



Family in kitchen; NASA File Photo

Students explore the breakdown of food into chemical components used for various purposes in the body.



**Main Lesson Concept:**

Food provides molecules that serve as fuel and building material for all organisms.



**Scientific Question:**

Why do living things need food? How is food used by living things?

Objectives	Standards
<ul style="list-style-type: none"> <li>Students will record observations of what happens to food when they eat it.</li> <li>Students will describe the important roles that sugars, vitamins, minerals, water, proteins, and blood play in their bodies.</li> <li>Students will illustrate and describe the process that our bodies use to break down food, the parts that make up the food, and why each is important.</li> </ul>	<p><b>Partially meets:</b> 2061: 5E (6-8) #1</p>

Assessment	Abstract of Lesson
<p>Breaking down food observations, illustrations, and explanations in Astro Journal.</p>	<p>Students eat a piece of food and make observations to explore why living things need food and how living things use it. They also act out the breaking down of food into chemical components and serving different functions in the human body. Students illustrate and explain what happens to food, the parts of food, and the role or purpose of each. They discuss the conservation of matter as it relates to breaking down food.</p>



Prerequisite Concepts	Major Concepts
<ul style="list-style-type: none"> <li>Humans need water, oxygen, food, gravity, a moderate temperature and protection from poisonous gases and high levels of radiation to survive. (Astronomy Lesson 1)</li> <li>Some source of energy is needed for all organisms to stay alive and grow. (2061: 5E (3-5) #2)</li> <li>From food, people obtain energy and materials for body repair and growth. The indigestible parts of foods are eliminated. (2061: 6C (3-5) #1)</li> <li>All matter is made up of atoms, which are far too small to see directly through a microscope. Atoms may stick together in well-defined molecules or may be packed together in different arrays. Different arrangements of atoms into groups compose all substances. (2061: 4D (6-8) #1, Atmosphere Lesson 2)</li> <li>Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties. In chemical reactions, the total mass is conserved. (NSES: B 5-8 #1.2, Atmosphere Lesson 4)</li> <li>Oxygen is important to humans because it helps convert sugars into energy in the cells. (Atmosphere Lesson 5)</li> </ul>	<ul style="list-style-type: none"> <li>Food is made up of molecules.</li> <li>We break down these molecules and separate out what we need and don't need.</li> <li>Some of the molecules are used to rebuild tissue, bones, etc.</li> <li>Some molecules are used as fuel for energy.</li> <li>Water plays an important role as a key ingredient of blood that allows it to break down and transport nutrients throughout the body and to regulate body temperature.</li> </ul>



**Suggested Timeline (45-minute periods):**

- Day 1: Engage, Explore – Part 1, and Explain – Part 1 sections
- Day 2: Explore – Part 2, Explain – Part 2, Explore – Part 3, and Explain – Part 3 sections
- Day 3: Extend and Evaluate sections



**Materials and Equipment:**

- A class set of Astro Journal Lesson 2
- A piece of apple, carrot, celery, or any other fruit or vegetable for each student
- Knife to cut food
- Each group of six will need 6 signs or nametags that can be stuck on or worn around the neck and that read: “Sugars,” “Vitamins,” “Minerals,” “Proteins,” “Water,” and “Waste”
- 1 set of 6 signs or nametags that can be stuck on or worn around the neck and that read: “Host Person,” “Sugars,” “Calcium,” “Protein,” “Vitamin C,” and “Blood”
- Tape or string for signs
- White paper for illustrations for each student
- Chart paper
- 3 signs or nametags that read: “Blood,” “Sodium (Na),” and “Chloride (Cl)” (optional)
- 1 cracker for each student (optional)



**Preparation:**

- Duplicate a class set of Astro Journals.
- Prepare signs or name tags.
- Gather and cut up food.
- Prepare classroom. (Make sure there is enough room for the Breaking Apart of Food Activities in Explore Part 2 and Explore Part 3 sections.)
- Prepare chart paper with major concept of the lesson to post at the end of the lesson.

Differentiation
<p><b>Accommodations</b> For students who may have special needs: Have them work with a partner on the Astro Journal writing or report orally to the teacher.</p>
<p><b>Advanced Extensions</b> Research and report on the following questions: What is caffeine? What does it do? Does it provide energy? Prepare a poster or short presentation for the class.</p>

## Engage

(approximately 15 minutes)



Family on beach; NASA File Photo

### 1. Review Astronomy Lesson 1.

- Question: In Astronomy, what did you learn are the basic requirements that humans need to survive?
- Answer: *The basic requirements that humans need to survive are water, oxygen, food, gravity, a moderate temperature, and protection from poisonous gases and high levels of radiation.*

### 2. Draw on students' prior knowledge of where humans get their energy.

- Say: Energy is not one of the basic requirements listed for human survival.



