Mixtures

5th Grade Sample Lesson

www.stemscopes.com/science

Scope (Unit) Mixtures

Explore (Lesson) Scientific Investigation - Expect the Unexpected

The following pages introduce lesson resources that guide you through the STEMscopes NGSS 5th grade lesson. This sample lesson does not include all the elements and features of our digital and print science curriculum.

Resource List:

The following resources, as well as additional Scope resources not listed, can be found in the digital curriculum *5th Grade Scope, Mixtures.*

Home

- Standards Alignment
- Sample Lesson Plan
- Teacher Background
- CCC and SEP Scoring Rubric
- Answer Keys
- Materials List

Engage

- Investigative Phenomena – Introductory activity that facilitates a connection between the content and real-world phenomena and encourages students to ask why or how something happens.
- Graphic Organizer – Students fill this in as they work through the elements of this Scope.
- Accessing Prior Knowledge – A brief probing activity to gauge students' prior knowledge before engaging in the inquiry process.
- Hook – An engaging activity that includes instructor preparation, supplemental resources, and ready-made handouts for students.

Explore

- Explore 1: Scientific Investigation – This lesson sample.
- Explore 2: Scientific Investigation
- Explore 3: Inquiry Investigation

Explain

- Picture Vocabulary – Key terms explained through pictures and by definition.
- Linking Literacy – Strategies to help students comprehend difficult informational text.
- STEMscopedia – Reference materials that include parent connections, career connections, technology, and science news.
- Communicate Science – A class activity in which students use different forms of communication to discuss scientific topics connected to the content of this Scope.
- Science Rock - Science Rock – A musical/video software platform where students can sing and learn from standards-based science songs.
- Concept Review Game – An interactive game that helps students review important concepts.
- Content Connections Video – A short video that supports student understanding of the content.

Elaborate

- Math Connections
- Reading Science
- Career Connections
- Scientist Spotlight
- PhET: Simulation Practice

Evaluate

- Claim-Evidence-Reasoning
- Open-Ended Response Assessment
- Multiple Choice Assessment

Intervention

- Guided Practice
- Independent Practice
- Concept Attainment Quiz

Acceleration

- Extensions
- Science Art
- Books on Topic

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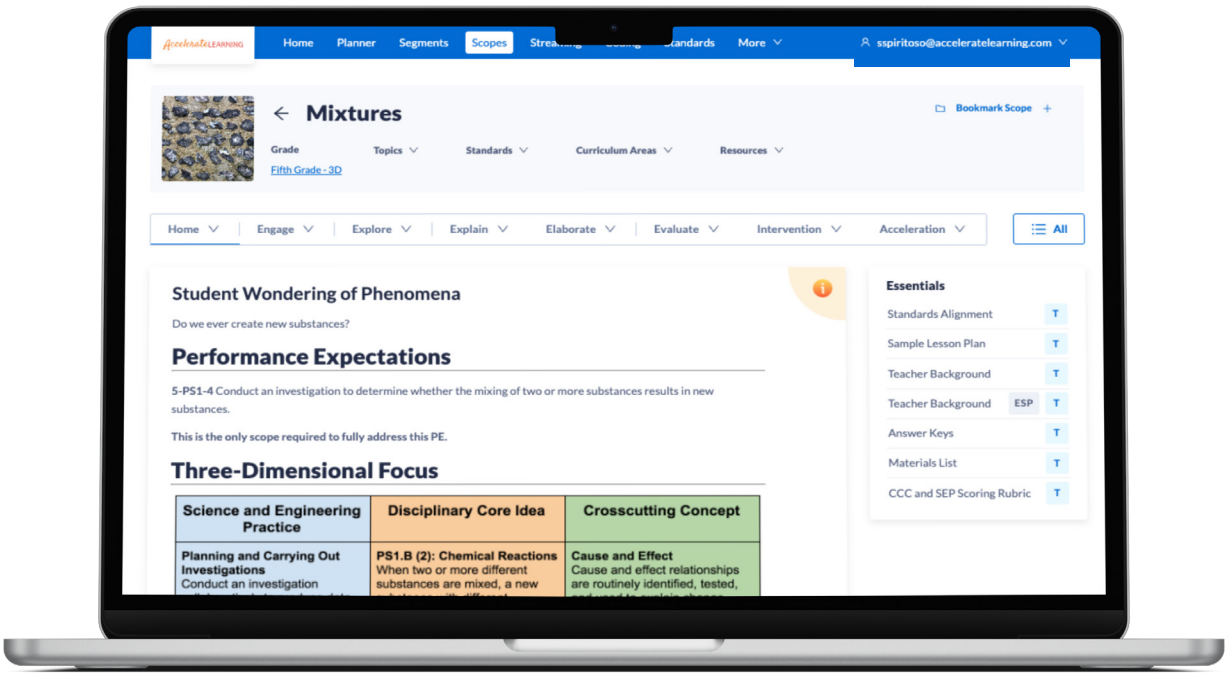
Scope (Unit) Overview

