Mixtures and Solutions Journal
Always follow the safety procedures outlined by your teacher.

Never put any materials in your mouth. Do not taste any chemical unless your teacher specifically tells you to.

Do not smell any unknown material. If your teacher asks you to smell a material, wave a hand over the material to draw the scent toward your nose.

Avoid touching your face, mouth, ears, or eyes while working with chemicals, plants, or animals.

Do not mix unknown chemicals just to see what might happen.

Always wash your hands immediately after using chemicals.

Clean up spills immediately.

Clean up your work space after each investigation.

Be careful when using sharp or pointed tools. Always make sure that you protect your eyes and those of your neighbors.

Report all accidents, even small ones, to your teacher.

Follow directions and ask questions if you’re unsure of what to do.

Behave responsibly during science investigations.
PART 1. Prepare three cups. Put one level spoon (5-ml spoon) of each solid material in its cup. Observe the three solid materials. Fill in the property chart below.

<table>
<thead>
<tr>
<th></th>
<th>Color</th>
<th>Texture</th>
<th>Particle shape</th>
<th>Particle size</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powder (diatomaceous earth)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt (sodium chloride)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PART 2. Add 50 ml of water (one full syringe) to each cup. Stir and observe. Write your observations here.

- Gravel and water
- Powder and water
- Salt and water

PART 3. Separate all three mixtures with filters.

a. Place a screen over an empty, labeled cup.
b. Stir the mixture thoroughly.
c. Pour the mixture through the screen filter.
d. If the screen filter doesn’t separate the mixture, repeat the process with a filter paper.

Were you able to separate the mixtures? Record your results.

<table>
<thead>
<tr>
<th></th>
<th>Screen</th>
<th>Filter paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. What is a mixture? Give some examples.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. What is a solution? Give some examples.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3. Is salt and water a mixture? A solution? Is it both a mixture and a solution?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

4. How do you know when a solid and a liquid form a solution?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

5. How can mixtures be separated?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

6. How are screen filters and paper filters alike? How are they different?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
MAKING A SOLUTION

1. Weigh 50 ml of water. Record its mass on line 2 in the box below.

2. Make a solution with one level spoon of salt and 50 ml of water.
3. Carefully weigh the solution. Record its mass on line 1 in the box below.

4. Calculate the number of grams of salt you put in the water to make the solution, by subtracting to find the difference.

| 1. Mass of salt-and-water solution | ________ g |
| 2. Mass of 50 ml of water          | ________ g |
| 3. Mass of salt                    | ________ g |

How could you separate the salt from the water in the solution?

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
Kim wrote in his journal,

*A solution is not a mixture, it is just a solution.*

Is he confused? How would you explain mixtures and solutions to Kim?
SEPARATING A DRY MIXTURE

Challenge: Design a method to separate a mixture of gravel, salt, and powder.

PART 1. Prepare the solid mixture.
   a. Label a plastic cup “dry mixture.”
   b. Put one 5-ml spoon of salt in the cup.
   c. Put one 5-ml spoon of gravel in the cup.
   d. Put one 5-ml spoon of powder in the cup.
   e. Stir the mixture with a stick.

PART 2. Describe your plan for separating the mixture so that the salt is in one cup, the gravel is in a second cup, and the powder is in a third cup.

PART 3. Summarize the results of your plan. Describe how you might improve your separation.
You are going to read an article about mixtures and solutions. This article will help you be able to describe various mixtures and solutions and ways you can separate them. You will also learn about elements and the periodic table. After you read the article, please answer the following questions using complete sentences.

