



# *What's The Matter With My Orange?*

## *Student Responsibilities*



### *Before You Begin...*

- 1) Read this page completely.
- 2) Make sure that you have the following supplies: scale, Data Sheet #1.
- 3) If you are sensitive to mold, you will want to take precautions (i.e., take the jars outside or use a vent hood) before opening the jarred oranges.

### *What To Do*

- 1) Record observations on Data Sheet #1. Rely on your senses of sight, touch, and smell. Remember to keep the ZipLoc bag closed during observations.
- 2) Record the mass of each orange on Data Sheet #1.
- 3) Make a prediction/hypothesis for changes that may occur by next week.
- 4) Display your observations at the center. (See your teacher for more information.)

### *After You Finish*

- 1) Check the area to make sure it looks neat and clean.
- 2) Return all materials safely to their place and **WASH YOUR HANDS.**
- 3) Schedule a time with your teacher to share your findings with the class.



*What's the Matter with My Orange?*  
*Background Information*



## *Bacteria*

### *What is it?*

Bacteria is a common name which represents a group of one-celled microscopic organisms.

These organisms are neither plants nor animals, but are classified as monerans. There are literally thousands of different types of bacteria.

### *How does it relate to this activity?*

The oranges in sealed containers provide the right conditions for bacteria to grow. These bacteria help to decompose the orange by feeding on its stored energy. You can actually view these bacteria on a wet slide with a 400x microscope.

### *Did you know?*

People cannot live without bacteria. Bacteria help to decompose plant and animal matter back to nutrients that sustain ecosystems. Bacteria present in your stomach aid in digestion. Bacteria are used by people to make foods such as yogurt and cheese. There are bacteria that can harm humans, such as the bacteria in untreated water that can spread cholera or the bacteria in meat that can cause botulism (food poisoning), but these bacteria are far outnumbered by bacteria that are beneficial to us.



## *What's the Matter with My Orange? Background Information*



# *Decomposition*

### *What is it?*

Decomposition is the process by which matter is broken down into nitrogen and other basic elements by bacteria, fungi, and other consumers. Decomposition is a chemical change since the properties of the object have changed and new substances (nitrogen, carbon, etc.) are produced.

### *How does it relate to this activity?*

Oranges in sealed containers cannot release their moisture to the atmosphere. This moisture, along with air and the energy of the orange, provide an excellent place for the growth of bacteria and fungi. The bacteria and fungi soften the skin and eventually break through to get the energy stored in the orange. Over time the bacteria and fungi will convert the orange into nitrogen, alcohol, and other matter produced through their waste products.

### *Did you know?*

All organic matter (plants, animals, plant and animal products, etc.) will eventually decompose. As a result, nitrogen, water, and other matter will be cycled back to the Earth.



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# *Dehydration*

## *What is it?*

Dehydration is the process by which solid matter loses its moisture through evaporation.

Dehydration is a physical change since the properties of the object have not changed and a new substance is not produced.

## *How does it relate to this activity?*

The skin of the orange has openings that are large enough to allow water molecules to escape, but small enough to slow bacterial and fungal growth. When left exposed to the air, oranges lose their moisture before bacteria and fungi are able to break down the skin of the orange. The result is a mummified orange which still has skin and pulp, but very little moisture.

## *Did you know?*

Egyptian mummies were preserved for thousands of years through the process of dehydration.



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# *Fermentation*

## *What is it?*

Fermentation is a process by which organic matter can be broken down into complex molecules when little oxygen is present. Fermentation is a chemical change since the properties of the object have changed and a new substance is produced.

## *How does it relate to this activity?*

When the sealed oranges were first put in their containers, there was enough oxygen trapped inside to promote the growth of yeast (a fungi). Once the oxygen was used up in the container, the yeast stopped reproducing and survived by changing the sugar in the orange into alcohol and carbon dioxide. The sweet odor coming from these sealed containers is a gas from the alcohol that is being produced.

## *Did you know?*

- Grape farmers produce wine through a similar process.
- Your body ferments the sugar made from digesting food when you exercise. If you exercise too rigorously, the waste product of fermentation (lactic acid) will cause a muscle cramp.



