SCIENCE NOTEBOOK

MIXTURES AND SOLUTIONS

5TH GRADE



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5TH GRADE

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## Mixtures

### Part 1

Prepare three cups. Put 1 level spoon (5 mL) of each solid material in each cup. Observe the three solid materials. Fill in the property chart below.

| | Color | Texture | Particle shape | Particle size |
|---|---|---|---|---|
| Gravel | | | | |
| Powder | | | | |
| Salt | | | | |

### Part 2

Add 50 mL of water (one full syringe) to each cup. Stir and observe. Write your observations on the opposite page.

Gravel and water:

Powder and water:

Salt and water:






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Salt and water:

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Mixtures and Solutions Module
Investigation 1: Separating Mixtures
No. 1—Notebook Master

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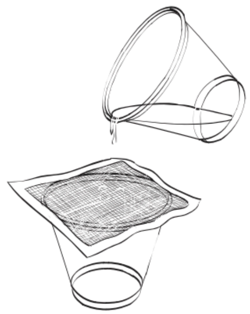
# Separations

## How can a mixture be separated?

### Procedure



Separate all three mixtures, using screens and filters.

1. Place a screen over an empty, labeled cup.
2. Stir the mixture thoroughly.
3. Pour the mixture through the screen.
4. Pour the mixture through the filter paper.

Did you separate the mixtures? Record your results.

| | Screen | Filter paper |
|---|---|---|
| Gravel | | |
| Powder | | |
| Salt | | |





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Separations

How can a mixture be separated?

Procedure

Separate all three mixtures, using screens and filters.

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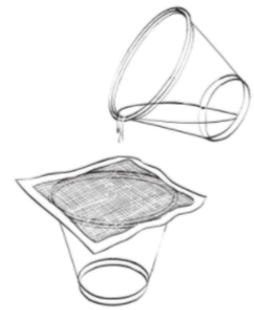
Investigation 1: Separating Mixtures
No. 2—Notebook Master



| Focus Question<br><br>How can a mixture be separated? | Focus Question<br><br>How can a mixture be separated? |
| --- | --- |
| | |

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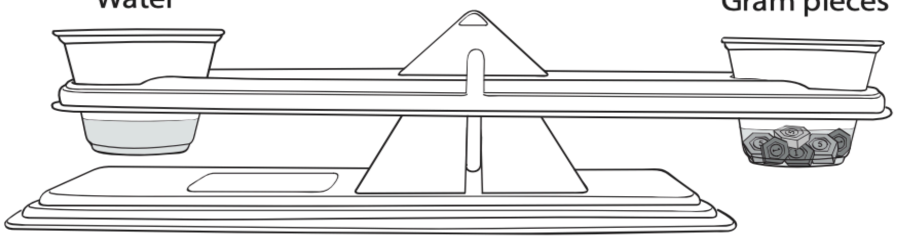
## Making a Solution




### Procedure

1. Weigh 50 mL of water. Record its mass on line 2.
2. Add 1 level spoon of salt to make a solution.
3. Weigh the solution carefully. Record its mass on line 1.

**1. Mass of salt solution** ____________ **g**

**2. Mass of 50 mL of water** ____________ **g**

**3. Mass of salt** ____________ **g**





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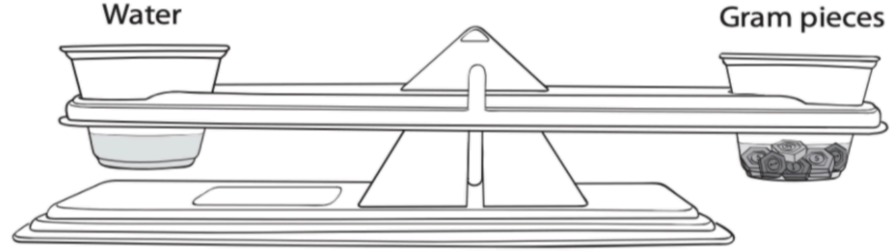
Making a Solution

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1. Mass of salt solution ____________ g

