

# Nutrition in Space

**Grade Level:** 5

**Time Required:** 6 - 10 days  
(using sun as energy source)  
two 45 minute class periods  
(using oven as energy source)

**Countdown:**

Fruits (i.e. apples, bananas, grapes)  
Vegetables (i.e. celery, carrots, tomatoes)  
Knife  
Cheese Cloth  
Drying Trays (i.e. cookie sheet or aluminum foil pieces)  
Gram scale and masses

**Suggested TEKS:**  
Math - 5.11 5.14  
Science - 5.2

**Suggested SCANS:**  
Information. Acquires and evaluates information.  
**National Science and Math Standards**  
Science as Inquiry, Life Science, Science In  
Personal and Social Perspectives, Science and  
Technology, Physical Science, Measurement,  
Reasoning, Observing, Communicating

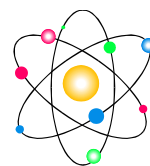
**Ignition:**

In 1959, NASA started planning for manned space travel and was challenged by the problem of how and what to feed astronauts. Two basic concerns arose:

- (1) preventing food crumbs from contaminating the spacecraft's atmosphere and
- (2) preventing the formation of potentially catastrophic disease-producing bacteria, viruses, and toxins.

To solve these problems, NASA hired the Pillsbury Company. The first solution was to coat bite-size food like sandwich cubes, thereby preventing crumbling. Also, as in Apollo, food like ham salad was packaged into toothpaste-type tubes and squeezed out. The second solution was more difficult. Pillsbury developed the HACCP (Hazard Analysis and Critical Control Point) concept. This procedure involves a systematic study of the food product to be produced and packaged, along with the processing conditions, handling, storage, packaging, distribution, and package directions for consumer use. The stages in the chain from raw materials to finished product are constantly monitored.

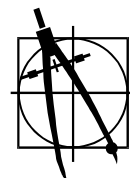
Due to lack of storage space and refrigerators on most manned spacecrafts, NASA has found that the method of dehydration and freeze-dried foods is an effective answer to feeding astronauts. The ancient method of dehydration serves two purposes: (1) to dry food, thereby reducing its moisture to between 5% and 25% and eliminating bacteria which cause decay and (2) to preserve food for future use without concern for an expiration date.



### **Liftoff:**

According to time and resources available, choose between using sun energy (which could require 10 days) and using the oven.

1. Make sure that your fruit is fully ripe.
2. Have students weigh each fruit and vegetable before drying and record weights in the table provided.
3. To use the sun method:
  - Cut the food into medium chunks (except the grapes, which should be left whole, either in a bunch or separated).
  - Place fruits and vegetables on drying trays outside and cover with cheesecloth. Dry on one side, then turn and dry on the other side. This should take 6 - 10 days.
4. To use the oven method:
  - Slice the fruit and vegetables one-eighth inch thick; put in a single layer on the drying trays. (Do not try the grapes in the oven because of their skin.)
  - Place in a 120 F oven for 8 - 12 hours.
5. Ask the students to weigh the dried fruit and vegetables. Record new weights in the table, and determine the mass/water weight loss.



### **Conclusion:**

1. Compare and contrast the process of dehydration with the processes of freezing and canning. Suggest that in other environments refrigerators may not be readily available. Ask for suggestions of other possible food storage.
2. Discuss the types of energy used. Predict energy sources that may be accessible in the future in different environments such as the moon and planets, most notably Mars.



### More Ideas:

- ◆ Extend the measurements in the table to include the ratio of loss of mass to beginning mass and the percentage of water in a variety of different fruits and vegetables (pear, pineapple, potato, squash, mushroom).
- ◆ Preserve meats (i.e., ham, beef, chicken, lamb) by sun or oven drying. Use extra care when drying meats due to the possibility of spoilage. The drying time for meat is about 3 days if done outdoors (although this method is not recommended) and several hours in the oven.
- ◆ Make jerky, using the following recipe.

#### *Jerky*

1 1/2 lbs. Lean, boneless meat (beef flank, brisket, top round steak, venison, turkey)  
1/4 cup soy sauce  
1 T. pepper  
1/4 t. garlic powder  
1/2 t. onion powder  
1 t. liquid hickory smoke  
Flavored salt  
Hot sauce/Tabasco (optional)

Partially freeze the meat to be used so that slicing will be easier. Trim and discard all fat from the meat. Cut the meat into 1/8 to 1/4-inch thick slices. In a bowl, combine sauces and seasonings until dissolved. Add the meat strips and coat thoroughly. Cover tightly; let stand overnight in the refrigerator. Shake off the excess liquid; sprinkle coarse black pepper on both sides. Arrange the meat strips close together, single layer, directly on the oven racks with shallow rimmed pans underneath. Dry the meat at 150 - 200 degrees F until it turns brown, feels hard, and is dry to the touch. Cooking time for chicken and turkey is about 5- 6 hours, 4 - 7 hours for beef and venison. Pat off any beads of oil. Cook and store in airtight plastic bags or jars with tight fitting-lids.

# The Effects of Dehydration on Fruits and Vegetables

<b>Food Sample</b>	<b>Mass (before drying) (g)</b>	<b>Mass (after drying) (g)</b>	<b>Loss of Mass (g)</b>