



## WHAT'S HAPPENING TO MY FOOD?!?

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### Annotation:

Students will observe and classify physical and chemical changes commonly occurring in foods.

### Primary Learning Outcomes:

Students will be able to define the following terms: *physical properties*, *chemical properties*, *physical change*, and *chemical change*.

Students will be able to distinguish between physical and chemical changes.

Students will be able to recognize the four indicators that a chemical change has occurred.

Students will be able to classify changes associated food as physical or chemical.

### Additional Topics Covered:

- Characterization of matter
- Kinetic theory of matter
- Freezing point depression/boiling point elevation
- Solubility

### Georgia Performance Standards:

#### *Characteristics of Science*

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

SCSh3. Students will identify and investigate problems scientifically.

#### *Physical Science Content*

SPS2. Students will explore the nature of matter, its classifications, and its system for naming types of matter.

#### *Chemistry Content*

SC1. Students will analyze the nature of matter and its classifications.

SC2. Students will relate how the Law of Conservation of Matter is used to determine chemical composition in compounds and chemical reactions.

**Duration:**

Teacher Preparation: 30 minutes

Introduction: 5 minutes

Student Activities: 70 minutes

Conclusion: 15 minutes

**Total Class Time: 90 minutes**

**Materials and Equipment:**

For Teacher Preparation:

- |                             |                    |
|-----------------------------|--------------------|
| 1. Drinking water pitcher   | 6. Bowls           |
| 2. Sugar-free Kool-Aid® mix | 7. Bread dough mix |
| 3. Water                    | 8. Cookie mix      |
| 4. Apple                    | 9. Mixing spoon    |
| 5. Apple slicer             |                    |

Per class:

*Station 1:*

1. Toaster
2. Loaf of bread

*Station 2:*

1. Hershey Kisses®

*Station 3:*

1. Bottle of Coca-Cola®
2. Bottle of flat Coca-Cola®
3. 4 oz. paper cups

*Station 4:*

1. Effervescent antacid tablets
2. Beaker
3. Water

*Station 5:*

1. Bowl of dry cookie mix
2. Cookies

*Station 6:*

1. Kool-Aid® drink
2. Rock salt
3. Gallon-size freezer bags
4. Quart-size freezer bags
5. Measuring cups
6. Ice
7. Spoons

*Station 7:*

1. Apple slices
2. Apple slices submerged in bowl of water

*Station 8:*

1. Bowl of dry bread mix
2. Bowl of bread dough

*Station 9:*

1. 2 bottles Ken's Steak House Caesar® salad dressing

*Station 10:*

1. Sugar-free Kool-Aid® mix
2. Pitcher of water
3. 4 oz. paper cups
4. 1 qt. plastic water bottle
5. ¼ tsp. measuring spoon

**Safety:**

Students should use caution when using the toaster.

**Technology Connection:**

Not applicable.

**Procedures:**

Teacher Preparation:

Prepare for each student a copy of the *What's Happening To My Food?!?* student handout. Set up the ten stations so that each station contains the appropriate procedures and materials.

Procedures for each station are attached and should be posted at each station.

The following stations require additional set up.

*Station 3:*

Remove the cap from one bottle of Coca-Cola® and allow it to sit, overnight if possible, to flatten.

*Station 5:*

Place the dry cookie mix in a bowl for easier viewing.

*Station 6:*

Prepare Kool-Aid® drink by adding two Kool-Aid® packets to one gallon of drinking water.

*Station 7:*

Using the apple slicer, slice an apple. Place several of the slices in bowl and cover with water. Allow the other slices to sit out on the counter, overnight if possible, to brown.

*Station 8:*



Fill a small bowl with a portion of the dry bread mix. In a larger bowl, add the remaining dry bread mix, the included yeast packet, and 1 cup of water. Mix well and allow the dough to sit out overnight, if possible, to rise. Place the bowl of dough at the station.

#### *Station 10:*

Fill the pitcher with water and place at the station. Empty 5 packets of Kool-Aid® mix into a small bowl.

#### Introduction:

The food that we eat undergoes a number of changes, both chemical and physical. For example, foods are fermented, frozen, cooked, and cured. These changes are a vital part of the processing that food undergoes before making its way to our plate.

Matter is classified by its physical and chemical properties. A *physical property* is a property of matter that can be measured without changing the chemical nature of the substance. Mass, volume, color, and melting points are examples of physical properties. A *chemical property* is a property of matter that can be observed only when substances interact with one another. Combustability, solubility, and flammability are examples of chemical properties.

Changes in matter are classified as either physical or chemical. A *physical change* is a change that affects only physical properties of matter. Changes of state or size are examples of physical changes. A *chemical change* is a change that produces one or more new substances. Evidence that a chemical reaction has occurred include the evolution of a gas (bubbles or odor), the formation of a precipitate (an insoluble solid formed from a solution), the emission or absorption of energy in the form of heat or light, or a change in color in the reaction system.