2. Mass of 50 mL of water ____________ g

3. Mass of salt ____________ g

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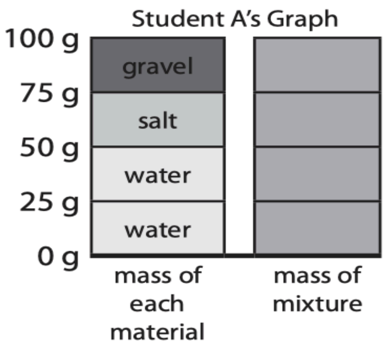
Mixtures and Solutions Module
Investigation 1: Separating Mixtures
No. 3—Notebook Master

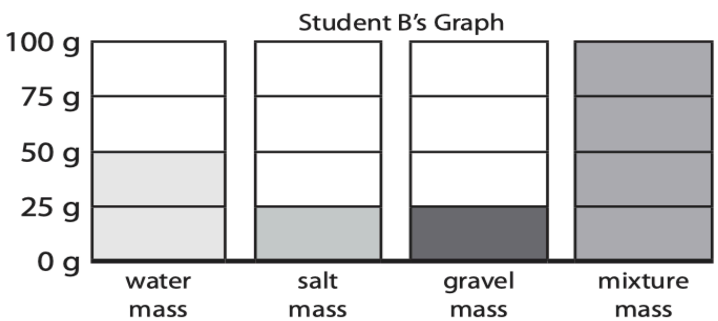
## Response Sheet—Investigation 1

Student A and Student B each measured the mass of three materials. They put the materials together and measured the mass of the mixture.

Below are the graphs that Student A and Student B made to show what they did.

Explain which graph you think better shows that the mass of materials doesn't change when they are mixed together.





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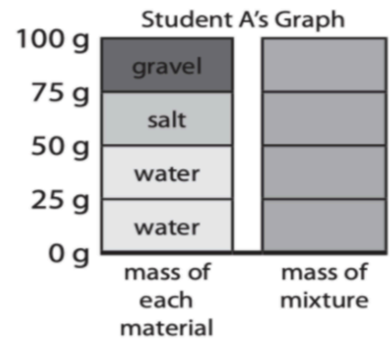


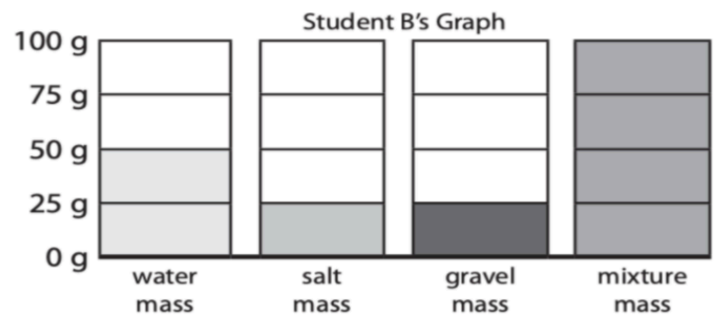


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Investigation 1: Separating Mixtures
No. 4—Notebook Master

| Focus Question<br><br>Where does the solid material go when a solution is made? | Focus Question<br><br>Where does the solid material go when a solution is made? |
| --- | --- |
| | |

## Science Practices

1. **Asking questions.** Scientists ask questions to guide their investigations. This helps them learn more about how the world works.
2. **Developing and using models.** Scientists develop models to represent how things work and to test their explanations.
3. **Planning and carrying out investigations.** Scientists plan and conduct investigations in the field and in laboratories. Their goal is to collect data that test their explanations.
4. **Analyzing and interpreting data.** Patterns and trends in data are not always obvious. Scientists make tables and graphs. They use statistical analysis to look for patterns.
5. **Using mathematics and computational thinking.** Scientists measure physical properties. They use computation and math to analyze data. They use mathematics to construct simulations, solve equations, and represent different variables.
6. **Constructing explanations.** Scientists construct explanations based on observations and data. An explanation becomes an accepted theory when there are many pieces of evidence to support it.
7. **Engaging in argument from evidence.** Scientists use argumentation to listen to, compare, and evaluate all possible explanations. Then they decide which best explains natural phenomena.
8. **Obtaining, evaluating, and communicating information.** Scientists must be able to communicate clearly. They must evaluate others' ideas. They must convince others to agree with their theories.