Scope (Unit) Social and Group Behavior



Student Wondering of Phenomena

Do we ever create new substances?

Performance Expectations

5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Three-Dimensional Focus

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Planning and Carrying Out Investigations Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-PS1-4)	PS1.B (2): Chemical Reactions When two or more different substances are mixed, a new substance with different properties may be formed.	Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4)

Mixtures

Explore 1: Scientific Investigation - Expect the Unexpected

Everyday Phenomena

How do we know if a chemical reaction has occurred?

Description

(CCC) Students explore how a change in temperature and the production of gas are signs of a chemical reaction.

Materials

Printed Materials
1 Expect the Unexpected (per student)
1 Student CER (per student)
1 Graphic Organizer (from Engage section of this scope) (per student)

Reusable
1 Long stirring stick (per group)
1 Thermometer (per group)
6 Large, clear plastic cups (per group)
1 Pair of goggles (per student)

Consumable
2 Paper towels (per group)
3 tsp Yeast (per group)
180 mL Hydrogen peroxide (per group)
3 tsp Baking soda (per group)
180 mL Distilled white vinegar (per group)

Preparation

- Print a Student Journal for each student.
- Place each group's materials in a container for easy distribution and collection.
- Remind students the day before the investigation to wear older clothes to school or bring a large, old shirt to cover their clothes, since they will be working with hydrogen peroxide, which can bleach their clothing.
- **Safety:** When dealing with potentially hazardous materials, proper eye protection is necessary.

STEMcoach in Action

The skills inherent in designing and implementing a scientific investigation are applicable to many situations outside the science classroom. Skills such as observing, asking questions, collecting and analyzing data, and drawing and communicating reasonable conclusions are important to all individuals. When we say "cultivating scientific investigation," we are describing the practices that help students develop the skills associated with scientific investigation. For further information regarding cultivating scientific investigations, please click the provided link.
Site

Procedure and Facilitation Points

Part I

1. Discuss lab safety prior to distributing materials:
    - When working in a lab, it is extremely important that you do not taste any of the materials, even if you think it is edible.
    - You should wear your goggles the entire time, because groups around you may be conducting tests, even if you are not.
    - Never play around in the lab, as this could cause accidents and injuries.
    - If you are wearing a shirt with long sleeves, roll them up, and tie back your hair if it is long.
    - Do your very best to prevent the materials from getting on your skin or clothing.
    - Wash your hands with soap and water if you get something on them.

Part II

1. Distribute materials to each group.
2. As students work through the activity, look for teachable moments to introduce students to the following vocabulary terms. Try to point out examples of the terms as students are working so that they can connect the meaning of the word with their experiences. Encourage students to use the following words as they record and discuss their findings.
    - **Substances**: particular types of matter with specific properties
    - **Mixture**: a combination of two or more substances in which each keeps its own properties and both can be easily separated
    - **Properties**: physical or chemical characteristics of matter used to describe or identify a substance
    - **Chemical reaction**: a property or characteristic of a substance that is observed or measured during a reaction in which the chemical composition or identity of the substance is changed
    - **Solution**: a liquid mixture in which one substance is mixed evenly throughout another substance
    - **Reversible**: able to be changed the other way around
3. Have students pour the peroxide into one cup and place the thermometer in the liquid.
4. Students may need to let the thermometer sit for a minute until it has stabilized. They should then record the temperature in their data table.
5. Ask students to make a prediction as to what will happen when yeast is added to the peroxide.
    - Do you think it will get colder, get hotter, or stay the same temperature once they are mixed? Students will probably think the temperature will stay the same, since the substances being mixed are both room temperature.
6. Students may now pour in the yeast and stir.
7. Encourage students to touch the outside of the cup to physically feel what happened.