Explain to students that the laboratory exercise comprises 10 stations. Throughout the period, they are to visit each of the 10 stations and perform the tasks listed. Students will be allowed 7 minutes to complete each station. Students should record observations and conclusions on the data table provided as part of the *What's Happening To My Food?!?* student handout.

#### Student Activity:

Students should follow procedures found at each station to complete the tasks listed.

#### Conclusion:

Review each station with the students, discussing the correct classification of each physical and chemical change, along with evidence that led to the classification. An explanation of each station follows.

#### *Station 1:*

Toasting is a chemical change caused by Maillard, or nonenzymatic, browning. During the Maillard reaction, the aldehyde group of a sugar molecule reacts with the amine group of an amino acid or protein molecule, leading to the formation of brown polymers and highly flavored chemicals. In addition to the browning of bread, the Maillard reaction is responsible for the

color and flavor of many cooked carbohydrate- and protein-rich foods, including onions and grilled and roasted meats.

*Station 2:*

A unique quality of chocolate is that its fat constituent, cocoa butter, melts just below body temperature. The heat added to the kiss when placed in the mouth causes it melt, changing from a solid to a liquid. Therefore, the melting of a kiss is a physical change.

*Station 3:*

The process by which a soda goes flat is a physical change. Carbonated beverages are produced by introducing carbon dioxide into the liquid under high pressure, resulting in a supersaturated solution. When a soda can is opened, there is a rapid escape of gas from the liquid, called effervescence. The escaping material, in the form of bubbles, is carbon dioxide. The escape is due to a decrease in pressure within the can upon opening, causing a decrease in solubility of the carbon dioxide and release of gas from the solution. Thus, the flattening of a soda involves the transformation of carbon dioxide from the dissolved state to a gaseous state rather than the evolution of a gas.

*Station 4:*

The tablets are an antacid, or a weak base that neutralizes excess acid levels in the stomach. This change in the acid level helps to relieve indigestion and heartburn. The change that occurs when an antacid tablet is added to water is chemical. Sodium bicarbonate, the active ingredient in the tablet, reacts with citric acid—also found in the tablet—to release carbon dioxide, which can be seen as bubbles in the water.

*Station 5:*

The baking of cookies is a chemical reaction. Heat is added to the cookie dough, thus catalyzing a cascade of chemical reactions. Students may be most familiar with the reaction involving baking soda, a leavening agent responsible for the rising of the cookies.

*Station 6:*

The freezing of the Kool-Aid® solution is a physical change. Salt, when added to the water, lowers the freezing point of the water, resulting in an ice water solution that is colder than the normal freezing point of water (0°C). This ice water solution is then able to absorb enough energy from the Kool-Aid® solution to cause it to freeze.

*Station 7:*

When the apple, the cells along the cut are ruptured, releasing the enzymes that are necessary for the cell to live. The browning of apples involves an enzyme called polyphenol oxidase. When released by cutting, the enzyme has access to oxygen in the air and undergoes a chemical reaction that causes the fruit to turn brown. The easiest way to prevent browning is to put the sliced apples in water so that the enzyme does not have access to oxygen. You can also heat the apples to denature the enzyme.

*Station 8:*

The rising of dough is the result of a chemical change. Yeast, a single-cell fungus, metabolizes sugar to create alcohol and carbon dioxide. The carbon dioxide gas created gives bread its airy texture. Gluten, an elastic protein found in flour, captures the carbon dioxide produced by yeast in tiny flour “balloons,” causing the dough to rise. The alcohol, which burns off during baking, contributes to an important component of the bread's flavor.

*Station 9:*

The mixing of salad dressing is a physical change. The dressing is made up of several immiscible layers of ingredients, and shaking of the bottle causes a temporary emulsion and suspension.

*Station 10:*

The dissolving of the Kool-Aid® powder into water is a physical change. The powder, the solute, is dissolved in water, the solvent, forming a Kool-Aid® solution.

**Assessment:**

Students should be assessed based on completion of the *What's Happening To My Food?!?* student handout.

*WHAT'S HAPPENING TO MY FOOD?!?*

*Station 1 Procedures*

**Place a slice of bread in the toaster and toast.**

**As the slice of bread toasts, examine a second slice of bread. Record on your student handout all observations of appearance, texture, and aroma.**

**When toasting is complete, remove the toast from the toaster and allow it to cool.**

**Examine the toast. Record on your student handout all observations of appearance, texture, and aroma. Indicate any changes that occurred as a result of toasting.**

**Properly dispose of bread and toast.**



## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 2 Procedures*

**Unwrap a Hershey Kiss® and record its state on your student handout.**

**Place the chocolate in your mouth and allow it to sit on your tongue. Do not chew.**

**Record on your student handout all changes that occur to chocolate within your mouth.**

**Properly dispose of all wrappers.**





## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 3 Procedures*

**Pour yourself a sample of both the fresh Coca-Cola® and the flat Coca-Cola®.**

**Record on your student handout any differences in appearance between the two samples.**

**Sample the fresh Coca-Cola® and the flat Coca-Cola®. Record on your student handout any differences observed between the two samples.**