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Investigation 1: Separating Mixtures
No. 5—Notebook Master

## Engineering Practices

1. **Defining problems.** Engineers ask questions to make sure they understand problems they are trying to solve. They need to understand the constraints that are placed on their designs.
2. **Developing and using models.** Engineers develop and use models to represent systems they are designing. Then they test their models before building the actual object or structure.
3. **Planning and carrying out investigations.** Engineers plan and conduct investigations. They need to make sure that their designed systems are durable, effective, and efficient.
4. **Analyzing and interpreting data.** Engineers collect and analyze data when they test their designs. They compare different solutions. They use the data to make sure that they match the given criteria and constraints.
5. **Using mathematics and computational thinking.** Engineers measure physical properties. They use computation and math to analyze data. They use mathematics to construct simulations, solve equations, and represent different variables.
6. **Designing solutions.** Engineers find solutions. They propose solutions based on desired function, cost, safety, how good it looks, and meeting legal requirements.
7. **Engaging in argument from evidence.** Engineers use argumentation to listen to, compare, and evaluate all possible ideas and methods to solve a problem.
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Investigation 1: Separating Mixtures
No. 6—Notebook Master

## Elements of the Engineering Design Process

1. Understand the problem thoroughly.
2. Carefully define the criteria and constraints placed on a solution.
3. Devise a plan for a solution.
4. Build the planned solution.
5. Test the solution and evaluate its performance.
6. Return to the planning phase and revise the plan, based on data from the test.
7. Repeat Steps 4–6 until the solution satisfies the criteria and constraints.
8. Obtain a patent and go into production.





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Mixtures and Solutions Module
Investigation 1: Separating Mixtures
No. 7—Notebook Master

| Focus Question<br><br>How can you separate a mixture of dry materials? | Focus Question<br><br>How can you separate a mixture of dry materials? |
|---|---|
| | |

| Focus Question<br><br>Are there materials outdoors that will dissolve in water? | Focus Question<br><br>Are there materials outdoors that will dissolve in water? |
|---|---|
| | |

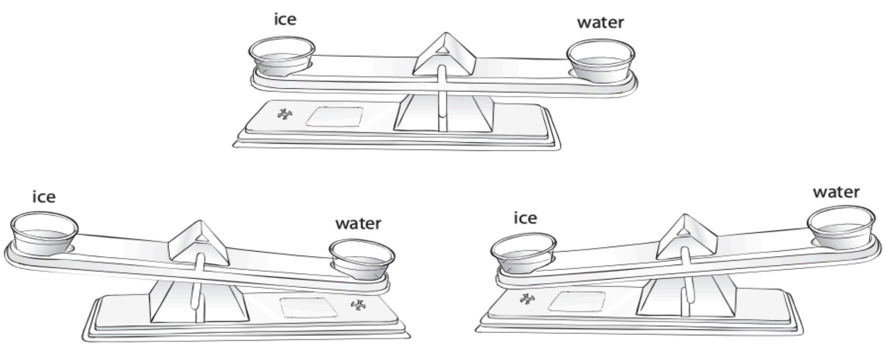
| Focus Question<br><br>What is the process to develop a model of the black box? | Focus Question<br><br>What is the process to develop a model of the black box? |
| --- | --- |
| | |

| Focus Question<br><br>How does a drought-stopper system work? | Focus Question<br><br>How does a drought-stopper system work? |
| --- | --- |
| | |

## Response Sheet—Investigation 2

A student freezes a cup of ice. He puts it on the left side of a balance. He then puts an empty cup on the right side of the balance, and pours in just enough water to make the balance level. Then he puts a lid on each cup. The balance remains level.

Circle the picture that shows what you think the balance will look like after the ice has completely melted.




Explain why you circled the picture that you did. Be sure to discuss volume and mass in your explanation.





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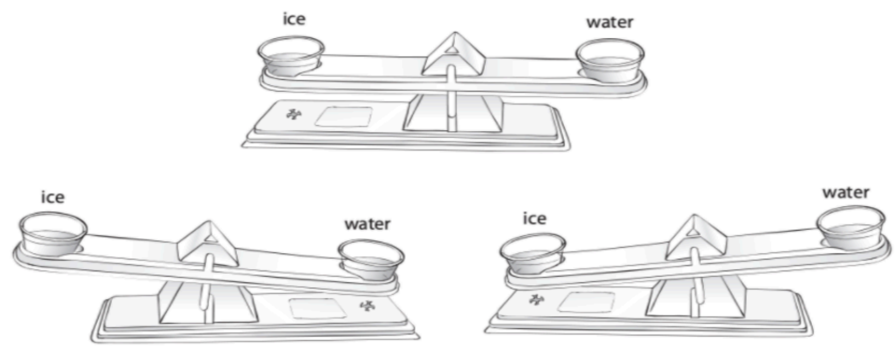


