Newark Board of Education

School Closure Packet

Mathematics and Science

Grade 7

Roger León
Superintendent

2020 School Year

NAME:____

TEACHER:______________________________________

GRADE 7 SCHOOL CLOSURE PACKET

DIRECTIONS

Complete each activity in the School Closure Packet. Be sure to read all texts and complete activities thoughtfully and thoroughly.

Students are to return the completed packet to their teachers when school reopens.

Parents/Guardians, you are encouraged to assist in the following ways:

- Make a plan to complete the activities. For some activities, manipulatives are needed. If you do not have these at home, you can utilize the online manipulatives: https://www-k6.thinkcentral.com/content/hsp/math/hspmath/na/common/itools_int_9780547584997_/main.html
- Provide a time and quiet space for your child to work on these assignments.
- Help your child to complete the activities if he or she needs support.
- Review and discuss your child's responses. (Strongly urged at grades Kdg - 4)
- Provide positive feedback and praise for sincere effort and independence.
- Ensure your child understands the directions to each problem and listen to him/her read.
- Ensure that the completed packet is returned to school when school reopens

Thank you for helping your child to be successful!

Newark Board of Education	Grade 7	Mathematics

Day 1

Lesson Module Opener Module 9 (pages 291 - 292)

1) Mousetrap on the Coordinate Plane: Page 291 Once you plot the vertices, how do you finish drawing the polygon? What are some ways to check that you graphed the polygon correctly? What does it mean when we say the location of the mouse has integer coordinates?

2) Are You Ready?: #1- #10 Page 292 Complete these problems to review prior components and skills you will need for this module.

Day 2

Lesson 9-1 Day 1 (pages 293 - 294): Draw Circles and Other Figures

1) Review I Can Statement:
I can inscribe triangles in circles and draw geometric figures meeting given conditions.

2) Spark Your Learning: "Draw Circles and Other Figures" Page 293. What do you suppose paper folding has to do with making a circle? How many times will you need to fold the paper in order to find the center? How will you use a compass to draw the largest circle for the fire pit?

3) Build Understanding: #1 Page 294 In Part B, if the third point could be placed anywhere on the circle other than at the endpoints of the given diameter, then how many triangles could you draw? For Part C, explain why the triangle with side length 1.25 inches could not be drawn? Children will need to use a compass to draw their circles. Encourage them to use a straightedge to draw the sides of their triangles to complete Page 294.

4) Step It Out: #2 - #3 Page 295-296 When you have found the center of the circle where the diagonals of the square intersect, how will you make your inscribed circle? Encourage children to use a ruler to draw the square and the diagonals so that they precisely locate the center.

Day 3

Lesson 9-1 Day 2 (pages 296 - 300): Draw Circles and Other Figures

1) Review I Can Statement:
I can inscribe triangles in circles and draw geometric figures meeting given conditions.

2) Check Understanding: #1-3 Page 296

3) On Your Own: #4- #9 Page 297 - 298 Use tools to draw figures with given conditions. (Compass will be used)

4) More Practice/Homework: #1-7 Pages 299 -300

Day 4

Lesson 9-2 Day 1 (pages 301 - 304): Draw and Construct Triangles Given Side Lengths

1) Review I Can Statement:
I can determine whether three lengths could be side lengths of a triangle, and given two side lengths. I can find the range of possible lengths for the third side.

2) Spark Your Learning: "Draw and Construct Triangles Given Side Lengths" Page 301 How can you organize your work to make sure you try all the combinations? Why the triangle collapsed on itself with the combination of 2 in., 3 in., and 5 in.?

3) Build Understanding: #1 - #3 Pages 302 - 303 Provide tools, such as rulers and compasses, to children or allow them access to geometry software to complete this task.
Online Triangle Maker

	4) Step It Out: #4 Page 304 In Part B, if you were to manipulate the side lengths to form a triangle, what would result? Encourage children to justify their answer or reasoning.
Day 5 **Lesson 9-2 Day 2 (pages 304 - 308): Draw and Construct Triangles Given Side Lengths** **1) Review I Can Statement:** I can determine whether three lengths could be side lengths of a triangle, and given two side lengths. I can find the range of possible lengths for the third side. **2) Check Understanding:** #1 - #2 Page 304 **3) On Your Own: #**3 - # 17 Pages 305 -306 **Extra Practice:** Khan Academy **4) More Practice/Homework:** #1 - #16 Pages 307-308	**Day 6** **Lesson 9-3 Day 1 (pages 309 - 313): Draw and Construct Triangles Given Angle Measures** **1) Review I Can Statement:** I can determine whether it is possible to draw a triangle given angle measures. If it is, I can construct such a triangle. **2) Spark Your Learning:** "Draw and Construct Triangles Given Angle Measures" Page 309. What strategy could you use to tackle this problem? Should you start by making a drawing? By choosing angle measures? **3) Build Understanding:** #1 - #2 Pages 310-311 Children will need access to a protractor and ruler. For #1, How many triangles did you draw? Do you think you could draw even more? Encourage children to use a ruler and protractor to construct their triangles. Use grid paper will be easier. For #2 Is it possible to draw a triangle with two right angles? Explain why or why not. Draw two triangles that are very different from one another and find the sum of their angle measures. What do you notice? Online Triangle Maker **4) Step it Out:** #3 Page 312 Use a ruler and protractor or geometry software to complete this task.
Day 7 **Lesson 9-3 Day 2 (pages 312 - 316): Draw and Construct Triangles Given Angle Measures** **1) Review I Can Statement:** I can determine whether it is possible to draw a triangle given angle measures. If it is, I can construct such a triangle. **2) Check Understanding:** #1 - #2 Page 312 Determine if a triangle can be constructed with given angle measures and side lengths. **3) On Your Own:** #3 - #11 Page 313 Use of a ruler and a protractor is required to complete. **4) More Practice/Homework:** #1 - #12 Pages 315-316	**Day 8** **Lesson 9-4 (pages 317 - 322) Classify and Organize Triangles** **1) Review I Can Statement:** I can use tools to draw or construct figures that meet given criteria, and I can analyze the resulting figures. **2) Step It Out:** #1 - #2 Pages 317-318 How do you know how many triangles can be formed? How do you know that two different triangles are possible? **3) Check Understanding:** #1 - #2 Page 318 **4) On Your Own:** #3 - #9 Pages 319-320 **5) More Practice/Homework:** #1 - #9 Pages 321-322