1. What are some examples of mixtures (give at least 5 examples)?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2. How can mixtures be separated (list all three ways)?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

3. What is an element?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

4. What are some examples of solutions (give at least four examples)?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
5. How is a solution different from a mixture? ______________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

6. When salt dissolves in water, which is the solute? ________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

7. When salt dissolves in water, which is the solvent? ______________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

8. When liquid detergent dissolves in water, which is the solvent? ___________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

9. When liquid detergent dissolves in water, which is the solute? _____________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

10. What is a good way to separate solutes such as salt from solutions? ______________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

11. What name do we give the tiniest piece of an element? ____________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

12. What is each element made of? ________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
13. How many elements are found naturally on Earth?
______________________________________________________________________________

14. Name 4 elements.
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

THE FIRST 30 ELEMENTS: Look at the sidebar on page 3 and answer the following questions using complete sentences.

1. What is the lightest atom on the list?
______________________________________________________________________________
______________________________________________________________________________

2. What is the heaviest atom on the list?
______________________________________________________________________________
______________________________________________________________________________

3. Is aluminum heavier or lighter than titanium?
______________________________________________________________________________
______________________________________________________________________________

4. Is iron heavier or lighter than titanium?
______________________________________________________________________________
______________________________________________________________________________

5. Is iron heavier or lighter than aluminum?
______________________________________________________________________________
______________________________________________________________________________

6. The air we breathe is mostly a mixture of oxygen and nitrogen. The amount of nitrogen in the air is four times greater than the amount of oxygen. Which of these two elements is the lighter?
______________________________________________________________________________
______________________________________________________________________________

7. Argon, neon, oxygen, fluorine, nitrogen, chlorine, and helium are all gaseous elements. Put these seven gases in order from lightest to heaviest.
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
8. Iron, aluminum, nickel, titanium, chromium, copper, zinc, and cobalt are all metal elements. Put these eight metals in order from lightest to heaviest.

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

9. How many atoms does one drop of water contain? ___________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

10. How long would it take to count the number of atoms in one letter on this page?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

11. What element was used to fill the blimp on page 4? _________________________________
______________________________________________________________________________
______________________________________________________________________________
You are going to read an article about the historical importance of salt to humans and the development of a salt industry. After you read the article, please answer the following questions using complete sentences.

1. Why was salt important to people?

2. Name two ways salt is obtained.

3. Salt is made up of what two elements?

4. Who found a way to separate the elements in salt?

5. In what ways is salt used today (give at least 3 examples)?

6. What do scientists call a substance that is made up of more than one element?

7. How are chlorine and sodium used today?
SALT AND FOLKLORE: Read the sidebar on page 10 and answer the following questions using complete sentences.

1. What does superstition mean (look it up in the dictionary)?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2. How would you know if a statement is true or a superstition?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

SALT TO THE RESCUE: Read the sidebar on page 8 and answer the following questions using complete sentences.

1. What is a goiter?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2. What element helps cure goiters?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

3. Who suggested that iodine could be added to salt?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

4. Why does the World Health Organization hope to use iodized salt?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 1: SEPARATING MIXTURES

Andy had a box of animal crackers. He counted them out and found 20 cookies:

7 elephants
6 tigers
5 monkeys
2 zebras

If Andy put all the animal crackers back into the box and took one out without looking, what is the probability of his choosing

a. an elephant?

b. a tiger?

c. a monkey?

d. a zebra?

Does the sum of the probabilities $a$, $b$, $c$, and $d$ equal 1?
HOME/SCHOOL CONNECTION
INVESTIGATION 1: SEPARATING MIXTURES

Materials
Make a mixture known as oobleck. You will need
- 1 Mixing bowl
- 1 Spoon
- 1 Measuring cup
- Cornstarch
- Water

1. Put about a cup of cornstarch in the mixing bowl.
2. *Slowly* add water to make a mixture, stirring as you go.
3. When the starch is all wet, it will turn into oobleck.

Explore the properties of oobleck.
- Is it a solid or a liquid?
- What happens when you place solids, like coins or spoons, on the surface?
- What happens when you try to push your hand gently into the oobleck? When you try to push your hand hard and fast into the oobleck?
- Pick up a handful of oobleck. Can you hold it?
- Can you cut a ribbon of oobleck with scissors?
- What happens to the properties of oobleck when you change the amounts of the two ingredients in the mixture? More water? More cornstarch?

