GRACE Education Curriculum Satellites	
Teachers	Grades K-5
Science	

Marbles In Space

Background Information: A satellite is a celestial body that orbiting another of larger size. The Moon is a natural satellite of Earth. Artificial satellites are machines that are sent into space by people. They orbit the Earth and have lots of different jobs. There are basically six types of satellites circling the Earth – communication, resource, navigation, military, scientific, and weather satellites. Hundreds of artificial satellites are orbiting Earth right now!

Objectives: At the end of the lesson, students will be able to:

- Describe and simulate how satellites are launched into orbit.
- Define vocabulary related to satellites and satellite launches.
- Explain an orbit path of a satellite and why it does not fall.

Standards: Science: unifying concepts and processes; earth and space science; physical science
Math: measurement; geometry

Vocabulary:

Natural Satellite	Artificial Satellite	Orbit Drag
Orbiter	Payload	Rocket
Booster		

Materials:

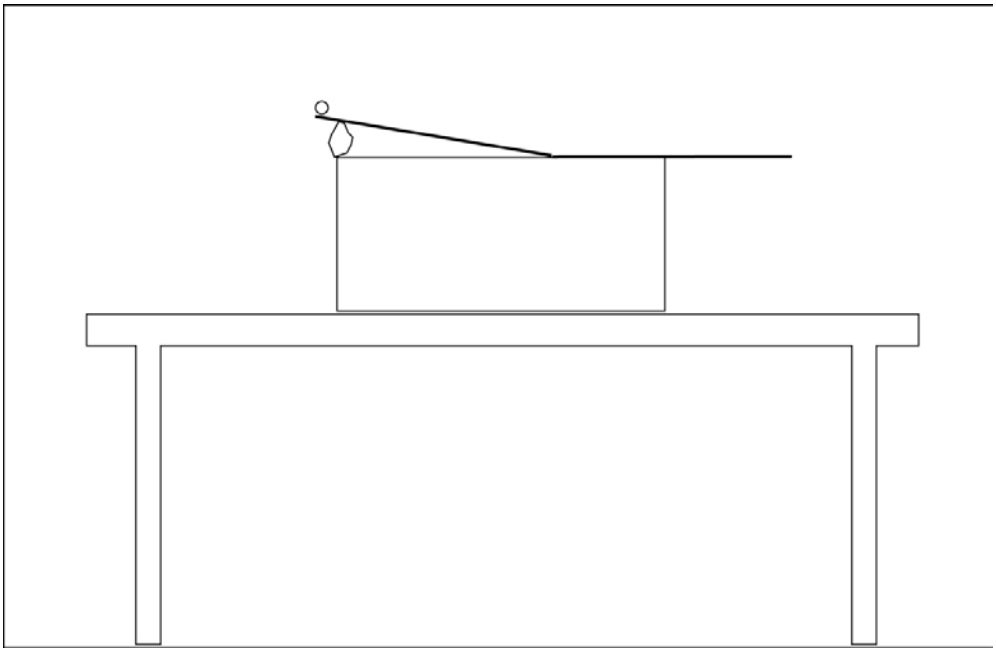
Satellite fact sheet	Cardboard box
modeling clay	marbles [vary weight and size]
Earth overhead	2 plastic rulers [grooved center]
Overhead projector	

Directions to the Teacher:

Use the satellite fact sheet to explain satellites. Make all of the materials available for the students. Have the students follow the directions to make their launcher. Remind students to measure as accurately as possible (an exact measurement is not possible – all measurements are an estimate).

Directions to make launcher:

1. Take the cardboard box and turn it upside down. Remind students to use precise measurements.
2. Pretend that the table is Earth. Place the box 8 inches from the edge of the table. Use modeling clay to set up various heights (1 inch, 2 inches, and 5 inches).
3. Place the first grooved ruler on the box with 4 inches hanging over the edge.
4. Place the other ruler so that one end touches the end of the first ruler and the other end is supported by the clay.
5. Before conducting the experiment, have the students predict what they think may happen at each level. Write predictions on worksheet.
6. Conduct the experiment. Hold the marble at the top of the raised ruler and release. Watch what happens.
   - At 2 inches: The marble will roll down and off the ruler end. It will curve downward just past the edge of the table (earth) simulating how satellites are released into orbit.
   - At 1 inch: The marble will hit the table or Earth because the gravity of earth pulls the satellite towards the Earth.
   - At 5 inches: The marble will roll over the edge and actually be too far away from Earth. It will break away from the gravitational pull of Earth and escape into space.
7. Now try it with marbles that are different sizes and weights and observe what happens.



Extensions:

Research how other satellites launch into space.

Find the space agency headquarters, like NASA, in other countries.

Where are satellites tracked?

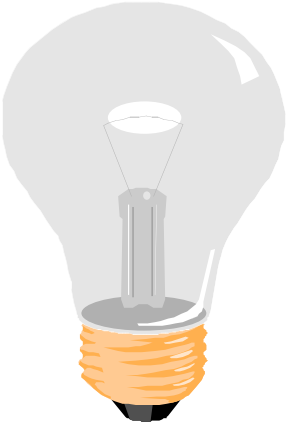
References / Resources:

VanCleave, Janice. *Gravity.* John Wiley and Sons: Canada, 1993.

Walker, Niki. Satellites and Space Probes. Crabtree: NY, 1998.

PREDICTION CHART

What do you think will happen to your marble satellite?



Marble Satellite 1:

Marble Satellite 2:

Marble Satellite 3:

Satellite Fact Sheet

- Satellites are launched into orbit.
- Gravity holds all planets and moons in orbit.
- If there were no gravity, the Earth and other planets would keep going out into space in a straight line.
- A satellite does not continue to move forward in a straight line because gravity pulls the satellite toward Earth.
- A satellite is a celestial body that is orbiting another of larger size.
- The moon is a natural satellite of Earth.
- People send artificial satellites, like GRACE, into space. They orbit Earth and carry out a variety of jobs.
- Orbits are paths around the planet.
- An orbit of a satellite depends on the job the satellite has to do.
- Artificial satellites have small remote controlled rockets called boosters.
- The boosters push the spacecraft farther into space and increase its speed so that it is remains in an orbit and it is not pulled back by Earth's gravity.
- A satellite is called a payload when it's carried to the launch vehicles.
- Satellites are launched to a height above the earth by booster rockets and then the satellite is released parallel to the Earth's surface.
- The path of a satellite appears to be a circle but is more like an ellipse and is said to be in orbit.
- The launching speed has to be great enough for the satellite to overcome the pull of gravity. If it is too slow the satellite will be pulled back into Earth. If too fast, the satellite will break away from Earth's gravitational pull and escape into space.
- Air pushing against a satellite, causing it to slow down, is called “drag.”

Name_____

Date _____

Marbles in Space Experiment

Directions: Write down which line the marble had reached when the force of the magnet attracted it.

	BIG MAGNET	SMALL MAGNET
BIGGEST PLANET		
MEDIUM PLANET		
SMALLEST PLANET		

1. Which two objects had the strongest attraction? (They were attracted from farthest away.)_____

   _____

2. Which two objects had the weakest attraction? (They needed to be very close to attract.) _____

   _____

3. Why do you think these had the strongest and weakest attraction?_____

   _____