Day 9	Day 10
Lesson Module 9 Review (pages 323 - 324) **1) Vocabulary:** #1 - #3 Page 323 Students should review the vocabulary terms for this module. **2) Concepts and Skills:** #4- #12 Page 323 - 324 Use tools and strategies from this module to complete the review.	**Lesson Module Opener Module 12 (pages 389 - 390)** **1) Which Fraction Doesn't Belong:** Page 389 How can you find the fraction represented by each diagram? How can you decide if two fractions are equivalent fractions? What will two diagrams have in common if they represent equivalent fractions? **2) Are You Ready?:** #1- #7 Page 390 Complete these problems to review prior components and skills you will need for this module.
Day 11 **Lesson 12-1 (pages 391 - 394): Understand Representative Samples** **1) Review I Can Statement:** I can identify the population and sample of given survey scenarios, and determine whether the sample is random and/or representative of the population. **2) Spark Your Learning:** "Understand Representative Samples" Page 391. What is the entire group or population in this situation? Why is the research analyst not interested in polling non-registered voters that reside in the city? Can you think of any other situations where voters have to decide about spending money? **3) Build Understanding:** #1 Page 392 Would a sample surveying teenagers leaving a specific competitor's restaurant be representative? **4) Check Understanding:** #1, #3 Page 393 **5) On Your Own:** #5-8 Page 394 Understanding Random Sampling **6) More Practice/Homework:** #1 - #12 Pages 315-316	**Day 12** **Lesson 12-2 Day 1 (pages 397 - 400) Make Inferences from a Random Sample** **1) Review I Can Statement:** I can use proportional reasoning to make inferences about populations based on the results of a random sample. **2) Spark Your Learning:** "Make Inferences from a Random Sample" On page 397 What is the total amount of trail mix in the small bag? In the small bag, what is the ratio of pounds of nuts to pounds of raisins? Discuss with children how sampling can be beneficial in making predictions about behaviors, trends, and outcomes. **3) Build Understanding:** #1 Page 398 What is the independent axis labeled? What is the dependent axis labeled? In Part B, how are you interpreting the phrase most students? Do you anticipate the results of both of your surveys to be the same? Explain. **4) Step It Out:** #2 - #3 Pages 399-400 Encourage children to continue to use percents to solve problems. For #2, Why is it important that Javier randomly selects his sample cartons? Could you also use Javier's sampling to predict the number of cartons of eggs having no broken eggs? For #3 Does the worker's technique provide a representative sample? How could the store manager find about what percent of the total population of headphones would be defective?
Day 13 **Lesson 12-2 Day 2 (pages 401-404) Make Inferences from a Random Sample**	**Day 14** **Lesson 12-3 (pages 405 - 410) Make Inferences from Repeated Random Samples**

1) Review I Can Statement: I can use proportional reasoning to make inferences about populations based on the results of a random sample. **2) Check Understanding:** #1 - #2 Page 400 Use the Box plot to answer the questions. **3) On Your Own:** #3 - #15 Pages 401 - 402 Children compare the sample ratios to the population ratio. **4) More Practice/Homework**: #1 - #12 Pages 403-404	**1) Review I Can Statement:** I can calculate sample ratios, and I can make inferences about the populations from the samples. **2) Step It Out:** #1 - #2 Pages 405-406 What is the actual population ratio to which you make your sample ratio comparisons? What is meant by how much variation can be expected from a sample? **3) Check Understanding:** #1 - #2 Page 406. **4) On Your Own: #**3 - #4 Pages 407-408 **5) Extra Task:** https://achievethecore.org/content/upload/7.SP.A.2_PARCC.pdf 6) **More Practice/Homework:** #1 - #7 Pages 409-410
Day 15 **Lesson Module 12 Review (pages 411 - 412)** **1) Vocabulary:** #1 - #3 Page 411 Students should review the vocabulary terms for this module. **2) Concepts and Skills:** #4- #10 Page 411 - 412 Use tools and strategies from this module to complete the review.	

IQWST	Grade 7 / 8	Science----Instructional Plan

Day 1

Task: Read the article-Why can I Easily wash soap off my hands with water? independently.

Response Questions: Answer the response questions using the article.

- **Article:**
  - Why can I easily wash soap off my hands with water?

Day 2

Task: Read the text- Melting Points

Response Questions: Answer the response questions using the article.

- Article:
  - Melting Points

Day 3

Task: Read the text- How can two objects that are the same size have different masses?

Response Questions: Answer the response questions using the text.

- Article
  - Same Object Different Mass

Day 7

Task: Read the article- Why is the Statue of Liberty

Day 4

Task: Read the text What is a chemical reaction?

Response Questions: Answer the response questions using the text..

- Article:
  - What is a Chemical Reaction?

Day 5

Task: Read the article-Is burning a chemical reaction?

Response Questions: Answer the response questions and using the article.

- Article:
  - Is burning a chemical reaction?

Day 6

Task: Read the article- The Chemistry Behind a Warming Life Jacket..

Response Questions: Answer the response questions using the article.

- NEWSELA Article
  - https://newsela.com/read/lib-warming-life-jacket/id/2001004793/?collection_id=2000000156

Day10

Task: Read the article- What is a mixture in science?

Green?
Response Questions: Answer the response questions using the article.
 	
• Article
  ○ Why is the Statue of Liberty Green?
	Response Questions: Answer the response questions using the article.
	
	• NEWSELA Article
	  ○ https://newsela.com/read/lib-mixture-overview/id/55425/?collection_id=2000000156

Day 8
 	
Task: Read the article-What is the same and different about boiling water and electrolysis?
 	
Response Questions: Answer the response questions using the article.
 	
• Article
  ○ What is the same and different about electrolysis?
	Day 11
	
	Task: Read the article- Overview: Erosion and Weathering
	
	Response Questions: Use the model to help you answer the scenario using details and evidence. Use the text to help support your response.
	
	• NEWSELA Article
	  ○ https://newsela.com/read/lib-erosion-weathering/id/55966/?collection_id=2000000156

Day 9
 	
Task: Read the article- Ore deposits are a source of valuable metals and minerals
 	
Response Questions: Answer the response questions using the article.
 	
• NEWSELA Article
  ○ https://newsela.com/read/natgeo-ore/id/48652/?collection_id=2000000156
	Day 12
	
	Task: Read the article-The effects of air pollution
	
	Response Questions: Use the article to help you answer the questions using details and evidence. Use the text to help support your response.
	
	• NEWSELA Article
	  ○ https://newsela.com/read/lib-air-pollution/id/42356/?collection_id=2000000156

Notes From Your Teacher:

IQWST	Grade 7		Science--Instructional Plan

Day 13 **Task:** Read the article- Deadly anad Life Giving Elements of the Periodic Table **Response Questions**: Answer the response questions using the article. • NEWSELA Article ○ https://newsela.com/read/lib-periodic-table-group-15/id/52308/?collection_id=2000000156	**Day 16**
Day 14 **Task:** Read the article-Experiment:What causes rust? **Response Questions**: Answer the response questions using the article. • NEWSELA Article ○ **https://newsela.com/read/lib-experiment-rust-oxidation/id/37490/?collection_id=2000000156**	**Day 17**
Day15 **Task:** Read the article- What's the difference between weather and climate? **Response Questions**: Answer the response questions using the article. • NEWSELA Article ○ https://newsela.com/read/natgeo-	**Day 18**

difference-weather-climate/id/2000002784/?collection_id=2000000156	

Notes From Your Teacher:

Name____Date__________

Solubility

Use the article, Why can I easily wash soap off my hands with water? to answer the following questions.

1. What does it mean for a substance to be soluble?

2. ____________________ is the capacity of one substance to dissolve in a liquid substance.

3. Give two examples of substances which are soluble in water.

4. What happens to a substance when it dissolves?

5. Are all substances soluble? Give an example of a substance that is **NOT** soluble in water.

Name____ Date____________

Melting Points

1. Describe the process of melting.

2. Explain the difference between melting and melting point.

3. A__________________of a substance is ____________________of that substance.

4. Explain why the melting point is difficult to measure.

5. Do all substances have melting points?Why or why not? Give two examples from the text.

Name____Date________

Properties

1. List five properties of matter.

2. How can you use mass and volume to find the density of a substance?

3. Define the vocabulary term, ***Density.***

4. The measurement of volume that scientists use when talking about density is ____________________________.

5. Explain two ways to measure volume.

6. Explain what density can help you to predict?

Name____Date______________

Chemical Reaction

1. Do you believe frying an egg is a chemical reaction? Explain Why or why not?

2. Define a ***chemical reaction*** according to the text.

3. How do you know if a new substance was formed from old substances being mixed together?

4. **Give 3 examples** of evidence of a property change from the plastic bag experiment after mixing.

Name____ **Date**____________

Is Burning A Chemical Reaction?