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Mixtures and Solutions Module
Investigation 2: Developing Models
No. 8—Notebook Master

| Focus Question<br>What is the difference between dissolving and melting? | Focus Question<br>What is the difference between dissolving and melting? |
| --- | --- |
| | |

## Soft-Drink Recipes

**Solution 1.** 3 spoons of powder and 1000 mL of water
**Solution 2.** 1 spoon of powder and 1000 mL of water

Similarities

Differences

| Solution 1 | Solution 2 |
|---|---|
| | |

**Solution A.** 2 spoons of powder and 1000 mL of water
**Solution B.** 2 spoons of powder and 500 mL of water

Similarities

Differences

| Solution A | Solution B |
|---|---|
| | |





Soft-Drink Recipes

Solution 1. 3 spoons of powder and 1000 mL of water
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Similarities

Differences

Solution A | Solution B

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Mixtures and Solutions Module
Investigation 3: Concentration
No. 9—Notebook Master

| Focus Question<br>Are all solutions made with soft-drink powder and water the same? | Focus Question<br>Are all solutions made with soft-drink powder and water the same? |
|---|---|
| | |

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## Salt Solutions 1 and 2

**Solution 1.** 1 spoon of salt and 50 mL of water
**Solution 2.** 3 spoons of salt and 50 mL of water

Similarities

Differences

| Solution 1 | Solution 2 |
|---|---|
| | |

**Mass and volume of Solutions 1 and 2**

| **Solution** | **Mass** (g) | **Volume** (mL) |
|---|---|---|
| 1 | | |
| 2 | | |





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## Salt Solutions 1 and 2

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Similarities

Differences

| Solution 1 | Solution 2 |
|---|---|
| | |

**Mass and volume of Solutions 1 and 2**

| **Solution** | **Mass** (g) | **Volume** (mL) |
|---|---|---|
| 1 | | |
| 2 | | |

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Mixtures and Solutions Module
Investigation 3: Concentration
No. 10—Notebook Master

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## Comparing Salt Solutions

### Compare Equal Volumes

If you compare the mass of 50 mL of Solution 1 with the mass of 50 mL of Solution 2, what will you observe?

### Prediction

Measured mass:
Solution 1 ________ Solution 2 ________

### Salt Solution 3: 3 spoons of salt and 150 mL of water

Is Solution 3 more concentrated, less concentrated, or the same concentration as Solution 2? Explain your answer.

### Focus Question

How can you determine which salt solution is more concentrated?





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Comparing Salt Solutions

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Mixtures and Solutions Module
Investigation 3: Concentration
No. 11—Notebook Master

## Response Sheet—Investigation 3


| | | |
|---|---|---|
| 2 spoons of salt<br>50 mL of water | 4 spoons of salt<br>100 mL of water | 6 spoons of salt<br>150 mL of water |

A student wanted to compare these three salt solutions.

a. How could she compare the solutions mathematically?

b. How could she draw a model to help her decide which solution is more concentrated?

c. How could she use a balance to determine which solution is the most concentrated?





Response Sheet—Investigation 3


2 spoons of salt 50 mL of water
4 spoons of salt 100 mL of water
6 spoons of salt 150 mL of water

A student wanted to compare these three salt solutions.
a. How could she compare the solutions mathematically?
b. How could she draw a model to help her decide which solution is more concentrated?
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Mixtures and Solutions Module
Investigation 3: Concentration
No. 12—Notebook Master

| Focus Question<br><br>How can you determine which salt solution is more concentrated? | Focus Question<br><br>How can you determine which salt solution is more concentrated? |
| --- | --- |
| | |

| Focus Question<br><br>How can you determine the relative concentrations of three mystery solutions? | Focus Question<br><br>How can you determine the relative concentrations of three mystery solutions? |
| --- | --- |
| | |

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## Liquid Layers

Use the straws to record the colors of the salt solutions you tried to layer.

When you succeed in layering all four solutions, put them in order in the table below, from most concentrated to least concentrated.

| Color | |
|---|---|
| | Least concentrated |
| | |
| | |
| | Most concentrated |

Which solution is most dense? Which is least dense?