- Question: Is energy important for human survival? Explain your answer.
- Answer: *Energy is important for human survival. Energy is needed so we can move, grow, and function.*
- Question: Where do we get our energy?
- Answer: *We get our energy from the food we eat.*
- Question: What is food made of?
- Answer: *(Allow students to share their ideas. Students may answer by naming specific ingredients that food is made up of.)*
- Question: What do you think makes up of each of the ingredients that you named?
- Answer: *(Allow students to share their ideas. Student responses may include that each of the ingredients is made up of atoms or molecules.)*

### 3. Review information about atoms and molecules from Atmosphere Lesson 2.

- Question: In Atmosphere, what did you learn are the building blocks of all matter?
- Answer: *The building blocks of all matter are atoms.*
- Question: What forms when atoms bond with other atoms?
- Answer: *Molecules form when atoms bond with other atoms.*
- Question: Is food made of matter?
- Answer: *Yes, food is made of matter.*
- Question: How do you know that food is made of matter?
- Answer: *(Accept all reasonable answers. Students may respond that foods are solids and liquids or that foods take up space.)*
- Question: What kind of matter is food made up of?
- Answer: *Food is made up of molecules.*
- Question: What do you think happens to those molecules when we eat food?
- Answer: *(Allow students to share their ideas on this.)*

### 4. Introduce the purpose of the lesson.

- Say: Today, we are going to look at the importance of food for all organisms.



## 5. Introduce the Scientific Question.

- Say: The Scientific Question we will be exploring is:
  - Why do living things need food? How is food used by living things?

### Explore – Part 1

(approximately 20 minutes)



Astronauts eating space food in wardroom of Skylab trainer; NASA

#### 1. Ask students to hypothesize/predict what happens to food when they eat it.

- Question: What happens to food when you eat it?
- Have students record their hypothesis/prediction in the Hypothesis/Prediction section of their Astro Journals.



**MISCONCEPTION:** Students tend to use the term “food” in ways that are consistent with the everyday meaning of food, and not the biological meaning. They have little information about food being transformed and made part of a growing organism’s body. The Eating Food Activity below will help to teach the concept that food is broken down and that some is used for building material, some as energy, and some as waste.

## 2. Begin Eating Food Activity.

- Give each student a piece of apple, carrot, celery, or any other fruit or vegetable that you think most students would eat.
- Ask students to take a small bite of their piece of fruit or vegetable.
- Say: As you bite into your piece of food, think carefully about what your body is doing to this piece of food.
- Explain to the students that they are going to eat the rest of the food. Encourage the students to eat their food slowly so that they can think about what is happening to the food as they eat.



- Say: As you eat the food, write observations in your Astro Journal about what is happening in your body.

**\* Note to Teacher: Depending on the age and level of your students, you can have students complete this part of the activity on their own, or you can provide leading questions to help the students with their observations.**

## Explain – Part 1 (approximately 10 minutes)



Astronaut preparing meal on middeck of Space Shuttle; NASA

### 1. Have students share their observations from the activity.

- Question: What observations did you make while eating your food?
- Answer: *(Allow students to share their observations. Student responses may include that teeth break down the food into smaller parts, that saliva helps the food to become soft and mushy, and that the food is swallowed and goes down into the stomach.)*

### 2. Discuss student conclusions from the activity.

- Question: What happened to the size of the food as you ate it?
- Answer: *The food was broken into smaller pieces.*
- Question: Did the amount of food change while you were eating it? Explain your answer.
- Answer: *No, the amount of food did not change while I was eating it. The food was broken into smaller pieces, but the total amount of food remained the same.*
- Question: Do you think the food continues to be broken into smaller pieces over time?
- Answer: *Yes, the food continues to be broken into smaller and smaller pieces over time.*



## Explore – Part 2

(approximately 10 minutes)



Vegetable assortment; NASA File photo

### 1. Guide students in the Breaking Apart of Food Activity.

- Place six students in each group.

**Note to Teacher: If you are short on time or materials, the following activity could be completed as a demonstration by one group of students.**

- Have each student in the group put on one of the signs for this activity. These signs can be taped on or worn using string. There should be enough students so that one student has each of the following signs: Sugars, Vitamins, Minerals, Protein, Water, and Waste.