1. Why do sparklers light up?

2. What is the chemical reaction that makes fireworks work?

3. Explain the vocabulary term "**reactant**".

4. Explain the vocabulary term "**product**".

5. The ______________________is an important symbol scientists use when they write chemical equations. The arrow means____________ _______ ____________. You could also think of it as changes to.

6. What other ways can a chemical reaction be represented? Give two examples from the text.

Name____Date____________

The Warming Life Jacket

1. Define the term " **Hypothermia**".

2. What did the high school scientist Danielle Mallabone create to help save lives?

3. Explain how the innovation works.

4. Describe the chemical calcium-oxide.

5. The heat-producing, or__________________, reaction warms the water between the life jacket and someone's body.

Name____Date__________

Why is the Statue of Liberty Green?

1. About how long did it take for the green color to appear on the Statue, and Why did the green color appear on the Statue of Liberty?

2. Explain the two substances that caused the change in the Statue of Liberty.

3. Define the terms "**Acid rain**" and "**Sulfuric Acid**" .

Name____Date_______________

Boiling Water and Electrolysis

1. How are Boiling water and electrolysis the **same**?

2. How are boiling water and electrolysis **different**?

3. When liquid water evaporates, is it still considered liquid water? Explain why or why not.

4. Explain and describe the steps of the process of **electrolysis**.

Name____Date__________

Metals and Minerals

Read the article and answer the following questions.

1. Define the term **"Ore".**

2. Where is "Ore" located?

3. Explain two reasons Copper Ore is mined.

4. Which element is the second-most abundant element on Earth?

5. How is metal extracted from rock when found in the Earth, and which two processes are used?

6. How do the miners use electrolysis?

Name____Date____________

Mixtures

1. In chemistry how does a mixture form?

2. Provide three examples of mixtures from the text.

3. Name the two categories of mixtures.

4. Define the two categories with the definition from the text.

5. Give two examples of solutions from the text.

6. Give two examples of colloids from the text.

7. How can suspensions be separated? Give two examples of suspensions from the text.

Name____Date__________

Effects of Acid Rain

1. What two processes are weathering and erosion responsible for?

2. Explain why these processes are NOT dependent on each other.

3. In what ways does water work like an adaptable tool in nature?

4. Explain what causes rock to change in nature based on information from the text.

5. How do plants and animals take a toll on Earth's Rocks?

Name____Date______________

The Effects of Air Pollution

After reading the article, "The effects of Air pollution". Answer the following questions.

1. Explain what air pollution is referred to in the text.

2. What does the author of the text believe is causing climate change?

3. Describe and explain the Greenhouse Gas Effect.

4. What two types of chemicals destroyed the Ozone.

5. Describe the damages that occurred.

6. How does acid rain harm the planet?

7. What has the United States put in place to stop air pollution?

Name____Date____________

Elements of the Periodic Table

After reading the article, "Deadly and Life giving Elements of the Periodic Table", read and answer the response questions below.

1. Define the term elements.

2. Give two examples of elements.

3. Each column of the periodic table is called a __________________.

4. Explain the uses and properties of Nitrogen.

5. Name and describe the properties of two other household elements that you may find at home.

6. What happens to cells where the phosphate is out of control? What could be the result of consequences?

Name____Date__________

What Causes Rust?

After reading the article, "What Causes rust?". Read and answer the following questions.

1. Provide two examples of an oxidation-reduction reaction.

2. What happens during oxidation?

3. How is rust produced?

4. Do you believe water will affect a piece of wool steel (or Brillo Pad)? Why or why not?

Name____Date______________

Weather Vs Climate

After reading the article, "What's the difference between weather and climate? Read and answer the following questions.

1. Explain what the text refers to **weather** as.

2. How does data help meteorologists?

3. Explain what the text refers to **climate** as.

4. How has human activity accelerated climate change?

5. Describe the **Paris Agreement**. How many countries came together to sign the agreement? Which country announced it would withdraw from the agreement?

Reading 9.1 – What Is the Same and Different about Boiling Water and Electrolysis?

Getting Ready

You may already have learned what happens to molecules when you boil water. Now, you have investigated what happens during the process of electrolysis of water. In the following space, list your ideas about how boiling water and electrolysis compare.

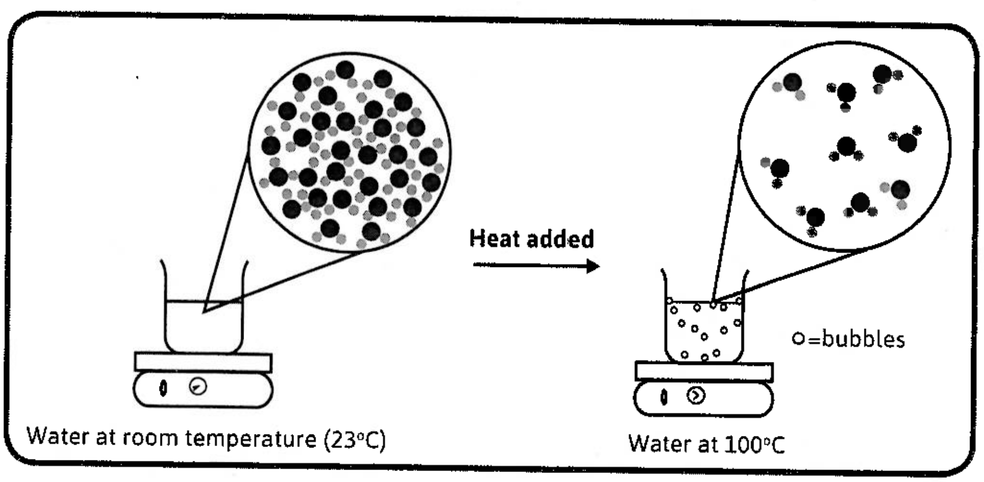
As you read, you will learn more about similarities and differences between water during boiling and electrolysis.

How Are Boiling and Electrolysis of Water the Same?

The experiments of boiling water and electrolysis used the same substance—water. This water was in the liquid state to begin both experiments. Both times, energy was added to the water. This, however, is where the similarities end.

How Are Boiling and Electrolysis of Water Different?

First, think about when you boil water. Thermal energy is added to the water from a hot plate or from your stove. Look at the pictures. A beaker of water is on a hot plate.



Each water molecule, H_2O, is represented by three circles. The big, dark circle represents an oxygen atom and the two little gray circles represent two hydrogen atoms. The beaker of water contains billions of water molecules in the liquid state. In the liquid state, each water molecule is attracted to the neighboring water molecules. When thermal energy is added to water, the water molecules gain energy and move faster and faster until they can overcome the attraction of other molecules and go into the gaseous state. When a water molecule gets enough energy, it can break away from the rest of the molecules. Then it can move from the beaker into the air as a gas molecule. This process is called evaporation.

Evaporation is when liquid water molecules gain enough energy to become gas molecules and go into the air. The picture on the right side is a representation of water in the gaseous state or phase. You cannot see molecules moving from liquid water to gaseous water. What you do see are bubbles in the water.

If you compare the liquid and the gas molecules, they have the same arrangement of atoms in H_2O molecules. This means that the same substance—water—is there before and after boiling. The molecules are just farther apart after adding energy. If you remove the thermal energy, the molecules will slow down and condense back into the liquid phase. The properties of the water before boiling and after cooling would still be the same.

An equation can represent boiling of water. The following is a word equation for boiling.