8. **(SEP)** Students should put the thermometer into the cup and record the temperature on their data table. Students should complete three trials, recording data each time.
    - Were you right? Answers may vary.
    - What type of change occurred? It got hotter.
    - What made the temperature change? The materials must have reacted with each other somehow to cause heat to be released.
9. Students should describe what the mixture now looks like on their journal page.
    - Did you see anything happen? Yes, there were bubbles.
    - Were there bubbles in the peroxide before you mixed in the yeast? There were a few, but a bunch more were formed after mixing in the yeast.
10. Have students pour the vinegar into the other cup and place the thermometer in the liquid.
11. Students may need to let the thermometer sit for a minute until it has stabilized before they record the temperature in their data table.
12. Ask students to make a prediction as to what will happen when baking soda is added to the vinegar. It will make bubbles.
    - Do you think it will get colder, get hotter, or stay the same temperature once they are mixed? Answers may vary.
13. Students may now pour in the baking soda and stir.
14. Encourage students to touch the outside of the cup to physically feel what happened.
15. Students should put the thermometer into the cup and record the temperature on their data table.
    - Were you right? Answers may vary.
    - What type of change occurred? It got colder.
16. Students should describe what the mixture now looks like on their journal page.
17. Students should complete the CER, using their data, before discussing the results with the class.
18. **(CCC)** Discuss:
    - Did you see anything happen? Yes, there were bubbles.
    - What do you think the bubbles are? They are a gas.
    - What do these things tell us? The bubbles are some sort of gas that was a new substance produced when the substances in the mixture reacted with each other.
        - Record this example of a cause and effect relationship on the class crosscutting concept chart. Discuss other examples of cause and effect that the students have previously explored. Charts can be found in the teacher toolbox.
    - Was there a measurable change? There was a change in temperature.
    - **(SEP)** What do the production of a gas and change in temperature indicate? The production of gas and the change in temperature tell us that a chemical change or chemical reaction happened and a new substance has formed.
19. Consider explaining for students the difference between the gas produced by the chemical reactions in this exercise and the gas that appears in a carbonated drink when the top is opened. The gas here appears when two substances are mixed and a new substance, the gas, is produced. The gas in a soda can appears when the pressure inside the can is reduced, releasing a gas that was already there but held in solution by high pressure.
20. Have students record the evidences of chemical change on their Graphic Organizers.
21. Have students write down any questions they have that they would like to investigate further.

Connection to the Investigative Phenomena

Once students have completed the activity, have them refer to the Investigative Phenomena question, anchor their learning, and revise their thinking.

Math Moment

NGSS specifies no Common Core Math alignment; however, we suggest connecting this learning task to math standard *5.MD.A.1: Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m) and use these conversions in solving multi-step, real world problems.*

Each group in this activity receives 60 mL of peroxide and vinegar. Have students **solve** for the equivalent measurement in liters.

Check out this module's Math Connections for further practice!

Intervention Strategies

Roadblock: Does Not Share or Allow Others to Take Turns

In this activity, students have the opportunity to create chemical reactions using materials and instruments that may be new to them. Due to this excitement, students may not want to share the responsibilities and may want to do it all themselves. Modify the activity so that each student takes small turns or is in charge of a job, such as pouring or measuring the temperature. Gradually increase the length of each student's turn as they display success. Learn more strategies in the Intervention Toolbox.

Explore

Name: _____ Date: _____

Expect the Unexpected

Explore Lesson

Driving Question
Can we mix things to create a new substance?

