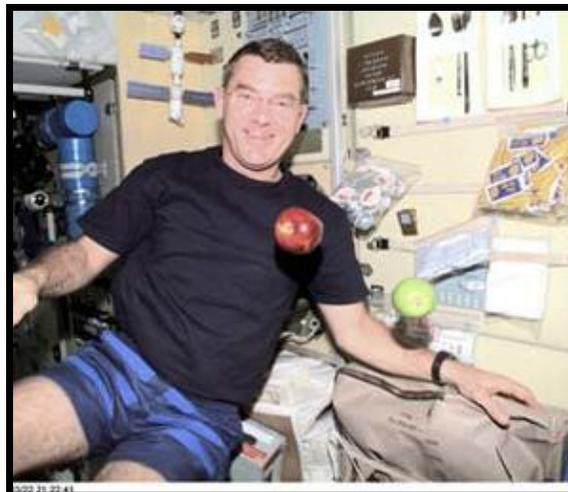


Space Food

At our Living in Space show, you will discover how astronauts do many things including eating, sleeping, exercising, and using the restroom in space! These activities may not seem challenging to do here on Earth, but in the microgravity environment of space, they are much more complicated. During this exercise your students will explore properties of matter as they prepare food like the astronauts do in space.

Space Food Background:

Surprisingly enough, astronaut food is not that different from the food we eat on Earth. Astronauts can choose from a variety of foods such as fruits, nuts, peanut butter, chicken, beef, seafood, candy, brownies, etc... Drinks include coffee, tea, orange juice, fruit punches, and lemonade.



The primary difference between space food and Earth food is the preparation method. Space food preparation varies with the food type. Some foods can be eaten in their natural form, such as brownies and fruit. Other foods are dehydrated on Earth and require adding water in space. These rehydratable foods include macaroni and cheese or spaghetti. A warming oven is available in the space shuttle and the space station to maintain temperatures of foods. There are no refrigerators in space, so space food must be stored and prepared properly to avoid spoilage, especially on longer missions.

Prior to launch, the average space shuttle weighs 4.5 million pounds. The weight of the vehicle determines the amount of fuel needed, and the fuel used contributes significantly to the cost of the launch. These costs can be reduced by eliminating some weight through the removal of water from most of the prepackaged foods. Once in space, astronauts can use water for rehydration from the Orbiter's fuel cells. The fuel cells produce electricity by combining hydrogen and oxygen gas. Since water is a useable bi-product from the fuel cells, it can be used to rehydrate food in space.

Each rehydratable food packet has a small tube used to inject the water. The amount of water needed is labeled on each food packet. To add water, a large gauge hollow needle is inserted through the tube and the water flows into the packet. Beverage packets are similar to rehydratable food packets. A straw is inserted through the same tube used for injecting water. When not in use, a clamp closes the straw.

Condiments, such as ketchup, mustard and mayonnaise, are available in packets. Salt and pepper are available in liquid form only. In their solid state, it would be impossible to sprinkle them onto food as the particles would float away. This presents a danger to the on board equipment, computers, and other supplies.

Space Food

Objective:

Students will rehydrate food, measure solids and liquids, and identify states of matter.

Standards:

Physical Science, Unifying Concepts and Processes
Measurement

Activity Procedure:

1. Show pictures of space food to the class.
2. Lead a class discussion about space food. Ask students what they know about food in space and how it may or may not be different from food on Earth. Ask why it is necessary to remove water from food prior to space shuttle launches.
3. Tell the students that they are going to make 3 different types of their own space food.
4. Provide each student with a cup of water, 3 zip lock bags, 1 spoon, and 1 straw. During the making of each food item, ask students to identify the state of matter for the dry mix. Then have them identify the change in the state of matter once the water is added to the mix.
5. Students should follow these directions to make their foods:
 - Tang: Measure 2 tablespoons of tang into the plastic bag. Fill the bag about 1/4 full of water, zip the bag, and carefully shake the bag to mix the contents.
 - Chocolate Pudding: Measure 4 tablespoons of chocolate pudding into the second zip lock bag. Add just enough water so that the pudding is not runny. Mix by squishing the bag.
 - Oatmeal: Measure 3 tablespoons of oatmeal into the last zip lock bag. Add just enough water so that the oatmeal is not runny. Squish the bag and mix the contents.
6. Once all of the food is prepared, tell the students to slowly open one corner of their drink packet and put the straw in the bag. Tighten the area around the straw so it does not move. Students can use their spoons to eat their oatmeal and pudding.
7. Dig in and enjoy!

Materials

- Tang
- Chocolate pudding
- Oatmeal
- Cup of water for each student
- 1 tablespoon per student
- 3 Zip lock bags per student
- 1 straw per student
- 1 plastic spoon per student
- Pictures of space food (see www.nasa.gov)



Space Food 3rd-5th Grade Enrichment Activity

Objective: Students will use scientific inquiry to determine the physical properties of the ingredients in a Tang or Kool-Aid mixture.

Standards:

Science as Inquiry, Physical Science
Measurement

Activity Procedure:

1. Students will conduct an inquiry investigation to determine the amount of time it takes for the water from a glass of Tang to evaporate. Students will also determine whether or not the dry mix returns to its original physical state once the water has evaporated.
2. Assign students to small groups of approximately 4 students. Have one student from each group collect the materials.
3. Each group should record predictions on how long it will take the water to evaporate, and what (if anything) will be left in the glass once the water completely evaporates.
4. Each group will follow these procedures:
 - Weigh the empty glass and record the measurement.
 - Measure the dry mix and place it in the water glass.
 - Next, measure the water according to the directions on the Tang package and mix it in the glass.
 - Weigh the Tang glass on the scale. Subtract the weight of the empty glass and record this amount as the weight of the Tang.
 - Place the glass of liquid on the scale and record the weight on the student data sheet.
 - Each day observe the amount of fluid in the glass. Weigh the glass and record the amount.
5. Once all of the water has evaporated, students will draw conclusions about the physical characteristics of the dry mix and the Tang mixture.

Materials

- Measuring cups for each group
- Measuring spoons for each group
- Drinking water
- Tang or Kool-Aid powder (1 serving per group)
- Water glasses for each group
- Student data sheet
- Scales

Extension:

Have different groups place their glasses of Tang in various locations, such as near a window that receives sunlight, in a closet, or on a table in the classroom. Compare the amount of time it takes for all of the water to evaporate for each of these glasses. Have students make predictions about which will take the longest/shortest amount of time to evaporate.

Name: _____

Student Data Worksheet

Experiment Questions: How long will it take the water to evaporate completely? What will be left in the glass once the water evaporates?

Hypothesis Sentence (My prediction):

Experiment Directions:

- 1) Weigh the empty glass _____grams
- 2) Follow Tang package directions to make the Tang.
- 3) Weigh the tang on the scale. Subtract the weight of the empty glass from this measurement.
- 4) Record the weight of the Tang in the space below.
_____ grams

Record the date of measurement and weight of the Tang:

Date_____	_____grams

Conclusion Sentence

Space Food



Re-Hydration Station

Sample Food Packets



Sample Food Packets