**Note to Teacher: Many students will not be comfortable wearing the “Waste” sign. A discussion prior to handing out the signs might be needed depending on the age level of your students. If the “Waste” sign is going to cause too many problems, you could modify this activity and use an object in the classroom to represent the waste.**

- Have the students in each group get together in a tight cluster with their arms linked.
- Say: You are forming a piece of an apple. Be prepared because a person is about to eat the apple.
- Have the students move slightly up, down, and around while staying connected to represent the teeth and mouth of a person beginning to eat the apple.
- Say: Now slowly let go of each other’s arms and begin walking away from each other.
- Have students record their observations of this activity in their Astro Journal.



## Explain – Part 2

(approximately 15 minutes)



Vitamin and mineral assortment; NASA File photo

### 1. Discuss student observations from the Breaking Apart of Food Activity.

- Question: What observations did you make during this activity?
- Answer: *Allow students to share their ideas. Student responses may include that the chemicals in food break apart as we eat the food.*
  
- Question: What substances did you learn make up food?
- Answer: *Substances that make up food are sugars, vitamins, minerals, proteins, water, and waste.*
  
- Question: What happened to the substances when the food was eaten?
- Answer: *The substances broke apart from each other.*
  
- Question: What do you think your body uses each of these substances for?
- Answer: *(Allow students to share their ideas.)*
  
- Question: Do you think that all of these substances are used for the same purpose? Explain your answer.
- Answer: *No, all of these substances are not used for the same purpose. Waste, for example, is released out of the body and is not used.*
  
- Question: What is an example of a vitamin?
- Answer: *(Accept all correct answers. One vitamin that students may name is vitamin C.)*
  
- Question: What is a food that contains vitamin C?
- Answer: *(Accept all correct answers. Students may respond that an orange is a food that contains vitamin C.)*
  
- Question: Why do you need to eat foods with vitamin C?
- Answer: *(Allow students to share their ideas. Students may know that you need vitamin C to help fight colds.)*
  
- Say: Vitamin C is important to your body for a variety of reasons. Two of these are because it helps fight against infections, and it is needed for tissue growth and repair.



- Question: What is an example of a mineral?
- Answer: (Accept all correct answers. Students may not be familiar with examples of minerals. One common mineral is calcium.)



**Note to Teacher: Students may ask what the difference between a vitamin and a mineral is. A vitamin is a complex chemical created by plants or animals. A mineral is a chemical element such as calcium, iron, potassium, sodium, and zinc.**

- Question: Calcium is a mineral that you eat every day. What foods contain calcium?
- Answer: (Accept all correct answers. Student responses will most likely include milk or other dairy products.)
- Question: Why do you need to eat or drink foods with calcium?
- Answer: (Allow students to share their ideas. Students may know that calcium is important for healthy bones.)
- Say: Calcium is important to your body because it is part of your bones.
- Question: In Atmosphere Lesson 7, you learned about a gas that makes up 78% of our atmosphere. Do you remember what this gas was?
- Answer: Nitrogen is the gas that makes up 78% of our atmosphere.
- Question: Do you remember why nitrogen is important to our bodies?
- Answer: (Allow students to share their ideas. Students may remember that nitrogen contributes to the air pressure necessary to support our bodies and that nitrogen makes up proteins.)
- Say: Proteins are important to our bodies because our skin, hair, and muscles are made up of proteins. Proteins are also what make up our genes.
- Question: Why do you think water is important in your body?
- Answer: (Allow students to share their ideas. Students may respond that without water they would dehydrate or that their body needs water to function. Students may recall this information from Astronomy Lesson 1.)
- Say: Water is very important to us, making up 70% of our bodies. Without it, we would not be able to function. An important role that water plays in our body is that it is a key ingredient of our blood. Water gives our blood its fluid form. Without water, our blood would be a gel-like substance.
- Question: What do you notice happens when you put salt in water?
- Answer: (Students may have noticed that salt dissolves in water.)
- Say: Water allows salt and other molecules to separate into individual elements so that they can be used for important functions like bone growth or muscle movement. Water also enables blood to easily transport nutrients to the proper locations and regulates our body temperature.