NOTE: If you want to keep oobleck to work with it another day, store it in a covered container in the refrigerator.
SATURATING A SOLUTION

Steps for determining the amount of solid material required to saturate 50 ml of water.

1. Put a filter paper in the funnel. Sprinkle it with water.

2. Place the labeled cup under the funnel.

3. Pour the saturated solution from the bottle into the wet filter.

4. Place the saturated solution on one side of the balance and 50 ml of water on the other side.

5. Add gram masses to the water until it balances. The amount of mass added to the water is equal to the mass of the solid material dissolved in the saturated solution.

6. Record the results in your journal.
Jasmine and Mack were making instant iced tea. In the 1/2-liter glasses, Mack put two spoonfuls of iced-tea powder and Jasmine put four spoonfuls. Both filled their glasses half full with water from the tap. Mack stirred his mixture and it all dissolved. Jasmine stirred hers, and it didn’t all dissolve.

“I think you have a saturated solution,” said Mack. ”Why don’t you add more water?”

“I know another way to make it dissolve,” said Jasmine.

Would Mack’s suggestion to add more water work? Explain your answer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What could Jasmine do to make the powder dissolve?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Challenge: Can you identify the mystery chemical?

Here is a table of properties for five chemicals.

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Appearance</th>
<th>Amount needed to saturate 50 ml of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>Small white grains</td>
<td>14 grams</td>
</tr>
<tr>
<td>Baking soda</td>
<td>Small white grains</td>
<td>3 grams</td>
</tr>
<tr>
<td>Epsom salts</td>
<td>Small white grains</td>
<td>48 grams</td>
</tr>
<tr>
<td>Citric acid</td>
<td>Small white grains</td>
<td>60 grams</td>
</tr>
<tr>
<td>Alum</td>
<td>Small white grains</td>
<td>6 grams</td>
</tr>
</tbody>
</table>

Record your observations about the mystery chemical.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

The mystery chemical is ________________________________
“Decompression Sickness”
Pages 11-13

You are going to read an article that will help you learn about how a gas dissolves in a liquid (nitrogen in the bloodstream) and what can happen if gas comes out of a solution too quickly. After you read the story, please answer the following questions using complete sentences.

1. What is the gas that causes decompression sickness? ________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

2. What happens if the gas comes out of the bloodstream too quickly? ________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

3. How is decompression sickness like caisson disease? ________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

4. How does decompression sickness affect the body? ________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

5. Explain how decompression sickness can happen to pilots. _________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

6. What do divers call decompression sickness? ________________________________
   ____________________________________________________________________________
You are going to read an article about how citric acid is manufactured and its use as a food additive. After you read the article, please answer the following questions using complete sentences.

1. What flavor does citric acid give foods? ____________________________________________
   ______________________________________________________________________________

2. What are some sour foods that you like to eat? ______________________________________
   ______________________________________________________________________________

3. In what foods is citric acid found naturally? ________________________________________
   ______________________________________________________________________________
   ______________________________________________________________________________

4. To what foods is citric acid added? _______________________________________________
   ______________________________________________________________________________
   ______________________________________________________________________________
   ______________________________________________________________________________

KARL WILHELM SCHEELE: Read the sidebar on page 15 and answer the following questions using complete sentences.

1. What are some of the discoveries Scheele made? ____________________________________
   ______________________________________________________________________________
   ______________________________________________________________________________

2. When did he live and in what country was he a chemist? ____________________________
   ______________________________________________________________________________
   ______________________________________________________________________________

3. Do you think it is important for scientists to publish their work as soon as possible? Why or why not? ________________________________________________________________
   ______________________________________________________________________________
   ______________________________________________________________________________
   ______________________________________________________________________________
CITRIC ACID AND YOUR TASTE BUDS: Read the sidebar on page 15 and answer the following questions using complete sentences.

1. What four tastes do our tongues detect? ___________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2. Where on your tongue are taste buds for the four different tastes? Draw a picture in the box below.