## What's the Matter with My Orange? Background Information



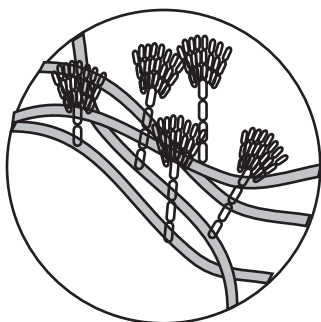
# Food Chains/Webs

### *What are they?*

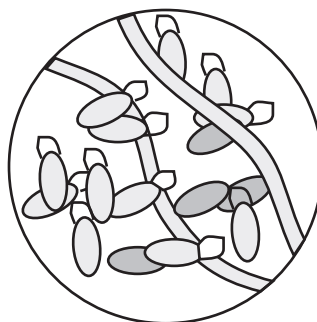
A food chain shows the energy connections between living things. Orange >>> bacteria is a food chain that illustrates bacteria getting energy from an orange. A food web shows multiple food chain connections among living things within an ecosystem. A food web for the oranges in sealed containers is shown below.

### *How does it relate to this activity?*

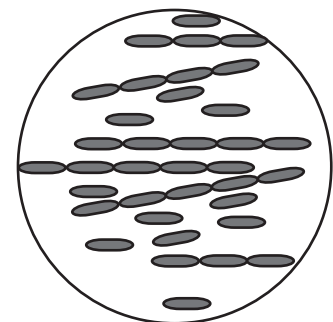
The oranges in sealed containers provide the right conditions for microscopic life such as bacteria, mold, and yeast to grow. These living things get their energy from the orange.



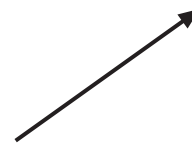
mold



yeast



bacteria



orange

Images are magnified approximately 400 times their actual size.





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# *Needs of Living Things*

Living things need the following to grow and reproduce:

**space**  
**water**  
**energy**  
**air**

Combine these four with **time** and you have a great acronym--SWEAT.

## *How does it relate to this activity?*

The sealed containers provide an environment that allows living things to grow and reproduce. The *energy* and *water* stored in the orange combined with the *air* and *space* in the jar allow for the growth of fungi (such as yeast) and bacteria over *time*.

## *Did you know?*

Air provides different needs for different living things. While animals use oxygen from the air, plants use carbon dioxide from the air. Some bacteria even use nitrogen from the air!



## What's the Matter with My Orange? Background Information



# Physical vs. Chemical Change

### What is it?

#### Physical Change

- The physical properties (the way it looks, smells, feels, etc.) may or may not change.
- The change may be reversible.
- A new substance *is not* produced.

#### Examples:

- cutting logs to make firewood
- falling leaves from a tree
- mining bauxite from the ground

#### Chemical Change

- The physical properties change.
- The change is not reversible.
- A new substance *is* produced.

#### Examples:

- burning firewood to make carbon and heat
- composting leaves into soil
- making aluminum from bauxite

### How does it relate to this activity?

The unjarred orange is physically changing as it dehydrates. The jarred orange is chemically changing as it decomposes into alcohol, nitrogen, and other matter.





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# *The Water Cycle*

## *What is it?*

*Water Cycle* is a phrase that describes the flow of water on the Earth. Usually we think of this as water evaporating into the air; condensing into clouds; precipitating downward; and collecting on the Earth, and then the process starts all over again. While this is true, there are many more aspects of the water cycle to consider. The human role in the water cycle, percolation of water in the soil, and transpiration of water through plants are just a few of the many other ways water cycles on the Earth.

## *How does it relate to this activity?*

Oranges store moisture within their skins. The unjarred oranges evaporate their moisture into the air through transpiration. This can be inferred as students observe a smaller mass and size in these oranges over the first several weeks. The jarred oranges also evaporate their moisture, but the sealed jar prevents this moisture from escaping. As a result, evaporation, condensation, precipitation, and collection all occur within the sealed jar.



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# *Yeast*

### *What is it?*

Yeast is a form of fungi. Fungi are organisms that are neither plants nor animals. They feed on dead and decaying matter to get their energy. Yeasts can ferment sugars to produce alcohol and carbon dioxide.

### *How does it relate to this activity?*

The oranges in sealed containers provide the right conditions for certain yeasts to grow. These yeast help to decompose the orange by feeding on the energy stored in the orange. When the yeast and bacteria in the container use up the available oxygen, they will get energy through the process of fermentation. The sweet alcohol smell emanating from the sealed jars is the result of fermentation.

### *Did you know?*

Yeast fermentation is used to raise bread. Yeast mixed into bread dough gets energy from the dough and gives off a gas waste product. This gas causes dough to rise prior to baking and gives us fluffy bread instead of flat, heavy bread.