



FOOD FOR SPACEFLIGHT

Student Section _____

Student Name _____

This lesson will help you select and compare foods for spaceflight suitability, and package them for spaceflight.

During this lesson, you will

- select foods to test for spaceflight suitability.
- subject foods to spaceflight suitability testing based upon criteria.
- collect data by sorting foods based upon the results of the suitability for spaceflight testing.
- develop packaging for the suitable foods for spaceflight.
- develop a conclusion based upon the results of this activity.

Problem

What foods are best suited for spaceflight and what makes foods suitable for spaceflight?

Observation

As astronauts travel into space, they need energy and proper nutrition to help keep them healthy. Astronauts have to take their food with them when they go into space. There are no refrigerators in space, so space food must be specially prepared and preserved to avoid spoilage, especially on longer missions. Food preparation, or making food ready to eat, varies with the type of food. Some foods can be eaten in their natural form, such as nuts or dried fruit. Other foods require removing the water, or dehydrate, in order to preserve and store the food. The dehydrated food is prepared by adding water back to it, or rehydrated in order to return the food to the way it was when first cooked. Macaroni and cheese, and spaghetti are dehydrated foods that astronauts must prepare this way.

One of the favorite foods of the astronauts is the tortilla.

Tortillas are popular in space for several reasons. First, they are nutritious. Tortillas contain large amounts of carbohydrates that the body needs to function. Second, tortillas are easily stored since they lay flat and they don't take up too much room. Third, tortillas are one of the perfect space foods because they do not produce small, broken pieces, or crumbs.

Crumbly or loose foods can float and make the inside of the International Space Station or space shuttle unclean and become an annoyance or even a hazard to crews and equipment. Tortillas are easier to handle in reduced gravity and they also stay fresh longer than sliced bread. Making a wrap type sandwich with a tortilla requires less handling than when using two slices of bread.

Materials

Per student

- a portion size of a variety of foods for testing
- eye protection

Per group

- assorted packaging materials such as
 - zipper seal bags of all sizes
 - paper bags
 - aluminum foil
 - plastic wrap
 - recyclable storage bags
 - tape
- mailing labels or masking tape
- markers

Safety

- Review classroom rules.
- Review lab safety rules.
 - Wear eye protection.
 - Use wafting procedure.
 - Never taste in the science lab.
 - Clean up work area.
 - Dispose of waste properly.

Unlike tortillas found in restaurants, NASA's are mold resistant. The specially formulated tortillas are produced with less water than normal and are packaged in plastic bags filled with nitrogen. The tortillas taken on the ISS have a shelf life of about eighteen months.

In this activity you will select, compare, test and package foods for spaceflight suitability.

Use the first column of this KWL chart to organize your observations about foods for spaceflight. Brainstorm with your group what you want to know about foods for spaceflight, then list in the second column of this KWL chart.

KNOW	WANT TO KNOW	LEARNED

Hypothesis

Based on your observations, answer the "problem question" with your best guess about what will happen. (What foods are best suited for spaceflight and what makes foods suitable for spaceflight?) Your hypothesis should be written as a statement.

My hypothesis: _____

Test

1. Brainstorm with your teacher and class about the kinds of foods the astronauts take into space. Discuss why foods must be freeze-dried, thermostabilized, or dehydrated.
2. Place the portioned foods that your group brought for testing in one location for discussion. Observe these foods with your group. Discuss with your group why you brought the foods you did.
3. As a group, set up a list of properties that would make your food suitable for spaceflight. You will look for these properties during testing. Record these properties on the Food for Spaceflight Data Sheet.
4. What types of tests would qualify the foods for spaceflight? As a group, create tests for the foods you brought from home. These tests will discover if the food shows properties that would make them suitable for spaceflight.
5. Record your tests on the Food for Spaceflight data sheet in the student section.
6. Put on your eye protection. Remember smelling rules in the science lab and do not taste.
7. **Test** each food using the suitability tests you formulated.
8. **Collect and record data** on the Food for Spaceflight Data Sheet.
9. Based on your test and the posted criteria, decide if each food is suitable for spaceflight and check "yes" or "no" on the Food for Spaceflight Data Sheet.
10. Gather all food items that are suitable for spaceflight together. Set all other food items aside.

11. Discuss the packaging materials you have to use and determine which packaging material would be best for each food.
12. Package the foods with the food packaging material. Label each food item with mailing labels or tape and a marker.
13. **Record** the materials used for packaging each food on the Food for Spaceflight Data Sheet.

Study Data

After conducting all tests, packaging and labeling, study the data on the Food for Spaceflight Data Sheet by answering the following questions.

1. What did your testing prove?
2. What are common properties for the foods that you decided could be eaten in space?
3. What packaging material was used the most often? Why?
4. Does this data support your hypothesis? Why or why not?
5. How do your results compare to class results?

Conclusion

- Update the LEARNED column in your KWL chart.
- Restate your hypothesis and explain how the results do, or do not, support your hypothesis.

Food for Spaceflight Data Sheet

Type of food	Property to test	Test applied to food	Results of test	Suited for spaceflight?	Food packaging material used
				<input type="checkbox"/> Yes <input type="checkbox"/> No	
				<input type="checkbox"/> Yes <input type="checkbox"/> No	
				<input type="checkbox"/> Yes <input type="checkbox"/> No	
				<input type="checkbox"/> Yes <input type="checkbox"/> No	
				<input type="checkbox"/> Yes <input type="checkbox"/> No	
				<input type="checkbox"/> Yes <input type="checkbox"/> No	

Scientific Investigation Rubric

Activity: FOOD FOR SPACEFLIGHT

Student Name _____

Date _____

Performance Indicator	0	1	2	3	4
The student developed a clear and complete hypothesis.					
The student followed all lab safety rules and directions.					
The student followed the scientific method.					
The student recorded all data on the data sheet and drew a conclusion based on the data.					
The student asked engaging questions related to the study.					
The student conducted all food tests they designed according to the spaceflight criteria.					
Point Total					

Point total from above: _____ / (24 possible)

Grade for this investigation _____

Grading Scale:

A = 22 - 24 points

B = 19 - 21 points

C = 16 - 18 points

D = 13 - 15 points

F = 0 - 12 points