3. How do bitter and sour tastes warn us of possibly harmful foods? _______________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 2: REACHING SATURATION

A science class was doing an experiment to determine how much salt it takes to saturate 50 ml of water. Here are the groups’ results.

Group 1 — 14 g
Group 2 — 16 g
Group 3 — 15 g
Group 4 — 14 g
Group 5 — 15 g
Group 6 — 12 g
Group 7 — 14 g
Group 8 — 20 g

Can you make a histogram of the class results?

Review the data and the histogram to determine these numbers.

Mean

Median

Mode

Range

DEFINITIONS

Mean is the total divided by the number of groups. Mean is the same as average.

Median is the number that is in the exact middle when the numbers are arranged from smallest to largest.

Mode is the number that occurs most often.

Range is the largest number minus the smallest number.
Did you know you can make your own silly putty right at home? Here’s what you will need.

**Materials**
- 20 ml White household glue (Colored glue won’t work.)
- 5 ml Saturated borax solution (See Step 1.)
- Water
- 1 Plastic bag
- Food coloring
- 2 Plastic cups or small jars (Baby-food jars work great.)

**PROCEDURE FOR SILLY PUTTY**

1. In a plastic cup mix 15 ml (1 tablespoon) of borax with enough water to dissolve it (about 40-50 ml). This will make a saturated solution.

2. In a separate plastic cup mix 20 ml (4 teaspoons) of white glue with 5 ml (1 teaspoon) of water and a few drops of food coloring.

3. Add 5 ml of the saturated borax solution to the cup of glue.

4. Mix the mixture for a few minutes and watch what happens.

5. Now test your silly putty for stretching, bouncing, newsprint transfers, and so forth. How long will it stretch? How high will it bounce? Record your observations and bring them to class.

6. Place the putty in a plastic bag to preserve it.
## SOFT-DRINK RECIPES

| SOLUTION 1. 1 spoon of powder in 1000 ml of water |
| SOLUTION 2. 3 spoons of powder in 1000 ml of water |

List all the ways that the solutions are the same.

- 
- 
- 
- 

List all the ways that the solutions are different.

- 
- 
- 
- 

| SOLUTION A. 2 spoons of powder in 1000 ml of water |
| SOLUTION B. 2 spoons of powder in 500 ml of water |

List all the ways that the solutions are the same.

- 
- 
- 
- 

List all the ways that the solutions are different.

- 
- 
- 

My recommended recipe for soft drink is ________________________
PART 1. Make salt solutions 1 and 2.

a. Label two cups "Solution 1" and "Solution 2."

b. Use the 5-ml spoon to measure salt for solutions 1 and 2.

c. Use the syringe to measure the water.

d. Stir with a stirring stick.

<table>
<thead>
<tr>
<th>Solution 1</th>
<th>Solution 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 spoon of salt</td>
<td>3 spoons of salt</td>
</tr>
<tr>
<td>50 ml of water</td>
<td>50 ml of water</td>
</tr>
</tbody>
</table>

PART 2. Use the balance to make the comparisons described below.

Compare 50 ml of water and 50 ml of solution 1.

- Water
- Solution 1

Circle the solution that is heavier.

Compare 50 ml of solution 2 and 50 ml of solution 1.

- Solution 2
- Solution 1

Circle the solution that is heavier.

PART 3. Make a third salt solution in a third labeled cup.

<table>
<thead>
<tr>
<th>Solution 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 spoons of salt</td>
</tr>
<tr>
<td>150 ml of water</td>
</tr>
</tbody>
</table>

Discuss in your group which solution is more concentrated, solution 2 or solution 3. Write your prediction here. ____________________________

PART 4. Use the balance to compare solution 2 and solution 3.

Time out! Discuss your plan with your group before using the balance.

Which solution proved to be more concentrated? ____________________________
In comparing three solutions Julie wrote in her journal that solution 3 was the most concentrated because it had the most water and the most salt. What can you tell Julie about concentration?