Why do you think so?






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| | |
| | |
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Which solution is most dense? Which is least dense?

Why do you think so?

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Mixtures and Solutions Module
Investigation 3: Concentration
No. 13—Notebook Master

| Focus Question<br><br>What is the relationship between salt-solution concentration and density? | Focus Question<br><br>What is the relationship between salt-solution concentration and density? |
|---|---|
| | |

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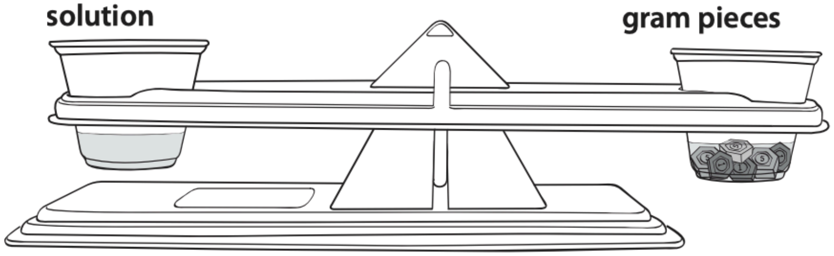
## Saturating a Solution

**Determine the amount of solid material required to saturate 50 mL of water.**

### Procedure

1. Put a filter paper in the funnel. Wet the paper to soak it.
2. Place a 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. Put a cup with 50 mL of water on the other side.
5. Add gram pieces to the water until the system is balanced.






Mixtures and Solutions Module
Investigation 4: Reaching Saturation
No. 14—Notebook Master

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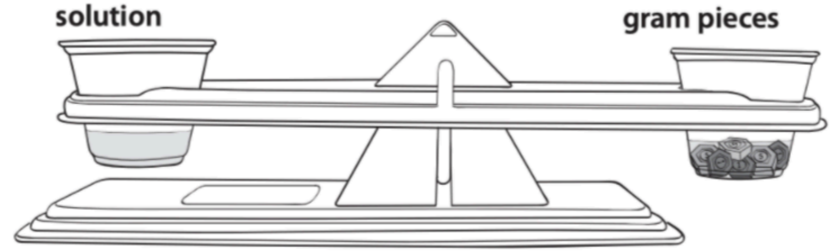


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Mixtures and Solutions Module
Investigation 4: Reaching Saturation
No. 14—Notebook Master

| Focus Question<br><br>Is there a limit to the amount of salt that will dissolve in 50 mL of water? | Focus Question<br><br>Is there a limit to the amount of salt that will dissolve in 50 mL of water? |
| --- | --- |
| | |

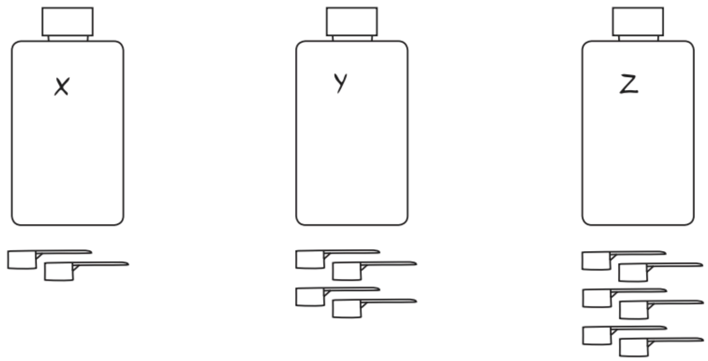
## Response Sheet—Investigation 4

A student wrote in his notebook:

| Bottle | Spoons of Sugar |
|---|---|
| x | 2 |
| y | 4 |
| z | 6 |

I made three solutions of water and sugar. I put the same amount of water in each bottle. I added sugar.

I shook each bottle for 1 minute. When I was done, I knew I had a saturated solution in Bottle Z.




The student's bottles are shown above.

a. Draw the liquid level in all three bottles.

b. Draw a model in the bottles to show the water and solid in each solution.

c. Be sure to show a saturated solution in Bottle Z.

d. If the student used Epsom salts instead of sugar, would you expect the same results?
Why or why not?





