

Whatever Will I Eat?

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.

Whatever Will I Eat?

Astronauts work closely with nutritionists at NASA's Johnson Space Center to plan menus that will satisfy them while on missions ranging from 2 weeks to 6 months in duration. Nutritionists ensure that each astronaut will get the proper nutrition and caloric intake to sustain their body's needs while in space. These needs vary for each astronaut.



Eight to nine months prior to a Space Shuttle mission, astronauts plan their menus. First, they meet with



nutritionists to test the food items available. Next they select their menu, which can include repeating days or non repeating days. They must choose breakfast, lunch, and dinner. Snacks are also included with their meals. Nutritionists then review the menu to ensure that each astronaut is meeting their own specific dietary needs.

Vitamin and mineral needs are significantly different for humans while in space. The amount of iron consumed in space must be limited to 10 milligrams per day for men and women. This is due to the fact that most of the iron from the food we eat goes into new red blood cells. Since astronauts have fewer red blood cells while they are in space, an excessive intake could cause health problems. Sodium and Vitamin D intake also must change in space. Sodium intake is reduced to reduce bone loss experienced in space. Vitamin D intake is increased to aid in bone health. In addition, lack of exposure to sunlight prevents the body from producing this vitamin as it does on Earth.

Astronauts going on long duration missions to the International Space Station (ISS) work with nutritionists from the Russian Space Agency as well since their menu includes both Russian and American food. Due to the nature of long duration space flight, an ISS astronaut's food may arrive long before the astronaut arrives at the ISS.

For future missions to the Moon and Mars, crops will be grown in space. Due to the long duration of these missions, it is not possible to carry the required amount of food on the spacecraft. These crops may include potatoes, soybeans, wheat, peanuts, dried beans, lettuce, spinach, tomatoes, herbs, carrots, radishes, cabbage, and rice.

The astronauts that will go back to the Moon, build a lunar base, and go on to Mars are sitting in your classrooms right now! NASA says these astronauts are currently between the ages of 5 and 20 years old!

Whatever Will I Eat?

Below are some typical menus astronauts have actually eaten in space on their missions. Individual astronaut menus for current missions are posted at http://www.nasa.gov/mission_pages/shuttle/main/index.html. Scroll down and click on the *More about the Crew* link. Each astronaut's menu link is next to their picture.

Plan your menu according to these guidelines:

1. Calculate your calorie needs at <http://www.bcm.edu/cnrc/?PMID=0> or by allotting for at least 1800-2000 calories based on gender.
2. Plan a breakfast, lunch, and dinner menu for all five days of the school week to include beverages, entrees, and snacks.
3. Menus must include at least 3 vegetables, 3 fruits, 2 protein items, and 2 carbohydrates for each day.
4. Plan carefully since these are the foods you will eat while on your mission.

LUNCH

This is a typical lunch for an astronaut. Here is what Mission Specialist, Stephen Bowen had for lunch on day 9 of mission STS-126.

Grilled Pork Chop	T	Thermostabilized
Mashed Potatoes	R	Rehydratable
Cauliflower w/ Cheese	R	Rehydratable
Applesauce	T	Thermostabilized
Cashews	NF	Natural Form
Butter Cookies	NF	Natural Form
Tea w/Sugar x 2	B	Beverage



BREAKFAST

This is a typical breakfast for an astronaut. Here is what space shuttle commander Rick Sturckow chose for breakfast during flight day 3 on mission STS-128.

Dried Apricots	IM	Intermediate Moisture
Sausage Pattie	R	Rehydratable
Seasoned Scrambled Eggs	R	Rehydratable
Tortilla x 2	FF	Fresh Food
Vanilla Breakfast Drink	B	Beverage
Orange-Pineapple Drink	B	Beverage
Metamucil Wafers, Apple	NF	Natural Form



DINNER

Shuttle Commander, Eileen Collins, had the following meal for day 11 of mission STS-114.

Noodles & Chicken	R	Rehydratable
Rice & Chicken	R	Rehydratable
Vegetable Risotto	R	Rehydratable
Green Beans w/ Mushrooms	R	Rehydratable
Tapioca Pudding	T	Thermostabilized
Tropical Punch	B	Beverage