Solution 1
50 ml of water
2 spoons of salt

Solution 2
100 ml of water
4 spoons of salt

Solution 3
150 ml of water
5 spoons of salt
You are going to read and follow a step-by-step process to grow a new crystal. You will be using a new substance (borax). After you read the step-by-step process, please answer the following questions using complete sentences.

1. What is borax?

______________________________________________________________________________
______________________________________________________________________________

2. How is it used?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

After growing your crystals, examine them with a hand lens and record the shapes below:

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

Compare your borax crystals to other crystals you have created so far by filling in the Venn Diagram below.
You are going to read an article is about a solution that is all around you – the air. After you read the article, please answer the following questions using complete sentences.

1. What is air and what is it made of? _______________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

2. What is the solvent and what are the solutes in air? __________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

3. What is the concentration of nitrogen in air?______________________________________
   ____________________________________________________________________
   ____________________________________________________________________

4. What is the concentration of oxygen in air? ________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

5. What are some of the other gases found in small concentrations in air?___________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

6. The article states that water vapor is found in air and that there is more water vapor when the air is warmer. How does this fact relate to what you know about adding a solute to heated water (or other liquid)? ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

7. What is pollution? ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
8. What is global warming?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

9. What might cause global warming?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

THE AIR ASTRONAUTS BREATHE: Read the sidebar on page 19 and answer the following questions using complete sentences.

1. Describe how air is managed in spacecraft.

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

AMAZING AIR FACTS: Read the sidebar on page 20 and answer the following questions using complete sentences.

1. Is it possible to live on Mars without a space suit? Why or why not?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2. How do you think your body can keep from being crushed by air pressure?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
Students in Mrs. Lorenzo’s class decided to sell fruit drinks after school to raise money for a field trip. In order to know what flavors to sell, they surveyed the fifth grade to find out what flavors were their favorites. Here are the results.

<table>
<thead>
<tr>
<th>Flavor</th>
<th>Cherry</th>
<th>Grape</th>
<th>Orange</th>
<th>Berry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room 14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Girls</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Room 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Girls</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Room 16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Girls</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Graph the results and answer the questions.

- Which flavor did the fifth grade prefer?
- Which flavor did the girls prefer?
- Which flavor did the boys prefer?
- Which flavors would you recommend selling after school? What are your reasons?

Bonus question: What percentage of the class preferred each flavor?

Cherry _____ %  Grape _____ %  Orange _____ %  Berry _____ %
You can grow some crystals in your home laboratory. Choose one of the approaches described below. Use safe laboratory procedures when working with chemicals.

**ALUM OR EPSOM SALTS CRYSTALS**

1. Evaporate an alum solution and save the crystals (see Step 3).
2. Prepare a supersaturated alum solution by dissolving alum in very hot water (close to boiling) until no more will dissolve. Cool the solution. Pour it into a jar.
3. Tie one alum crystal to the end of a thread. This is the seed crystal.
4. Hang the seed crystal in the jar of supersaturated alum solution and wait several days for the crystal to grow.
5. Remove the crystal, make another supersaturated alum solution, cool it, pour it into the jar, and put the crystal into the solution. Repeat this process for bigger and bigger crystals.

**BLUING CRYSTALS**

**Materials**
- 1/4 cup Water
- 2 tablespoons Bluing
- 2 tablespoons Salt
- 2 tablespoons Ammonia (without detergent)
- 1 Plastic cup or jar
  - Food coloring
- 1 Small lump of clay (if you use pipe cleaners)
  - Pipe cleaners, charcoal, sponges, or a paper-towel tube

1. Make a solution with the water, liquid bluing, salt, and ammonia.
2. Place a lump of clay on the bottom of the clear plastic cup or jar. Push three or four pipe cleaners into the clay. Put drops of food coloring on the tips of the pipe cleaners.
3. Pour the solution into the cup so that it covers the clay and all but 1 cm of the pipe cleaners.
4. Set the cup where it will not be bumped or disturbed. Crystals will start to form in a few hours.