**\* Note to Teacher: You may want to have students act out the solubility of water by having one student be blood with their arm on the shoulder of another student representing water. Have two people with arms linked represent salt. One person is sodium (Na), and the other is chloride (Cl). When the salt comes in contact with the water, the sodium and chloride should separate, each going in a different direction.**

- Say: So far we have discussed vitamin C, calcium, proteins, and water. We have explained how each of these molecules can be used as building materials.
- Question: At the beginning of this lesson, we talked about energy being essential for survival. What part of food provides this energy?
- *Answer: (Allow students to share their ideas. Encourage students to think about the parts of the food that were modeled in the Breaking Apart of Food Activity. Through the process of elimination, students may be able to conclude that sugars provide energy.)*
- Say: Sugars in food are used as fuel for energy.
- Question: Are all sugars the same?
- *Answer: (Students may know that there are different kinds of sugars in fruits and vegetables than in candy.)*
- Say: Sugars in candy are simple sugars, which are very easy to digest giving us a quick burst of energy. Sugars in fruits and vegetables are more complex, digest more slowly, and provide energy over a longer period of time. That's why dieticians recommend that we eat less candy and more fruits and vegetables.

**\* Note to Teacher: With older students you may want to introduce them to the term “carbohydrate.” Throughout this unit, when we talk about sugars, we are really talking about carbohydrates. Sugars are one type of carbohydrate. Starches like potatoes and rice are also carbohydrates, but we don't think of them as sugars, because they aren't sweet. However, you can illustrate that starches are composed of sugars by having them chew on a cracker for at least two full minutes, allowing their saliva to partially digest the cracker. They will eventually be able to taste the sugars that make up the starches in the cracker.**

- Question: Do we use all parts of food, when we eat it?
- *Answer: No, some parts we do not use.*
- Question: What happens to the part we don't use?
- *Answer: Our bodies discard it as waste.*



## Explore – Part 3

(approximately 15 minutes)



Bread assortment; NASA File photo

### 1. Lead students in the second part to the Breaking Apart of Food Activity.

- Say: We just discussed the importance of substances such as sugars, vitamins, and minerals. Now we are going to demonstrate the roles of some of these substances.
- Choose six students from the class to participate in this demonstration.



**Note to Teacher:** This activity is best completed as a demonstration so that you can talk the class through the role of each substance. This activity could be completed as a group activity with six students in each group if a script was given to each group with the following information.

- Assign one person in each group to be the “host person.” Have this person put on the sign that says “Host Person.”
- Have each student in the group put on a sign to play one of the following roles: sugars, calcium, proteins, vitamin C, and blood.
- Explain to students that each of these substances plays a very important role in your body.
- Have the “host person” stand in the middle where everyone can see him/her.
- Have the students representing the substances stand in a circle around him.
- Explain to students that during this activity the “blood” student will need to transport the other substances to the proper location on the “host person.”
- Question: Why is calcium important to our bodies?
- Answer: *Calcium is important to our bodies because it builds bones.*
- Have the “blood” student hold the hand of the “calcium” student and transport them to the bones in the arm of the “host person.” The “calcium” student can then put his/her hand on the bones in the arm of the “host person.”



- Question: Why are proteins important to our bodies?
- Answer: *Proteins are important because our skin, hair and muscles contain proteins. Proteins are also what make up our genes.*
- Have the “blood” student hold the hand of the “proteins” student and transport him/her to the hair of the “host person.” The student can then put his/her hand on the hair of the “host person.”
- Question: Why is vitamin C important?
- Answer: *Vitamin C is important to your body for a variety of reasons. Two of these are because it helps fight against infections, and it is needed for tissue growth and repair.*
- Have the “blood” student hold the hand of the “vitamin C” student and transport him/her to the tissues of the other arm of the “host person.” The student can then put his/her hand on the tissues in the arm of the “host person.”
- Question: Why are sugars important?
- Answer: *Sugars are used as fuel for energy.*
- Have the “blood” student hold the hand of the “sugars” student and transport them to the “host person.”
- Have the “sugars” student put his/her hands on the back of the “host person.” The “sugars” student should gently move the “host person” around. This is representing the “sugars” student providing the “host person” energy.
- Have students record their observations of this activity in their Astro Journal.

## Explain – Part 3

(approximately 5 minutes)



Protein assortment; NASA File photo

### 1. Discuss student observations from the second part of the Breaking Apart of Food Activity.

- Question: Does food disappear when we eat it?
- Answer: *No, food does not disappear when we eat it.*



- Question: What happens to the food in your body?
- Answer: *The food is being broken down into parts.*
- Question: When the food is broken down into parts, does the amount of matter change?
- Answer: *No, the amount of matter does not change. The matter is just broken down into smaller parts.*
- Say: We talked earlier in the lesson about the fact that food is made up of molecules.
- Question: What happens to these molecules when we eat food?
- Answer: *The molecules are broken down to form new substances.*