What We Need

1 Long stirring stick (per group)
1 Thermometer (per group)
2 Large clear plastic cups (per group)
1 Pair of goggles (per student)
2 Paper towels (per group)
1 tsp. Yeast (per group)
60 mL Hydrogen peroxide (per group)
1 tsp Baking soda (per group)
60 mL Distilled white vinegar (per group)

Procedure

1. Be sure to follow all safety rules.
    - When working in a lab, it is extremely important that you do not taste any of the materials, even if you think it is edible.
    - You should wear your goggles the entire time, because groups around you may be conducting tests, even if you are not.
    - Never play around in the lab, as this could cause accidents and injuries.
    - If you are wearing a shirt with long sleeves, roll them up, and tie back your hair if it is long.
    - Try to prevent the materials from getting on your skin or clothing.
    - Wash your hands with soap and water if you get something on them.
2. Pour the hydrogen peroxide into a cup. Place the thermometer in the the liquid. Let it sit a minute until it is stabilized, and then record the temperature on the data table. Remove the thermometer.
3. Predict if the temperature will increase, decrease, or stay the same when the yeast is added. Record your prediction.
4. Pour the yeast into the liquid in the cup. Observe what happens. Record your observations on the data table.
5. Place the thermometer in the mixture. Let it stabilize, and then read and record the temperature again.

Explore

Procedure, continued

6. Repeat these steps two more times for a total of three trials.
7. Pour the vinegar into the other cup. Place the thermometer in the liquid. Let it sit a minute until it is stabilized, and then record the temperature on the data table. Remove the thermometer.
8. Predict if the temperature will increase, decrease, or stay the same when the baking soda is added. Record your prediction.
9. Pour the baking soda into the liquid in the cup. Observe what happens. Record your observations on the second data table.
10. Place the thermometer in the mixture. Let it stabilize, and then read and record the temperature again.
11. Repeat these steps two more times for a total of three trials.

Data and Observations

When the yeast is added to the hydrogen peroxide, I think the temperature will _____.

Hydrogen Peroxide and Yeast			
	Temperature **before** Adding Yeast	Temperature **after** Adding Yeast	Observations and Notes
Trial 1			
Trial 2			
Trial 3			

Explore

When the baking soda is added to the vinegar, I think the temperature will _____.

Vinegar and Baking Soda			
	Temperature **before** Adding Baking Soda	Temperature **after** Adding Baking Soda	Observations and Notes
Trial 1			
Trial 2			
Trial 3			

Reflection

What did both tests have in common?

_____

_____

Was a new substance formed? How do you know?

_____

_____

Why do you think you tested each mixture three times?

_____

_____

Explore

Name: _____ Date: _____

Expect the Unexpected

Driving Question
Can we mix things to create a new substance?

What We Need

1 Long stirring stick (per group)
1 Thermometer (per group)
2 Large clear plastic cups (per group)
1 Pair of goggles (per student)
2 Paper towels (per group)
1 tsp. Yeast (per group)
60 mL Hydrogen peroxide (per group)
1 tsp Baking soda (per group)
60 mL Distilled white vinegar (per group)

Procedure

1. Be sure to follow all safety rules.
    - When working in a lab, it is extremely important that you do not taste any of the materials, even if you think it is edible.
    - You should wear your goggles the entire time, because groups around you may be conducting tests, even if you are not.
    - Never play around in the lab, as this could cause accidents and injuries.
    - If you are wearing a shirt with long sleeves, roll them up, and tie back your hair if it is long.
    - Try to prevent the materials from getting on your skin or clothing.
    - Wash your hands with soap and water if you get something on them.
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3. Predict if the temperature will increase, decrease, or stay the same when the yeast is added. Record your prediction.
4. Pour the yeast into the liquid in the cup. Observe what happens. Record your observations on the data table.
5. Place the thermometer in the mixture. Let it stabilize, and then read and record the temperature again.

Explore

Procedure, continued

6. Repeat these steps two more times for a total of three trials.
7. Pour the vinegar into the other cup. Place the thermometer in the liquid. Let it sit a minute until it is stabilized, and then record the temperature on the data table. Remove the thermometer.
8. Predict if the temperature will increase, decrease, or stay the same when the baking soda is added. Record your prediction.
9. Pour the baking soda into the liquid in the cup. Observe what happens. Record your observations on the second data table.
10. Place the thermometer in the mixture. Let it stabilize, and then read and record the temperature again.
11. Repeat these steps two more times for a total of three trials.

