National Aeronautics and Space Administration

| Grades | Subject |
|---|---|
| 5-8 | Physical Science |

Second United States Microgravity Laboratory Supplemental Activity

# Settling and Separation

**OBJECTIVE:**

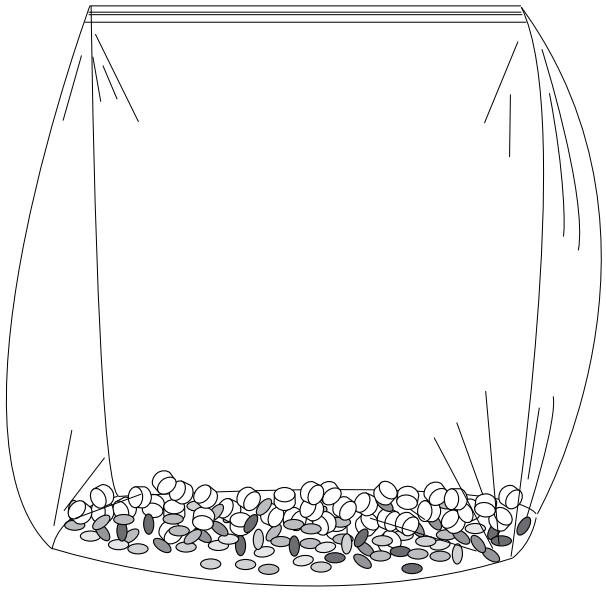
To demonstrate the effect of gravity on settling and separation.

**BACKGROUND:**

Gravity plays a major role in the way that two immiscible liquids (those liquids that remain chemically unchanged and separate when in contact) settle into two distinct layers. Oil and vinegar is a classic example of two immiscible liquids. Under the influence of gravity the denser liquid settles into a layer on the bottom and the lighter liquid forms a layer on top. This is an example of sedimentation. Under certain circumstances, solids also form layers. Unlike sedimentation, the denser material does not always form the bottom layer.

When a collection of different solid particles is agitated, it is common for the particles to rearrange into layers. Gravity is a major contributor to the way these layers form. Additional factors that influence the formation of the layers are the size and shape of the particles. This process is known as classification and it depends on gravity. Without the effects of gravity, classification is not expected to occur; layers would not form.

The following activity is an example of how agitation, gravity, size, and shape combine to cause a collection of different particles to classify into layers. Students will place coated chocolate candies and mini marshmallows inside a clear plastic bag and then inflate the bag. Next, students will shake the bag to see what happens. Astronauts on the Space Shuttle will conduct the same experiment. Students will compare their results to those obtained by the astronauts.



Experiment On Earth

**PROCEDURE: Earth Control Experiment**

**Step 1.** Count out 50 candy pieces and 50 mini marshmallows. Place them in a clear plastic bag.

**Step 2.** Seal the bag except for the last few centimeters. Insert a fat straw in the gap and blow through it to inflate the bag. Quickly remove the straw and seal the bag completely.

**Step 3.** Begin shaking the bag to mix the candy and marshmallows. Try rapid and slow shaking. Are there

**MATERIALS LIST**

Coated chocolate candies
Mini marshmallows
Clear, self-sealing plastic bags
(1 gallon size)
Fat drinking straw

any differences in what happens to the particles in the bag.

**Step 4.** Shake the bag rapidly, slow the shaking, and then stop. Describe what has happened to the candy and marshmallows.

**PROCEDURE: Microgravity Experiment**

**Step 1.** Observe the videotape of the candy and marshmallow demonstration that was conducted on the Second United States Microgravity Laboratory mission (USML-2, STS-73). Note: The tape will be available from NASA Teacher Resource Centers in late 1995 or early 1996.

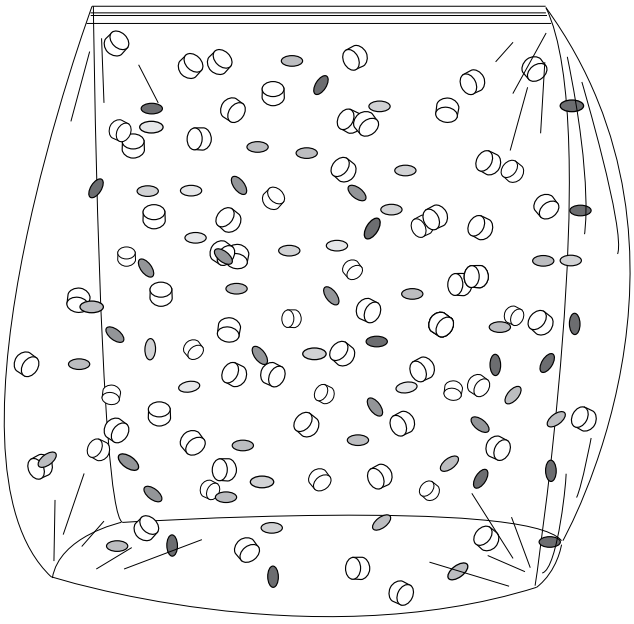
**Step 2.** Describe your observations of the movements of the candy and marshmallows in microgravity. How do they differ from the movements of the candies and marshmallows on Earth?

**QUESTIONS:**

**1.** What happens to the particles in the bag as you shake it?
**2.** Did you notice any layering of particles? If so, why did that happen?

**FOR FURTHER RESEARCH:**

**1.** Investigate what happens to two different liquids, such as mineral oil and water tinted with food coloring, when they are added together in a clear plastic bottle, shaken, and then held steady. What do you think will happen to the liquids if they are shaken together and then placed in a microgravity environment? How could you try this on Earth?
**2.** Conduct classification experiments with different particles such as candy coated nuts and mini marshmallows, dice and glass marbles, large marshmallows and mini marshmallows, and metal shot and sand. Is there any relationship between particle size, shape, and density and classification?
**3.** Try to find particles with different densities that will classify with the low density particles on the bottom.



Experiment In Microgravity