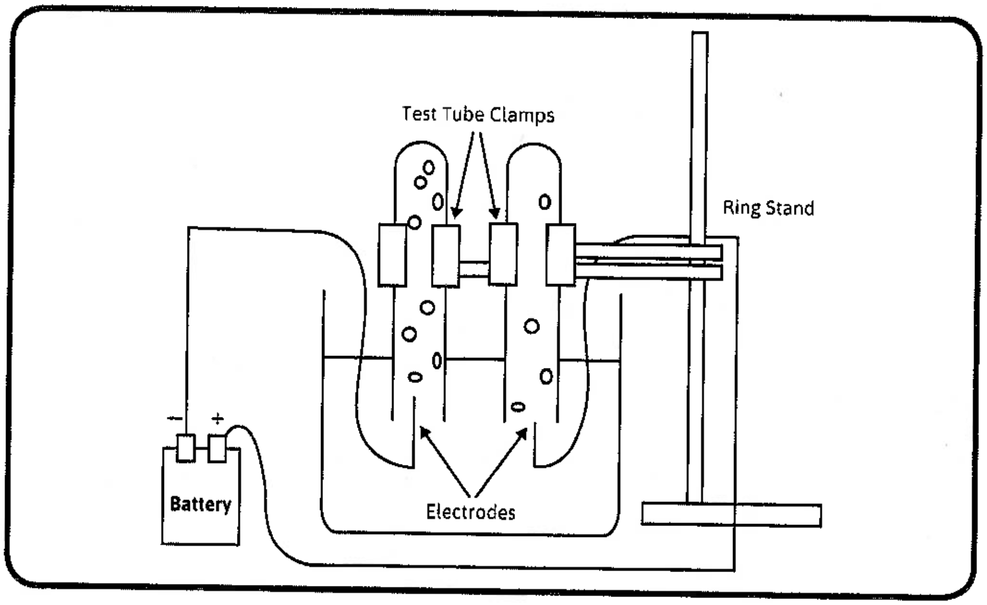
Thermal Energy Added

$$\begin{array}{ccc} \text{Water (liquid)} & & \text{Water (gas)} \\ & \longrightarrow & \\ H_2O & & H_2O \end{array}$$

Rewrite the equation using the chemical names. Is boiling a chemical reaction? Explain your ideas.

Now think about electrolysis. Just as with boiling, you began with water, H_2O, in the liquid state. Just like with boiling, energy was added. This time, however, the energy came from batteries. Instead of the energy going to making the water molecules move faster until some of them were eventually able to evaporate, electrical energy from the batteries was able to split the water molecules apart into oxygen and hydrogen. You cannot see molecules splitting apart, but you did see bubbles. This time, the bubbles were a sign of new substances. (You also saw bubbles during boiling.) You also did a flame test to get evidence that oxygen and hydrogen were formed. Oxygen and hydrogen are both gases at room temperature. They are different substances from water. They have different properties from water. If you remove the batteries that provide the energy, the hydrogen gas and oxygen gas will not go back to form water.

The following picture illustrates the electrolysis process. Each water molecule (H_2O) is represented by three circles. The big, dark circle represents an oxygen atom and the two little gray circles represent two hydrogen atoms. The beaker of water contains billions of water molecules in the liquid state. The electrical energy breaks apart the H_2O molecules. The newly formed H_2 molecules accumulate in one test tube and the newly formed O_2 molecules accumulate in the other test tube.



The electrolysis experiment you did can be described by the following word equation.

Water (liquid)——electrolysis——Hydrogen (gas) + Oxygen (gas)

You created marshmallow models of this process in class. When water has an electric current applied through electroysis, it breaks down to form hydrogen gas and oxygen gas. The following equation of electrolysis is written using the chemical formulas:

$2H_2O_{(l)}$——electrolysis——$2H_{2(g)} + O_{2(g)}$

Were new substances created from old substances during electrolysis? Explain.

In Order to Make New Substances, Do You Always Have to Start with Two or More Reactants?

Right now your definition of a chemical reaction is:

Think back to boiling water. Is this a chemical reaction? When water boils, atoms do not rearrange and no new substances are formed. You begin with water and end with water. It is just that water is in either the liquid phase or the gaseous phase. There is only one substance. Boiling is not a chemical reaction.

Now think back to electrolysis. Is this a chemical reaction? When water undergoes electrolysis, the water molecules split apart, so the atoms no longer have the arrangement of H_2O. They are in new arrangements. They are now O_2 and H_2 gas molecules. New substances are formed from the old substance (water). These new substances have different properties from water. Electrolysis is a chemical reaction.

It only has one reactant—water. Based on this new understanding that a chemical reaction can involve one, two, or more substances, you need to revise your old definition of a chemical reaction.

Write your new definition of a chemical reaction.

An Everyday Example of a Chemical Reaction with Only One Reactant

What do you think happens to grass that has been cut and left on a lawn? What happens to dead leaves? What about dead animals, trees, or plants in a forest or park? Dead matter decomposes. When matter decomposes, it breaks down from a complex form to a simpler form. This occurs with the help of bacteria and fungi. The old substance—dead grass, a dead animal, or a dead plant—has complex molecules. Through decomposition, these complex molecules split apart and the atoms combine in new ways to form new substances that have more simple molecules, or substances with only one type of atom. When plants break down, they form mainly carbon dioxide and water. These simpler substances become basic ingredients for healthy soil. It is a good thing that decomposition occurs. Otherwise, there would be dead plants and animals piled everywhere.

Electrolysis is an example of a decomposition process. The more complex molecules of water are broken down into more simple molecules of oxygen and hydrogen.

Reading 8.1 – Why Is the Statue of Liberty Green?

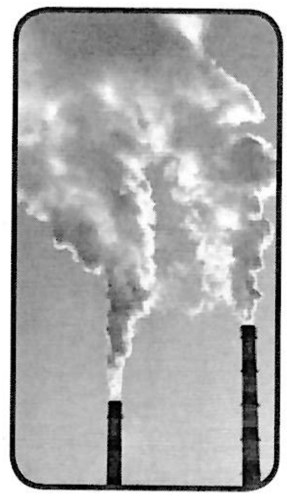
Getting Ready

Have you ever seen a green steeple, or a green roof on a building? Did you know that they started out being the same color as a shiny new copper square? Some steeples and roofs have a layer of copper on them, just like a copper square does. A copper square and a roof can be made of similar materials, but they do not appear the same color.

Why do you think steeples and roofs might appear green, but a copper square does not?

Why Does Copper Sometimes Turn Green?

Copper is a brown-color metal. Sometimes it is shiny and sometimes it is not. Many steeples and roofs made with copper are not that brown color, however. Instead, they are green. Something happened to the copper on those buildings so that it no longer appears brown like the brown color of a copper penny.



Something also happened to the Statue of Liberty. If you have ever visited the Statue of Liberty or seen color photos of it, you know that the Statue of Liberty looks green. When it was completed in 1886, the Statue of Liberty was the color of a new penny. By the time 20 years had passed, the statue appeared to be green instead. The Statue of Liberty also has a surface made of copper. What happened so that these roofs, steeples, and the Statue of Liberty turned green?

The green color appeared because a chemical reaction took place. The chemical reaction occurred between two substances. One substance was copper, and the other was acid rain. Acid rain is a name for rainwater that has certain substances mixed in it. These substances get in the air as factories burn coal. Sulfuric acid is one pollutant that makes up acid rain. As acid rain fell on the Statue of Liberty, the sulfuric acid reacted with the copper. A new, green substance formed from the reaction. Most of the new green substance is copper sulfate. Copper sulfate is green. The Statue of Liberty appears green because the copper that forms its outside layer is covered in green copper sulfate.