Data and Observations

When the yeast is added to the hydrogen peroxide, I think the temperature will _____.

Hydrogen Peroxide and Yeast			
	Temperature **before** Adding Yeast	Temperature **after** Adding Yeast	Observations and Notes
Trial 1	21℃	26℃	I saw lots of bubbles form. The cup felt warm from the outside.
Trial 2	21℃	27℃	
Trial 3	21℃	25℃	

Explore

When the baking soda is added to the vinegar, I think the temperature will _____.

Vinegar and Baking Soda			
	Temperature **before** Adding Baking Soda	Temperature **after** Adding Baking Soda	Observations and Notes
Trial 1	21℃	14℃	I saw lots of bubbles form. The cup felt cold from the outside.
Trial 2	21℃	15℃	
Trial 3	21℃	13℃	

Reflection

What did both tests have in common?
When we mixed the substances, the temperature of the mixture changed and bubbles formed inside the liquid.

Was a new substance formed? How do you know?
Yes, a new substance was formed. The bubbles were made of a gas that was not there before.

Why do you think you tested each mixture three times?
Mistakes can happen. If you get a similar result several times in a row, it means your result is probably accurate.

Explore

Name: _____ Date: _____

Expect the Unexpected
Claim-Evidence-Reasoning

Prompt
Write a scientific explanation that describes whether or not these two mixtures, hydrogen peroxide mixed with yeast, and vinegar mixed with baking soda, caused a new substance to form. State your claim, and provide specific evidence and reasoning for your answer.

Claim

_____
_____
_____

Evidence

_____
_____
_____
_____
_____

Reasoning

_____
_____
_____
_____
_____
_____

Explore

Points Awarded	2	1	0
Claim	Student makes an accurate and complete claim.	Student makes a claim that is inaccurate or incomplete.	Student does not make a claim.
Evidence	Student provides two or more accurate pieces of evidence, uses labels, and addresses variables.	Student provides one or two accurate pieces of evidence.	Student does not provide evidence or only provides inappropriate or vague evidence.
Reasoning	Evidence is connected to the claim and includes scientific principles and vocabulary.	Student cites a reason, but it is inaccurate or does not support the claim. Student's reasoning does not use scientific terminology or uses it inaccurately.	Student does not connect the evidence to the claim.

Explore

Name: _____ Date: _____

Expect the Unexpected
Claim-Evidence-Reasoning

Prompt

Write a scientific explanation that describes whether or not these two mixtures, hydrogen peroxide mixed with yeast, and vinegar mixed with baking soda, caused a new substance to form. State your claim, and provide specific evidence and reasoning for your answer.

Claim

A new substance was formed by both mixtures.

Evidence

When the hydrogen peroxide and yeast were mixed, bubbles formed and the temperature increased. When the vinegar and baking soda were mixed, bubbles formed and the temperature decreased.

Reasoning

The formation of a new substance means that a chemical change occurred. This happened when the hydrogen peroxide and yeast were mixed and when the vinegar and baking soda were mixed, because they both created a new gas that was not there before. The bubbles showed that the new gas was there, and the temperature change showed that a chemical change was happening.

Explore

Points Awarded	2	1	0
Claim	Student makes an accurate and complete claim.	Student makes a claim that is inaccurate or incomplete.	Student does not make a claim.
Evidence	Student provides two or more accurate pieces of evidence, uses labels, and addresses variables.	Student provides one or two accurate pieces of evidence.	Student does not provide evidence or only provides inappropriate or vague evidence.
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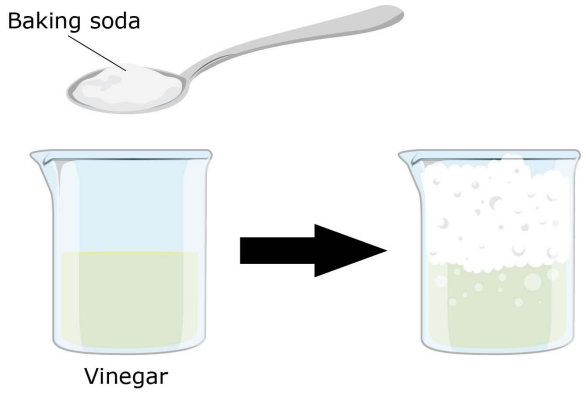
Picture Vocabulary