**NOTE:** The solution may be poured over broken charcoal, sponges, or sections of cardboard paper-towel tubes instead of clay and pipe cleaners. Whichever material you use, part of it must extend above the surface of the liquid.

**OBSERVATIONS**

Draw and write about the crystals.
DIRECTIONS

1. Number three cups and place them on the numbered circles.
2. Put the solid materials in cup 1 (one spoon of calcium chloride and one spoon of baking soda).
3. Carefully add 50 ml of water to cup 1.
4. Observe the results and record observations on the Fizz-Quiz Observations sheet.
5. Repeat the procedure for cups 2 and 3. (Take turns putting the chemicals into cups.)
Follow the Fizz-Quiz Place Mat directions to make the mixtures. Record the results. Draw and describe what you observed.

**Cup 1** 1 spoon of calcium chloride, 1 spoon of baking soda, and 50 ml of water

**Cup 2** 1 spoon of calcium chloride, 1 spoon of citric acid, and 50 ml of water

**Cup 3** 1 spoon of baking soda, 1 spoon of citric acid, and 50 ml of water

Which chemicals reacted to form a gas? ___________________________________________

Which chemicals reacted to form a precipitate? ______________________________________
Tarren wrote in his journal,

After I mixed calcium chloride, baking soda, and citric acid together in water, I saw bubbles and lots of fizzing. A short time later I saw a new white material on the bottom of the cup. A reaction took place.

After the same experiment Julie wrote,

After I mixed calcium chloride, baking soda, citric acid, and water, it dissolved.

Who wrote the better observation? Why do you think so?

Who has the better conclusion? Why do you think so?

Describe the differences between dissolving and reacting.
You are going to read an article that will help you understand chemical reactions and the difference between slow and fast reactions. After you read the article, please answer the following questions using complete sentences.

1. What is a chemical change?

2. What are two examples of chemical reactions at different speeds?

3. What can affect the speeds of chemical reactions?

4. When sodium and chlorine react, what is the product?

5. When hydrogen and oxygen react, what is the product?

6. When iron and oxygen react, what is the product?
You are going to read an interview between a student and a chemist. You are also going to read more about elements and the periodic table. After you read these stories, please answer the following questions **using complete sentences**.

1. What is your favorite question that was asked? Why? ______________________________________
   ________________________________________________________________________________
   ________________________________________________________________________________
   ________________________________________________________________________________

2. What does the chemist like best about her work? _____________________________________
   ________________________________________________________________________________
   ________________________________________________________________________________
   ________________________________________________________________________________

3. What are some of the things chemists can do besides work in a laboratory? ____________
   ________________________________________________________________________________
   ________________________________________________________________________________
   ________________________________________________________________________________

4. What kind of person is this chemist? ______________________________________________
   ________________________________________________________________________________
   ________________________________________________________________________________
   ________________________________________________________________________________

**THE PERIODIC TABLE:** Read and answer the following questions **using complete sentences**.

1. Who was the first person to identify elements? _______________________________________
   ________________________________________________________________________________
2. What does the word period mean on the table? 

______________________________________________________________________________

______________________________________________________________________________

3. How many elements were known when Mendeleev’s periodic table was published? ________

______________________________________________________________________________

4. How many natural elements are known today? ______________________________________

______________________________________________________________________________

5. How have the charts (tables) changed over time? ________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________
You are going to read an article to find out how people learned to make and use rubber. After you read the story, please answer the following questions **using complete sentences**.

1. What are the two kinds of rubber?

2. What is natural rubber and where does it come from?

3. How is synthetic rubber like natural rubber? What is it made from?

4. What mixture did Goodyear discover that made rubber usable? What did the mixture do?

5. Why is rubber an important product today?
Rachel was interested in the reactions that produce carbon-dioxide gas. She wondered if there was some way to predict how much gas a reaction would produce. She did the series of seven experiments recorded below and measured the amount of carbon dioxide released by each one.