In class, you will use a copper square to complete an investigation similar to the one that changed the way the Statue of Liberty looks. Since you do not want to be in this class for 20 years while you wait for the reaction to occur, you will change conditions so the reaction will go much faster than the one on the Stature of Liberty. Instead of sulfuric acid, you will use acetic acid. Acetic acid is a scientific name for a substance that makes up vinegar. You will place the copper square in a saturated environment of acetic acid.

Reading 7.1 – Is Burning a Chemical Reaction?

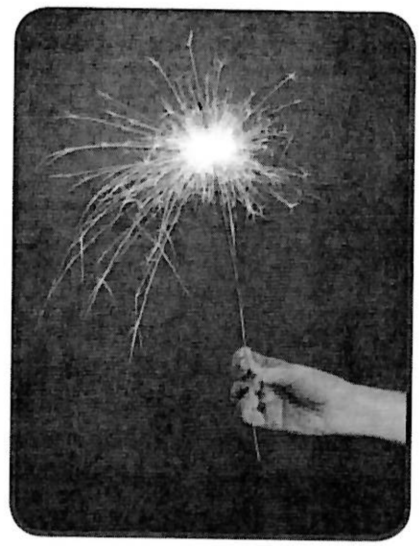
Getting Ready

Chemical reactions occur all around you. They do not happen just in the laboratory or in science class. For example, when you light a sparkler, you observe a chemical reaction. What do you think the old stuff and the new stuff are in the chemical reaction that makes a sparker light up?

Now read about sparklers and the chemical reaction that makes them light up.

Why Do Sparklers Light Up?

When your teacher burned magnesium in class, were you surprised by what happened? Burning is always a chemical reaction, even though it does not always make such a bright light.



The reaction you saw in class was similar to the reaction that occurs when you burn a sparkler. Sparklers can be made of different metals, but all sparklers work in a similar way. As a sparkler burns, the metal of the sparkler and oxygen from the air interact and form a new substance. The reaction would take a very long time if you just waited for it to happen. A flame gets the reaction started quickly. Often something needs to happen to get a chemical reaction started.

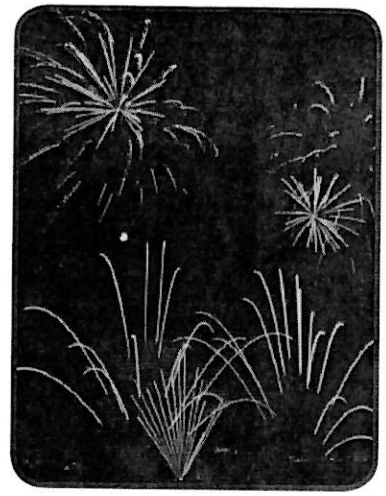
Substances may need to be mixed or heated first. Even if you mix all the right ingredients in the kitchen, they do not become a cake as they sit on the table. The ingredients need to be mixed and cooked. Then they interact to become something new—a cake.

In class, your teacher lit a magnesium strip with a flame. Then the oxygen and magnesium interacted to create magnesium oxide. Magnesium oxide was a new substance. As you saw in class, the reaction also produces bright light. This reaction is similar to the reaction that happens when you light a sparkler. Fireworks are another similar reaction. Once a flame lights the fuse, a chemical reaction happens to cause fireworks.

Fireworks can be many colors. You have probably seen green, red, and many other colors in the sky. Think about what you have learned about chemical reactions so far. What do you think makes fireworks different colors?

What Is the Chemical Reaction that Makes Fireworks Work?

Think about what you see and hear when you see fireworks. First, you hear a loud noise. Second, you see something shoot up into the sky. Third, you see a burst of color high in the air. What chemical reactions make this happen?



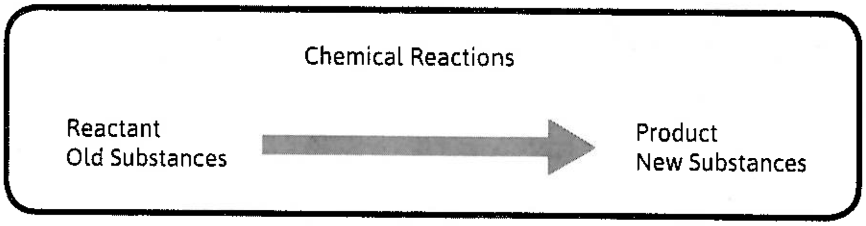
When a flame lights the fuel in a firework rocket, a chemical reaction occurs between the fuel and the oxygen. This reaction produces a gas. The gas escapes out of one end of the rocket, causing it to shoot into the sky. Once the rocket is in the sky, other substances inside the rocket are lit. Those substances react with the oxygen in the air. This reaction creates the burst of bright colors that you see in the sky. When you see many colors, it is because many chemical reactions are occurring. Each color and each sound is created by a different substance involved in different chemical reactions.

Reactants and Products in Chemical Reactions

In a chemical reaction, the old substances that interact with each other to form new substances are called reactants. The reactants are the starting substances in a chemical reaction. It may help you to think about the reactants as the substances that act together. In the sandwich bag experiment, the substances you started with in the bag were the reactants. The products are the substances you ended up with after you tipped over the test tube. The products of a chemical reaction are the substances you end up with. They are the new substances.

A reactant is a starting substance in a chemical reaction. → A product is the substance made by a chemical reaction.

Scientists represent chemical reactions in a variety of ways. In the representations that precede and follow, you see an arrow. The arrow is an important symbol scientists use when they write chemical equations. The arrow means *goes to form*. You could also think of it as *changes to*.



The paragraph about sparklers tells you some of the reactants and products when your teacher burned magnesium in class. Look back at that paragraph and find the reactants and products. In the following space, write a chemical equation that shows what the reactants and products were in that chemical reaction:

When you write about a reaction, you are writing a chemical equation. A chemical equation is a way to represent chemical reactions. The equations include plus (+) signs and an arrow. Notice that the reactants side of this chemical reaction has a plus (+) sign. Usually in math a plus sign means adding or combining. In a chemical equation, the plus sign means that the reactants are interacting. In some chemical reactions, the old substances interact by combining and forming one new substance. In other reactions, the old substances interact and form two or more new substances.

What Other Ways Can I Represent a Chemical Reaction?

Previously you represented the magnesium reaction with a chemical equation. It included the substances' names and the plus and arrow symbols. In class you represented the substances in other ways. For example, you used molecular formulas (numbers and letter-symbols of atoms) to represent substances. You also used marshmallows to model how magnesium metal and oxygen gas changed and a new substance formed.

What follows is the magnesium reaction in a chemical equation—this time, using a molecular formula:

$$2Mg \quad + \quad O_2 \quad \rightarrow \quad 2MgO.$$

(two magnesium atoms)	(one oxygen molecule)	(two molecules of magnesium oxide)

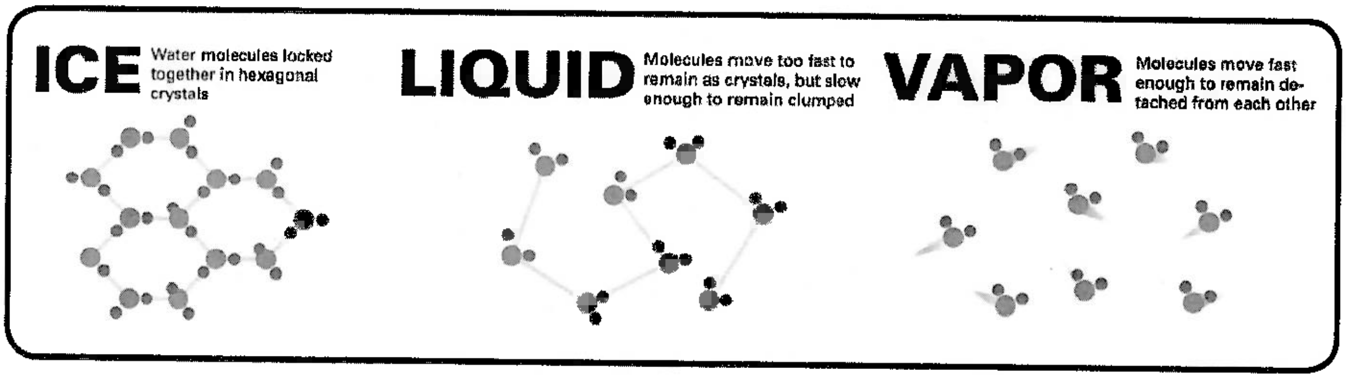
This chemical equation tells more about the atoms and molecules of each substance. You can see the number of atoms and the types of atoms. You can see the number of molecules and the types of molecules. You can see which atoms and molecules react and what they form. A chemical equation can help you understand what is happening to the old substances and new substances in a chemical reaction.