Mixtures

Picture Vocabulary

Chemical Reaction



A process in which substances combine to make one or more new substances

Mixture

A combination of two or more substances in which each keeps its own properties and both can be easily separated

Properties

Physical or chemical characteristics of matter used to describe or identify a substance

Reversible

Able to be turned the other way around

Solution

A liquid mixture in which one substance is mixed evenly throughout another substance

Substance

A form of matter that is the same throughout and has specific properties

Mixtures (A)

Math Connections

Math Connections

Name: _____ Date: _____

Manny and his family are using standard units of measure to make cookies. **Use the table below to help you with unit conversions for questions 1–4.**

Unit Conversion Chart

In These Units of Measure . . .	. . . There Are This Many Units.
1 gallon (gal)	4 quarts (qt)
1 quart (qt)	2 pints (pt)
1 pint (pt)	2 cups (c)
1 cup (c)	8 fluid ounces (fl oz)
1 cup (c)	16 tablespoons
1 tablespoon	3 teaspoons

1. Manny is making chocolate chip cookies for his parents and sister, but his recipe got smudged. He needs a huge handful of chocolate chips, which is about 1 _____ of chocolate chips. What should go in the blank?

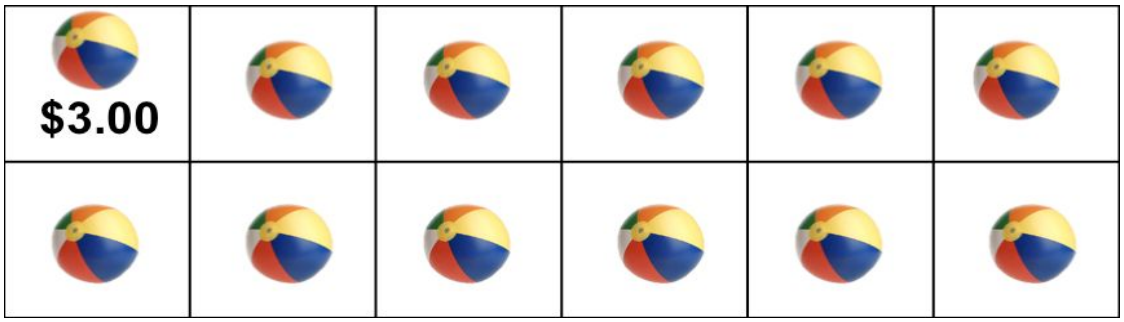
   A. Teaspoon
   B. Tablespoon
   C. Cup
   D. Gallon

2. Jane is making a solution of lemonade. It takes 1 cup of sugar, 2 cups of lemon juice, and 5 cups of water to make the perfect lemonade. What is the total number of quarts?
   (Hint: find the total number of cups, then convert that amount to quarts.)
   _____

3. Oops! Jane accidentally put 5 cups of sugar in the mixer with 2 cups of lemon juice and 5 cups of water. How much more lemon juice and water does she need?
   (Hint: Make sure you use the same proportion of ingredients as the original recipe shown in question 2. Consider making a table or drawing a model.)
   _____

Math Connections

4. Adrian is making a model of a mixture in her pool. She is going to take a picture of her model to show her science teacher. She wants 1 beach ball for every 2 square meters (m^2) of the water on the surface of her pool. The area of the surface of the pool is 24 m^2. She has divided her pool into sections that are 2 m^2 each. Each beach ball costs $3.00. What would be the total cost of the beach balls? **Use the information and model below to answer questions 5–9.**



Adrian only knows how to use metric units, such as meters (m) for length, kilograms (kg) for mass, and liters (L) for volume. She uses what she knows to create a solution for keeping her pool clean.