**Properly dispose of the samples.**



## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 4 Procedures*

**Unwrap and examine an antacid tablet.**

**Record on your student handout all observations of appearance and state.**

**Fill a beaker with water, and place the tablet in the beaker of water.**

**Record on your student handout all observations of the tablet and the water.**

**Pour the contents of the beaker down the drain.**

**Rinse and dry the beaker.**



## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 5 Procedures*

**Examine the cookie dough mixture. Record on your student handout all observations of appearance, texture, and aroma.**

**Examine a cookie. Record on your student handout all observations of appearance, texture, and aroma.**

**Indicate any changes that occurred as a result of baking.**

**Enjoy your cookie.**

**Dispose of any garbage.**



## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 6 Procedures*

**Fill a small plastic zipper bag with a half cup of Kool-Aid® and tightly seal.**

**Record on your student handout all observations of appearance and state of the Kool-Aid® solution.**

**Place the small bag, along with those of your groupmates, in a large plastic zipper bag.**

**To the large bag, add 1 cup of rock salt and 3 cups ice. Tightly seal the bag.**

**Gently shake the bag for several minutes until a change of state is observed in the Kool-Aid®.**

**Remove small bags from the large bag and record on your student handout all observations of appearance and state of the Kool-Aid® solution.**

**Use the provided spoon to enjoy your Kool-Aid®.**

**Dispose of all garbage.**



## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 7 Procedures*

**Examine the apple slices lying on the counter, and record on your student handout all observations of appearance, texture and aroma.**

**Examine the apple slices submerged in water, and record on your student handout all observations of appearance, texture and aroma.**

**Note any differences between the apples.**



## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 8 Procedures*

**Examine the dry bread mix. Record on your student handout all observations of appearance, texture, and aroma.**

**Examine the bread dough. Record on your student handout all observations of appearance, texture, and aroma.**

**Indicate any changes that occurred.**



## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 9 Procedures*

**Observe the bottle of salad dressing labeled “DO NOT SHAKE” and record on your student handout observations of its appearance, consistency, and type of mixture.**

**Carefully shake the bottle of salad dressing labeled “SHAKE.” Record on your student handout all changes observed as a result of shaking.**



## WHAT'S HAPPENING TO MY FOOD?!?

### *Station 10 Procedures*

**Fill the plastic bottle to the 8 ounce mark with water.**

**Examine the Kool-Aid® mix and record on your student handout observations of appearance, texture, and state.**

**Add ¼ tsp. of Kool-Aid® mix to the water bottle.**

**Place the lid on the bottle and tighten. Slowly invert the bottle several times.**

**Examine the resulting solution and record on your student handout all observations of appearance, texture, and state.**

**Use the provided cups to enjoy your Kool-Aid®.**

**Dispose of any garbage and pour any remaining Kool-Aid® down the drain.**

**Rinse and dry the plastic bottle.**





## **WHAT'S HAPPENING TO MY FOOD?!? *Student Handout***

### **Introduction:**

The food that we eat undergoes a number of changes, both chemical and physical. For example, foods are fermented, frozen, cooked, and cured. These changes are a vital part of the processing that food undergoes before making its way to our plate.

### **Purpose:**

To classify changes occurring in foods as chemical or physical.

### **Procedure:**

This laboratory exercise comprises 10 stations. Throughout the period, you are to visit each of the 10 stations. Procedures are listed at each station. You will have 7 minutes to complete each of the tasks, so work efficiently. Your teacher will notify you when it is time to move on to the next station. Remain at your station, with your groupmates, at ALL times. Points may be deducted from your assignment if you fail to do so.

At each station, perform the tasks listed. Found on the back of this handout is a data table to be completed for each task. In the appropriate section of the table, list the task, all observations, the type of change (chemical or physical), and supporting evidence of the type of change. For full credit, all information in the table must be accurate and complete. Upon completion of all ten stations, answer the discussion questions found below.

### **Discussion Questions:**

1. What do you think causes the toast to brown?
2. What is the approximate melting point of chocolate? How do you know this?
3. What gas fills the bubbles released from a newly opened Coca-Cola®? Where does it come from?
4. What gas fills the bubbles that are released from the Alka-Seltzer tablet?
5. Is it possible, when baking, to observe both chemical and physical changes? Provide an example.
6. Road workers add salt to roads in the winter to keep them from icing. Using this as an example, explain why salt was added to the ice when freezing the Kool-Aid® drink.
7. How did submersion in water prevent the apples from browning?
8. What ingredient is most important in the rising of dough?
9. Why do some salad dressings not separate while others do?
10. Will an unlimited amount of Kool-Aid® mix dissolve in the given volume of water?

**WHAT'S HAPPENING TO MY FOOD?!?** *Data Table*

Station	Task	Observations	Type of Change	Supporting Evidence
1	Toast			
2	Chocolate			
3	Soda			
4	Antacid			
5	Cookies			
6	Icee			
7	Apples			
8	Bread Dough			
9	Salad Dressing			
10	Kool- Aid®			