Look at the symbols for magnesium, oxygen, and magnesium oxide shown previously. Use the following space to draw a model of what happened in this chemical reaction. You may choose to draw atoms as marshmallows if thinking about what you did in class is helpful to you.

Reading 3.1 – Melting Points

Getting Ready

Have you ever melted butter in a frying pan or spread butter on hot corn on the cob or rolls? You have already learned that melting is a phase change. Melting is the process through which a substance changes from a solid to a liquid. Look at the diagram of water in three phases—solid, liquid, and gas. The diagram shows what the billions of water molecules do in each phase. Look at each part of the diagram. As you do, think about what the billions of molecules are doing when the butter melts on your food.



As you read, think about when melting point is important outside of science class.

What Is the Difference between Melting and Melting Point?

Butter starts to melt at approximately 32.3°C or 90.1°F. This temperature is called the melting point of butter. *Melting point* is the temperature at which a solid substance starts to become a liquid. A solid substance gets hot, but it does not start to melt until it reaches its melting point.

It is difficult to measure melting point in class. Scientists have tools and techniques they have learned that are difficult to do in a classroom. When you investigated melting butter, fat, and soap in class, you may have had some difficulty.

You learned that a whole stick of butter would take longer to melt than a small piece of butter because there is more of it. The time it takes for a piece of butter to melt depends on the size of the piece. However, the temperature at which each of them starts to melt is the same. Remember that a property of a substance is characteristic of that substance. If you had a huge chunk of butter or a small piece of the same butter, the melting point would be the same. It also does not matter what the shape of the substance is. A stick of butter and a round piece of the same butter have the same melting point. The time it takes to melt may change, but the temperature at which it starts to melt is the same.

Why Is Melting Point Difficult to Measure?

In class, you observed melting point when the substance just started to melt. Depending on where your thermometer was, it could have been still touching some of the solid substance or the thermometer could have been resting completely in the melted butter, while the solid butter was on the other side of the test tube. Where your thermometer rested, compared to where the solid and the liquid (melted) butter were, made a difference in what you saw. In fact, the solid butter stays at 32.3°C or 90.14°F until it melts. If the solid and liquid are stirred together, the temperature will stay the same until all of the solid melts. Only when the entire solid has melted will the temperature start to rise again. In class, you may have seen something different. You may have observed the temperature increase before the entire solid had melted. If you saw that, it was because the energy was increasing the temperature of the liquid instead of melting the rest of the solid. How evenly the particles of solid and liquid are distributed makes a difference when measuring temperature.

In class you did an experiment to determine the melting points of soap and fat. You can now use your observations as a way to describe how soap and fat are different. The difference in one of their properties was evidence that they are different substances. You can now add melting point to the list of properties you can use to learn about substances.

Properties	Not Properties
Color	Mass
Hardness	Volume
Solubility	Shape (round, tall)
Melting Point	Texture

Do All Substances Have Melting Points?

Look again at the definition of melting point. Do you think that all substances have melting points? For example, do you think aluminum has a melting point? Does oxygen have a melting point? Tell whether you think all substances have a melting point. Give reasons for your answer.

If the definition of melting point is the temperature at which a solid starts to become a liquid, then a substance can only melt if it is in a solid form. A gas does not melt. A liquid does not melt. Think about water as an example. Liquid water does not melt. Water vapor does not melt. When water gets cold enough to become a solid, it can melt when heat is added to it. The substance that ice, liquid water, and water vapor are made of has a melting point. That substance is water.

In fact, all substances have melting points. Think about oxygen for a minute. You probably think of oxygen as a gas. You breathe it in, and you know that people need to breathe oxygen to live. If you could make the temperature really cold, you could turn oxygen gas into solid oxygen. Once oxygen became solid, it could be melted into a liquid.

In everyday experience, however, the temperature is not cold enough to see oxygen as a solid. It is not even safe or possible for your teacher to demonstrate this in the classroom. People must rely on scientists who have done these things to provide other people with information.

The following table shows some of the properties of water and oxygen. Notice that oxygen and water both have melting points.

Substance	**Properties**		
	Melting Point	Color in the Gas Phase	Color in the Solid Phase
Water	0 °C	Colorless	Colorless
Oxygen	−218.79 °C	Colorless	Light Blue

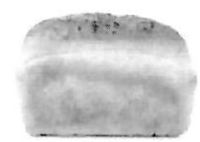
Some Properties of Water and Oxygen

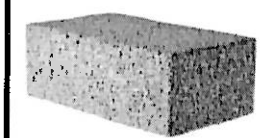
Look back at the diagram in the Getting Ready section of this reading. Use the diagram to describe the change that would occur if you observed oxygen (O_2) change from a solid into a liquid by melting.

Now think about this: How could knowing the melting point of a substance be helpful to scientists?

Reading 4.1 – How Can Two Objects that Are the Same Size Have Different Masses?

Getting Ready





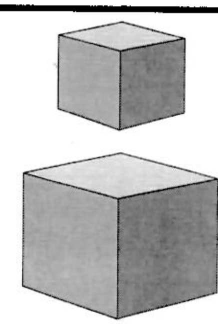
If you were sitting at a table and in front of you were a loaf of bread and a cement block that were the same size, which one would be heavier?

You probably do not need to do scientific tests to answer this question. You could easily pick up the loaf of bread, but the cement block would be harder to pick up. Even if a cement block and a loaf of bread have the same volume, they have different masses. They take up the same amount of space (volume), but the amount of stuff or matter in them is different (mass). Thinking about the bread and cement block may help you learn about another property of substances called density.

Properties	Not Properties
color	mass
hardness	volume
solubility	shape (round, tall)
melting point	texture
density	

Liquids and gases also have density. This reading will focus only on solids, however, like the chalk, soap, and fat you investigated in class.

How Can I Use Mass and Volume to Get a Property Called Density?



Imagine for a moment that one of these two cubes is cement. If you doubled the volume of the cement (if you had twice as much), what would you expect to happen to the mass of the cement? You might suppose that the mass would double because you have twice as much cement as you had before.

What if you broke off a piece of cement (or bread) so that it was only half the volume of the original piece? What would happen to the mass?

Even though cement and bread are not substances, they can help you to understand these concepts:

> Whatever you do to volume affects mass the same way.
>
> Whatever you do to mass affects volume the same way.

If you have half as much of a material, you would expect the volume of the material to also be half as much. If you have twice as much of the material, you would expect its volume to also be twice as much. Substances, which you know are always the same throughout, will follow this rule. This relationship between mass and volume will stay the same for any substance, no matter how much of that substance you can sample and measure in the classroom.