5. Adrian's pool has 1,260,000 liters of water. Adrian needs to add about 1/2 liter of chlorine solution for every 42,000 liters of pool water twice a week. There are 30 units of 42,000 liters in her pool. How many liters of chlorine does she need to use each time she adds the chlorine solution to the pool?
(Hint: this is a 2-step problem; you need to find how many liters of chlorine are used for the 1,260,000 liters of water and then multiply by 1/2.)

_____

6. How many liters of chlorine will she use in 1 week (7 days)?
(Hint: use your answer from above.)

_____

7. Adrian orders chlorine for her pool once a month. How many liters of chlorine will she need to order per month (4 weeks per month)?
(Hint: use your answer from above and multiply.)

_____

Math Connections

8. Adrian's chlorine-supply store is planning ahead for future orders and will be selling smaller, 1/2-liter sizes of pool chlorine solution. How many 1/2-liter sizes should the store stock if they receive 3 more orders from Adrian?
(Hint: she will need twice as many per month.)

_____

Claim-Evidence-Reasoning

Name: _____

CER Assessment

Scenario

Luke was making himself a cold drink with some water and lim m was making a snack with cheese and tomatoes. His dad was ta y mixing it with water. Luke noticed how everyone in his family was and causing changes. He wondered if his family was actually creating anything new.

Item 1	Item 2	Result
Effervescent antacid 	**Water** 	
Mozzarella cheese 	**Tomato** 	
Lime drink mix 	**Water** 	

Claim-Evidence-Reasoning

Prompt

Write a scientific explanation that describes which mixture caused a chemical reaction. State your evidence and reasoning to support your claim.

Claim:

_____

_____

Evidence:

_____

_____

_____

_____

Reasoning:

_____

_____

_____

_____

_____

_____

_____

_____

Claim-Evidence-Reasoning

Mixtures CER

Rubric for Writing a Scientific Explanation

Points Awarded	2	1	0
Claim	Student makes an accurate and complete claim.	Student makes a claim that is inaccurate or incomplete.	Student does not make a claim.
Evidence	Student provides two or more accurate pieces of evidence, uses labels, and addresses variables.	Student provides one to two accurate pieces of evidence.	Student does not provide evidence or only provides inappropriate or vague evidence.
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Claim-Evidence-Reasoning

Name: _____ Date: _____

Scenario

Luke was making himself a cold drink with some water and lime drink mix. His mom was making a snack with cheese and tomatoes. His dad was taking an antacid by mixing it with water. Luke noticed how everyone in his family was mixing things and causing changes. He wondered if his family was actually creating anything new.

Item 1	Item 2	Result
Effervescent antacid 	**Water** 	
Mozzarella cheese 	**Tomato** 	
Lime drink mix 	**Water** 	

Claim-Evidence-Reasoning

Prompt

Write a scientific explanation that describes which mixture caused a chemical reaction. State your evidence and reasoning to support your claim.

Claim:

The first set of pictures shows a chemical reaction has occurred.

Evidence:

In the first row, the tablet (Item 1) had no bubbles and the water cup (Item 2) had no bubbles. When they were mixed, there were bubbles. In the second row, the cheese stayed the same and the tomato changed shape. In the third row, the lime drink mix dissolved in the water.

Reasoning:

The effervescent antacid and the water released gases when they were mixed together. The gas was a new substance that was created because it was not there before the items were mixed. The water was a liquid and the tablet was a solid. The new substance is a gas. This is evidence of a chemical reaction. In the second picture set, there is no new substance. The cheese slices stayed the same. The tomatoes changed shape, which is only a physical change. In the third picture set, the water changed color when the lime drink mix was added, but no new substance was formed, because the mix dissolving in the water is just a physical change.

Claim-Evidence-Reasoning

Mixtures CER

Rubric for Writing a Scientific Explanation

Points Awarded	2	1	0
Claim	Student makes an accurate and complete claim.	Student makes a claim that is inaccurate or incomplete.	Student does not make a claim.
Evidence	Student provides two or more accurate pieces of evidence, uses labels, and addresses variables.	Student provides one to two accurate pieces of evidence.	Student does not provide evidence or only provides inappropriate or vague evidence.
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NGSS 3D
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K-12 SCIENCE
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