Response Sheet—Investigation 4

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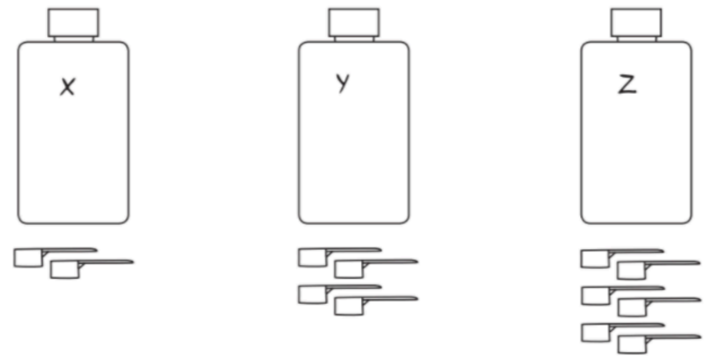


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Mixtures and Solutions Module
Investigation 4: Reaching Saturation
No. 15—Notebook Master

| Focus Question<br><br>Does it always take the same amount of solid materials to saturate 50 mL of water? | Focus Question<br><br>Does it always take the same amount of solid materials to saturate 50 mL of water? |
|---|---|
| | |

## Solubility Table

| Material | Appearance | Amount needed to saturate 50 mL of water (g) |
|---|---|---|
| Barium bromide | Small white grains | 52 |
| Citric acid | Small white grains | 67 |
| Epsom salts | Small white grains | 40 |
| Sodium chloride | Small white grains | 17 |
| Sodium acetate | Small white grains | 26 |


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| Sodium acetate | Small white grains | 26 |







## Solubility Table

| Material | Appearance | Amount needed to saturate 50 mL of water (g) |
|---|---|---|
| Barium bromide | Small white grains | 52 |
| Citric acid | Small white grains | 67 |
| Epsom salts | Small white grains | 40 |
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Mixtures and Solutions Module
Investigation 4: Reaching Saturation
No. 16—Notebook Master

| Focus Question<br><br>What is the identity of the mystery substance? | Focus Question<br><br>What is the identity of the mystery substance? |
|---|---|
| | |

| Focus Question<br><br>What is in our water samples?<br>What is a design to remove salt from ocean water? | Focus Question<br><br>What is in our water samples?<br>What is a design to remove salt from ocean water? |
| --- | --- |
| | |

**WARNING —** This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

## Two-Substance Mixtures

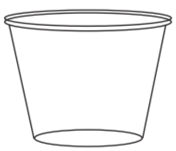
**Cup 1:** 1 spoon of calcium chloride, 1 spoon of baking soda

50 mL of water

**Cup 2:** 1 spoon of calcium chloride, 1 spoon of citric acid

50 mL of water

**Cup 3:** 1 spoon of baking soda, 1 spoon of citric acid



50 mL of water

1. Which substances reacted to form a gas?
2. Which substances reacted to form a precipitate?





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Mixtures and Solutions Module
Investigation 5: Fizz Quiz
No. 17—Notebook Master

| Focus Question<br><br>What is the effect of mixing two substances with water? | Focus Question<br><br>What is the effect of mixing two substances with water? |
|---|---|
| | |

## Response Sheet—Investigation 5

My neighbor wanted to make a model volcano. His aunt told him that a mixture of vinegar, baking soda, and soap powder would make good "lava." He made the mixture to see what would happen. Here are his observations.

First, I mixed the soap powder and baking soda. Nothing happened. Then I added vinegar. The mixture bubbled and spilled over the edge of the cup! After the bubbling stopped, the liquid was clear. There was no precipitate.

My neighbor said,

I think I made a mixture, a solution, and a reaction.

Do you think he made a mixture? Explain.

Do you think he made a solution? Explain.

Do you think he made a reaction? Explain.






Response Sheet—Investigation 5

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Do you think he made a mixture? Explain.

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Do you think he made a reaction? Explain.

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Mixtures and Solutions Module
Investigation 5: Fizz Quiz
No. 18—Notebook Master

| Focus Question<br><br>How can we identify the products from the baking soda and calcium chloride reaction? | Focus Question<br><br>How can we identify the products from the baking soda and calcium chloride reaction? |
| --- | --- |
| | |

| Focus Question<br><br>What happens when you mix substances with water in a bag? | Focus Question<br><br>What happens when you mix substances with water in a bag? |
|---|---|
| | |