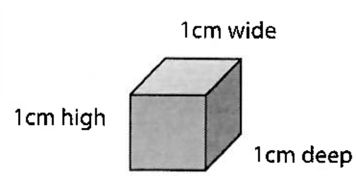
Why is this principle about the relationship between mass and volume always true of substances, but not always true of mixtures?

The relationship between mass and volume is what scientists call density. Density is the mass in a set volume of a substance. You may have heard the word *dense* before. When something is dense, it has a lot of mass for a little volume. You could say that cement is denser than bread. The amount of mass for a set volume of cement is more than the amount of mass for that same volume of bread. This mass-volume relationship is important because every substance has a specific mass-to-volume relationship. Every substance has a specific density.

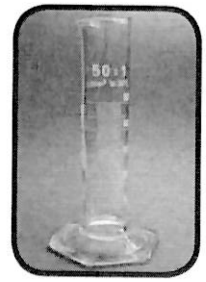
How Can You Determine Density from the Mass-Volume Relationship?

In class, you saw that pieces of chalk had the same density, even though they were different sizes. First, you measured the mass and volume of each piece of chalk. Then, for each piece, you divided its mass by its volume. The numbers you calculated for each piece of chalk should have been very similar to each other, around 2.4 g/cm^3. The *g* stands for grams (the mass of the chalk). The cm^3 stands for cubic centimeters (the volume of the chalk). The number with the g/cm^3 is the density of the chalk. You read the measurement, grams per cubic centimeter. It tells you about the mass-to-volume relationship.

The measurement of volume that scientists use when talking about density is 1 cubic centimeter ($1cm^3$). The following cube is approximately $1cm^3$. One cubic centimeter is a measurement for the volume of substances. The cube takes up space that is 1cm high, 1cm wide, and 1cm deep. When you calculate the density of chalk, it is like you are saying for every 1 cubic centimeter of chalk, you would have 2.4 grams of chalk.



Two Ways to Measure Volume



In class, you learned that the unit 1cm^3 and 1mL are two ways of stating the same measurement. You can see this by measuring an amount of water in a graduated cylinder. If you drop a 1cm^3 block into the cylinder, the amount of water it displaces will equal 1mL. Look at the picture of the graduated cylinder. If the water level starts at 30mL and you drop the 1cm^3 block into the water, the water level will rise to 31mL. That means that the water has been displaced by 1mL (31mL minus 30mL equals 1mL). In other words, a 1cm^3 block displaces water by 1mL.

These two units—1cm^3 and 1mL—can both be used to represent the same measurement. If you have the opportunity, you can do this in class so that you can see they are the same. When you refer to density, you can use either measurement, just as scientists can.

31mL (water measurement after adding 1cm^3 cube)

– 30mL (water measurement to begin)

1mL (difference = amount of water displaced)

Therefore, 1cm^3 = 1mL.

Density Tells You about a Substance

If you know the volume of a substance, the density can help you predict how much of a substance you have without measuring its mass. If you know its mass and its density, you know how much space a substance will occupy.

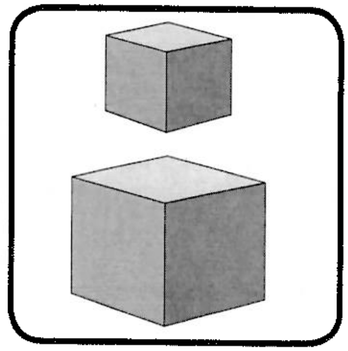
The density of aluminum is always 2.7g/mL no matter how big or small the piece is. Use aluminum's density to fill in the missing boxes in the following table.

To fill in the boxes, ask yourself: If I have 2.7g of aluminum for every 1cm^3, then how much aluminum would be in 2cm^3? Based on aluminum's density, how much volume (how many cm^3) would 0.85g of aluminum have? Remember that whatever you do to a set volume of a substance affects the mass in the same way.

Determining the Volume or Mass of Aluminum Based on Its Density

Substance	Volume	Mass	Density
Aluminum	1cm^3	2.7g	2.7g/cm^3
Aluminum	2cm^3		2.7g/cm^3
Aluminum		0.85g	2.7 g/cm^3

How Do Scientists Always Get 1cm³ When Figuring a Substance's Density?



It is often difficult to determine the density of something because most objects and most samples of substances are not exactly one cubic centimeter in size. Scientists use math to determine density no matter what mass or volume of a substance they have.

As long as you know the mass and volume of something, you can determine the density by determining the mass to volume ratio. You can do this by dividing the mass by the volume:

mass ÷ volume = density.

Using the formula, a person can determine the density of the bread and cement block, for example, even though they have a whole loaf of bread and a whole cement block in front of them. The formula allows a person to calculate without having a 1cm³ sample of each substance. The formula allows scientists (or you) to calculate density of any substance no matter what mass or volume of that substance they are measuring.

Density is a property of substances because every substance has a characteristic density, and that density does not change. A substance always has the same density. A small sample of the substance has less mass and takes up less space, but it has the same density as a different sample of the same substance. If the two cubes were both made of iron, their density would be the same. It does not matter if the larger sample has more mass and takes up more space. The mass and volume change, but the density of a substance is always the same.

If you tripled the volume of your sample of chalk, what would happen to the mass?

If you doubled the volume of your sample of chalk, what would happen to the density?

Try This at Home

Here is another way to observe the principle of density that may give you some surprises. Ask an adult if you can try this experiment at home. You will need a glass container that you can see through—a drinking glass, measuring cup, or empty jar will work. One at a time, you should slowly pour equal amounts of the following three liquids into the container:

- vegetable oil or baby oil
- corn syrup or pancake syrup
- water

Keep a chart of your observations. You may even want to draw what you see. What do you observe? What does this tell you about the density of the liquids and the objects you put into them?

Now, predict what will happen when you add some objects to your container. Try adding a paper clip or a safety pin, a toothpick or a cork, a grape or a raisin, a birthday candle, and a rubber pencil eraser. If an adult can show you how to separate an egg yolk from the egg white, predict what will happen when you drop an egg yolk into the container. Then do it. What does this investigation tell you about the densities of the materials you used? Maybe you can report what you learned back to your classmates.

Reading 2.1 – Why Can I Easily Wash Soap off My Hands with Water?

Getting Ready

Have you ever tried to wash your hands with butter? You probably have not because butter does not help to make your hands clean. Try it. Rub a small amount of butter, vegetable shortening, or lard on your hands, and try to rinse your hands with water. The fats make your hands slippery, but they do not rinse off easily. This reading will help you understand why you can rinse soap off your hands with water, but you cannot rinse fats off with water. You will have an opportunity to explain this later in the reading.

Solubility: What Does It Mean for a Substance to Be Soluble?

If you sprinkle a little salt into a glass of water and stir, the salt seems to disappear. Instead of seeing pieces of salt in the water, you see cloudy salt water. You do not see the grains of salt, because salt dissolves in water. Scientists say the salt is soluble in water. However, salt does not dissolve in all liquids. When you determine if a substance is soluble in a liquid, you are identifying another property of the substance. The property is called solubility.

Solubility is the capacity of one substance to dissolve in a liquid substance. The substance salt is soluble in water. Solubility in water is a property of salt. Remember that substances have properties that are always the same for that substance. If solubility in water is a property of salt, then it must always be true of salt. You will read more about this in the following sections.

When describing solubility, it is important to name the two substances—the substance being tested (salt) and the liquid substance it is being tested in (water). No one would say that salt is always soluble. Is salt soluble in milk? in cooking oil? in orange juice? Whether or not a substance is soluble depends on the substance and the liquid substance it is being tested in. You always have to name both of them to describe a substance's solubility. A correct way to describe the solubility of salt is to say, salt is soluble in water. Salt is not soluble in oil. If you sprinkle salt in a glass of oil, it will not dissolve.