## 2. Review chemical reaction information from Atmosphere Lesson 4.

- Question: Because the molecules interact and a new substance is produced, what would you call this?
- Answer: *When molecules interact and a new substance is produced, it is called a chemical reaction.*
- Say: Combining molecules into new molecules is only one kind of chemical reaction.
- Question: Can you think of some other ways that molecules might change?
- Answer: *(Allow students to discuss their ideas about this. Student responses may include that molecules can be broken down into parts, or that parts of the molecule might be replaced with different parts. They may recall this from Atmosphere Lesson 4.)*
- Question: During a chemical reaction, does the amount of matter change? Is matter created or destroyed during a chemical reaction?
- Answer: *No, the amount of matter does not change. It is neither created nor destroyed during a chemical reaction.*



## Extend/Apply

(approximately 30 minutes)



Fruit assortment; NASA File photo

### 1. Introduce students to the What Happens to Food When You Eat It Activity.

- Say: You have been asked to illustrate for elementary students what happens to food when you eat it. Using your knowledge from this lesson, draw a series of pictures that show what happens to food when you eat it. Then add in descriptions and labels for each drawing.
- Have students follow the directions in their Astro Journal for this activity.

## Evaluate

(approximately 15 minutes)



Dairy assortment; NASA File photo

### 1. Have students share their illustrations for the What Happens to Food When You Eat It Activity.

### 2. Discuss students' responses in their Astro Journals to ensure they have mastered the major concepts.

- Question: Why do living things need food?
- Answer: *Living things need food because it gives energy so that living things can move, grow, and function. It also provides nutrients to use as building materials.*



- Question: How is food used by living things?
- Answer: *When living things eat food, the food is broken down into molecules. Living things use some of the molecules, such as calcium as a building material, while some such as sugars are used for fuel. Molecules that are not needed are released as waste.*
- Question: Why is water important in living things?
- Answer: *Water is important in living things because it is a key ingredient in the blood allowing it to break down and transport nutrients throughout the body and regulate body temperature.*
- Question: So, if you were looking for or designing a habitable planet for humans, what would you need to make sure the planet had?
- Answer: *The planet would need to have food and water for human survival.*

### 3. Collect students' Astro Journals and evaluate them to ensure that they have mastered the major concepts:

- Food is made up of molecules.
- We break down these molecules and separate out what we need and don't need.
- Some of the molecules are used to rebuild tissue, bones, etc.
- Some are used as fuel for energy.
- Water plays an important role as a key ingredient of blood that allows it to break down and transport nutrients throughout the body and to regulate body temperature.

### 4. Bridge to next lesson.

- Say: Today, we learned the importance of food for all organisms. In the next lesson, we will learn how plants make their own food.



**Note to Teacher:** After each lesson, consider posting the main concept of the lesson some place in your classroom. As you move through the unit, you and the students can refer to the “conceptual flow” and reflect on the progression of the learning. This may be logistically difficult, but it is a powerful tool for building understanding.







## Astro Journal Biology Lesson 2: The Importance of Food

Name \_\_\_\_\_ Date \_\_\_\_\_ Class/Period \_\_\_\_\_

### What Happens to Food When You Eat It Activity

You have been asked to illustrate for elementary students what happens to food when you eat it. Using your knowledge from this lesson, draw a series of pictures that show what happens to food when you eat it. Then add in descriptions and labels for each drawing.

**Directions:**

1. Begin your drawings with a picture of a person eating food.
2. The drawings should show what is happening to the food as it is broken down, what parts make up food, and how each of these parts are used by your body.
3. The descriptions and labels should explain each picture in detail. Be sure to include why living things need food and how the food is used by living things.

Your illustrations will be evaluated using the following rubric:

<b>4</b> Expectations Exceeded	<ul style="list-style-type: none"> <li>• Illustrations clearly and accurately explain what happens to food when you eat it.</li> <li>• Illustrations have all required parts and uses good reasoning to create exceptionally powerful and detailed descriptions.</li> </ul>
<b>3</b> Expectations Met	<ul style="list-style-type: none"> <li>• Illustrations clearly and accurately explain what happens to food when you eat it.</li> <li>• Illustrations have all required parts and uses good reasoning in descriptions.</li> </ul>
<b>2</b> Expectations Not Quite Met	<ul style="list-style-type: none"> <li>• Illustrations are not completely clear or accurate in explaining what happens to food when you eat it.</li> <li>• Illustrations have most required parts and use some good reasoning in descriptions.</li> </ul>
<b>1</b> Expectations Not Met	<ul style="list-style-type: none"> <li>• Illustrations are not clear or accurate in explaining what happens to food when you eat it.</li> <li>• Illustrations are not clear or accurate in explaining what happens to food when you eat it, are missing several parts, and use little or no good reasoning.</li> </ul>