<table>
<thead>
<tr>
<th>Baking soda</th>
<th>Calcium chloride</th>
<th>Carbon dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 spoon</td>
<td>1 spoon</td>
<td>800 ml</td>
</tr>
<tr>
<td>1 spoon</td>
<td>2 spoons</td>
<td>1600 ml</td>
</tr>
<tr>
<td>1 spoon</td>
<td>3 spoons</td>
<td>1600 ml</td>
</tr>
<tr>
<td>2 spoons</td>
<td>1 spoon</td>
<td>800 ml</td>
</tr>
<tr>
<td>2 spoons</td>
<td>2 spoons</td>
<td>1600 ml</td>
</tr>
<tr>
<td>2 spoons</td>
<td>3 spoons</td>
<td>2400 ml</td>
</tr>
<tr>
<td>3 spoons</td>
<td>1 spoon</td>
<td>800 ml</td>
</tr>
</tbody>
</table>

Based on Rachel’s experimental results, answer the questions.

1. How many milliliters of gas would be produced if 3 spoons of baking soda reacted with 3 spoons of calcium chloride?

2. How many milliliters of gas would be produced if 2 spoons of baking soda reacted with 1.5 spoons of calcium chloride?

3. Rachel wanted to produce exactly 2000 ml of carbon dioxide. How much baking soda and calcium chloride should she use?
Project Ideas

- Look in *FOSS Science Stories* or books in the library for ideas about projects you might like to present to the class.

- Find out if each mixture makes a solution with water: flour, baking soda, alum, cooking oil, rubbing alcohol, or any other material you’d like to test.

- Research diatomaceous earth. Where does it come from? How is it used?

- Research sodium chloride. How does salt get to the table? Why are some people on low-salt diets?

- Find citric acid. It’s in many of the foods we eat. Read product labels and list products that contain citric acid.

- Research citric acid. What citrus fruits is it found in? How is it important in our diets?

- What effect does temperature have on saturation? Try experimenting with different temperatures of water—hot, iced, and so forth.

- Try dissolving a second material in a saturated salt solution. Will it dissolve? Will a third material?

- Investigate baking powder. What are the ingredients in baking powder? How does it react in water? How are baking powder and baking soda the same and how are they different?

- Investigate drinks. Many liquid products (for example, soft drinks) are complex solutions made of several materials dissolved in water. The order in which the ingredients appear on the label corresponds to their relative amount in the product. The substance listed first is the most concentrated, the second the next concentrated, and so forth. Bring the product to class and report on its contents in terms of concentration.

- Investigate limiting chemicals. Is the baking soda all used up in the reaction between calcium chloride and baking soda? Design an experiment to find out.

- Design a new filtering system for separating mixtures.

- Mix up a new mixture or solution and take it apart.

- Design a crystal mobile. Use the crystal formula in the home/school connection or research a new one using table salt, rock salt, sugar, Epsom salts, or borax.

- How do they get the fizz in soda? (See the resource *Soda Science: Designing and Testing Soft Drinks*.)

- Investigate rock candy. How is it made?

- Design an experiment that results in a new precipitate.

**NOTE:** You may collect and analyze information for your project using sound recorders, computer research, and cameras.
1. What is the question or the project that you are proposing?

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

2. What materials or references will you need to complete the project?

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

3. What steps will you follow to complete the project?

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
**PRESENTATION GUIDELINES**

You will have exactly 3 minutes to present your project to the class. In those 3 minutes you should answer these questions.

- What were you trying to find out (your question)?
- What materials or references did you need to do your project?
- What procedure did you follow to complete your project?
- What did you learn from doing your project?

When you begin speaking, you will see the **green card** held up for 2 1/2 minutes. When you see the **yellow card**, you have 30 seconds left. When you see the **red card**, it means you can finish your sentence, but you must stop within the next few seconds.

Practice your presentation so you will be sure it is at least 2 1/2 minutes long, but not more than 3 minutes long. Be sure you have included all of the information asked for above.