What do you think would happen if you had a very small amount of water in a glass and you filled the glass with salt? Would the salt dissolve? Give reasons for your answer.

In fact, only some of the salt would actually dissolve, and then the water would not be able to dissolve any more salt. The substance salt is always soluble in water; but you cannot dissolve a lot of salt in a small amount of water. (If possible try this at home to check it out for yourself.) The fact that some of the salt would dissolve in water is evidence that salt is soluble in water. Water can dissolve many substances, but not all substances are soluble in water. For example, aluminum does not dissolve in water. That is why you might see empty soda cans at the bottom of a lake or a river. The substance aluminum is not soluble in water.

Where Does a Substance Go When It Dissolves?

If you stir sugar into a glass of iced tea, the sugar will look like it has disappeared. You know the sugar is still there because the tea tastes sweet. This is an interesting fact about solubility. When a substance is soluble, it might look like it disappears in the liquid, but the substance is still there. The substance breaks up into very small pieces that are too small for you to see. Sugar is soluble in water, and a glass of iced tea is mostly made of water. The particles that make up the solid sugar move away from each other and mix with the particles of the water. Iced tea is another example of a mixture. It is a mixture of water and tea. Sweetened iced tea is a mixture of water, tea, and sugar.

In Lesson 1, you read that toothbrush bristles are made of nylon. Would you use a toothbrush with nylon bristles if nylon were soluble in water? Explain your ideas.

Not All Substances Are Soluble in Water

You have learned that solubility is another property of substances. Some substances are soluble in water, but others are not. Some substances are soluble in oil, or other liquids, and other substances are not. Solubility can help you better describe what substances are and how they can be used. Have you ever had something greasy on your hands that was difficult to wash off? One example is grease from working on machines or engines. Another example is cooking oil or butter.

Now that you have learned about solubility, how can you explain why greasy substances are difficult to wash off?

You have also learned that some ways of describing substances are not properties—like mass, volume, shape, and texture. You have now learned about solubility. Soon you will learn about other properties. Remember, properties help scientists describe substances, identify substances, and to tell samples of different substances apart. These are two lists of what you have learned so far, with the property solubility now added.

Properties	Not Properties
Color	Mass
Solubility	Shape (round, tall)
	Volume
	Texture

How do you know if something is a property or not?

Reading 6.2 – What Is a Chemical Reaction?

Getting Ready

Have you ever baked a cake? First you combine flour, sugar, eggs, and other ingredients. Then you pour the batter in a pan and put it in the oven. When you take it out of the oven, it is a cake. Do you think the ingredients changing into a cake in the oven are a chemical reaction? Explain why you think baking a cake is or is not a chemical reaction.

In this reading, you will learn more about chemical reactions. You will also learn how to find out whether baking a cake is a chemical reaction.

In class you observed a chemical reaction when you mixed road salt and baking soda in water. First you put two white solids into a bag. Then you put a cup of water in the bag without spilling it. After you closed the bag, you tipped the cup, and the liquid and solids combined. Once the substances combined, changes occurred. For example, you may have seen bubbles, the bag expanding, and a white solid form that did not dissolve. These changes are evidence that a change, called a chemical reaction, occurred.

A chemical reaction happens when two or more substances combine with each other in a way that makes new substances form. The substances are new because they are different from the substances you started with. The substances that you started with changed into different substances.

How Can I Know Whether New Substances Formed?

Remember learning about smell and how to tell if two substances are different? You may have learned that when substances are different, the properties of the substances are also different. If old substances change into new substances, the properties of the new substances will be different from the properties of the old substances.

If substances have different properties before and after a process, then a chemical reaction occurs. If properties change, something has to have happened. The substances are not the same substances anymore. When there are different substances with different properties before and after a process, a chemical reaction occurred. In this example, the process was stirring the ingredients together.

The things you observed in the sandwich bag experiment are evidence that a chemical reaction occurred. They are evidence of new substances that have different properties from the old substances.

Your observation of bubbles, the expanding bag, and the white solid that did not dissolve are evidence of a property change. You did not do anything else to the bag except mix the ingredients together. For example, you kept the bag at room temperature. Before mixing the substances, there was a little air in the bag, along with solids and a liquid. Then when you mixed the substances, you observed bubbles, and the bag got bigger. These observations are evidence that a gas formed. Before mixing, there was only a little gas in the bag, but after mixing, there was a lot of gas in the bag. That change is evidence that a new substance in the gas phase formed. You also know that the solids you started with dissolve in water, yet you ended up with a solid that was not soluble in water. A difference in the property solubility is more evidence that a new substance formed.

Remember that to tell for sure whether a chemical reaction occurred, a scientist must test the properties of the substances before and after a process. If a chemical reaction occurred, the properties of the materials will have changed. This is what always happens in a chemical reaction. New, different substances with different properties form.

What If I Mix Substances and the Properties Do Not Change?

If substances have the same properties before and after mixing or heating, a chemical reaction probably did not occur. This makes sense because the definition of a chemical reaction includes making new substances. If there are no changes in properties, there are probably no new substances. If there are no new substances, there was not a chemical reaction.

Now look at the Getting Ready in this lesson. Would you still give the same answer? In the space below, describe what you could do to determine whether baking a cake is a chemical reaction or not? What test(s) could you do?

Properties of the Solid Substances in the Plastic Bag Experiment Before and After Mixing

The experiment you did in class was a very complex chemical reaction. It involved many new substances and old substances. When a reaction is very complex, an easy way to compare substances is to compare only the substances that are in the same state of matter. That means comparing only the solids, only the liquids, or only the gases.

The following table tells the names and properties of the solid ingredients that were in the bag before mixing and after mixing. The table also shows properties of the solid substances. In class, you focused on the state of matter at room temperature. You also know about other properties, like melting point, solubility, and density. This table describes all of these properties, but only for the solid substances.

Solids		Properties		
		Melting Point	Solubility in Water	Density (at 20°C)
Substances (Before Mixing)	Road Salt	775°C	Yes	2.15g/cm^3
	Baking Soda	None*	Yes	2.20g/cm^3
Substances (After Mixing)	Table Salt	800.7°C	Yes	2.17g/cm^3
	Chalk	1330°C	No	2.71g/cm^3

After mixing, you saw a white substance, called a precipitate, in the bag. If you filtered the precipitate, you would get solid chalk. If you put the chalk in water, you would see more clearly that it is not soluble. If you let the water evaporate after you filter out the precipitate, you would see that the solution also contains sodium chloride, which is salt. What you did in class is complicated. The table will help you focus on only the solid substances as you think about what happened in your investigation.

When solid baking soda is heated, it breaks apart before it can become a liquid (melt). Scientists sometimes say that a substance that breaks apart before it can melt decomposes. Baking soda, for example, decomposes at approximately 55°C.

Did a chemical reaction occur in the plastic bag experiment? Construct an argument that uses data from the table as evidence to support your claim.

Can Straw Really Turn into Gold?

Now that you know a little more about chemical reactions, think about the *Rumpelstiltskin* story. In the fairy tale, one substance was involved in a process—spinning on the wheel—and then a different substance was made. Straw turned into gold. If the fairy tale were real, then that change would be called a chemical reaction. The substance that *Rumpelstiltskin* started with (straw) was different from the substance he ended with (gold). In real life, substances can change into other substances, but only in a fairy tale could straw turn into gold. Why? (Hint: Think about what gold is made of.) What is the scientific reason that straw cannot be turned into gold?