece. He was a great philosoper and teacher. Many of his teachings were based upon observation and common sense. Unfortunately that did not always lead him to the correct answer. One of his ideas was that light objects fall to the ground more slowly than heavy objects because he had seen it happen with his own eyes! A leaf after all falls to the ground more slowly than a rock.

If he had only experimented with that leaf and rock he might have been surprised at the result. Why not try it yourself? Take a flat rock about the size of the palm of your hand. Place a small leaf on top of the rock. Now, drop your hand quickly and observe the rock and leaf fall. Repeat the experiment. Did you discover that by riding on the rock the leaf fell just as fast as the rock all the way to the ground?

Galileo believed that all things fell at the same accelerated motion. He did a series of experiments involving an 18 foot grooved wooden ramp. He lined the groove with parchment paper and used a hard, smooth round bronze ball to roll down his ramp. He used a water clock to time the movement of the ball down the ramp. He discovered that the distance traveled by the ball was proportional to the square of the time of travel and that this relationship was true for all inclinations of his ramp. Since he did not have a stopwatch he was unable to measure the exact value of the acceleration of a body in free fall. We now know that if dropped in a vacuum the leaf and rock would accelerate at 9.8 m/sec/sec.

Galileo's hypothesis that all objects fall with the same acceleration in the absence of air resistance was clearly demonstrated by Astronaut David Scott during the Apollo 15 mission. Are you interested in seeing it actually happen? Go to : http://www1.jsc.nasa.gov/er/seh/feather.html You will be able to watch Astronaut Scott drop a hammer and a falcon's feather. Watch it and discover what happened!