MOSA MACK SCIENCE

Claim-Evidence-Reasoning
& The Scientific Method *Year 2*
Lesson 1: *The Solve*
Educator's Resource Guide

Prerequisite Lesson: Claim-Evidence-Reasoning and the Scientific Method

This is a follow-up lesson to the original from year 1. The topics of Claim-Evidence-Reasoning and the Scientific Method are important to review each year, as they set a solid foundation for scientific exploration throughout the year. If your students have not yet done the original year 1 lesson, begin with that lesson instead.

Note: Any blue text that is not a link is meant to only be read by the educator. Do not read these answers outloud to the students, as they should come to these conclusions on their own.

Objective

- In *The Solve*, the students will:

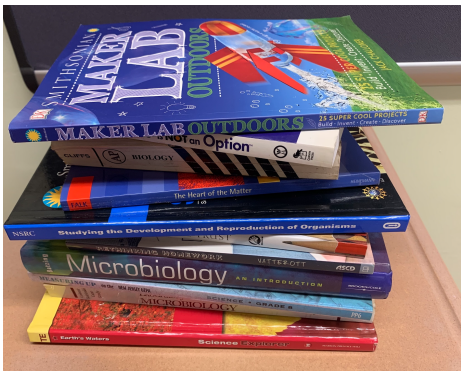
1. Observe and analyze a TV commercial to identify the **Claim-Evidence-Reasoning** presented.
2. Review information about Claim-Evidence-Reasoning and the **Scientific Method**.
3. Use the Scientific Method to test the claim.
4. Apply their knowledge of Claim-Evidence-Reasoning and Scientific Method vocabulary to investigate a new product claim.

If you are doing this lesson remotely, the students will view a recording of the lesson below and gather data along with the presenter.

Lesson Prep

Time Required
90-110 minutes
Materials Required
• Student Guide • Video clip: Reynolds Wrap commercial

- Computer with speakers (for projecting video) or headphones (for student viewing on laptops)
- Appendix A: Claim-Evidence-Reasoning Guide
- PowerPoint
- Students will be coming up with their own experiment to compare the strength of Reynolds Wrap vs. the store brand foil. Recommended materials to provide include the following per student team:
    - 2 ft sheet of Reynolds Wrap: (Note: A 200 ft foil roll will accommodate 8 groups of students. For example, if you have 5 classes that you will break up into 4 groups, you will need 3 rolls.)
    - 2 ft sheet of store brand foil
    - Electric balance/scale
    - Scissors
    - Rulers
    - Timers
    - ~10 Textbooks



Safety Considerations

- Have students use caution if they are cutting the foil themselves. The exterior of the foil box often has jagged, sharp edges.
- If students have designed an experiment that requires them to lift the foil, be sure they are lifting it over a table (as opposed to the floor) to prevent anything dropping near their feet.
- Review the student procedures for safety.

Science & Engineering Practices

- Asking Questions and Defining Problems
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Constructing Explanations or Arguments from Evidence

Cross Cutting Concepts

- **Cause & Effect**

Events have causes that can be simple or multifaceted. Deciphering causal relationships (and the mechanisms by which they are mediated) is a major activity of science and engineering.

- **Structure & Function**
  The way an object is shaped or structured determines many of its properties and functions.
- **Stability & Change**
  For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Inquiry Scale: Leveling Information

Level 1: Teacher-driven

Show the students the video clip of the Reynolds Wrap commercial and prompt them with questions to inspire more observations and questions. Once the class identifies the claim, lead them in identifying the evidence and reasoning, and introduce the activity. Then, use the Scientific Method PowerPoint to guide the class through each step of the Scientific Method to test the Reynolds Wrap claim. Once the experiment is complete, lead the class in applying their knowledge to a different advertisement. As a class, critique the ad to determine if the evidence presented accurately supports the claim. Then the students will independently complete the Exit Ticket questions.

Level 2: Student-driven

Instruct the students to view the video clip of the Reynolds Wrap commercial and explain that they will—independently or with a group—identify the claim, evidence, and reasoning provided in the commercial. The students will use the Scientific Method to design an experiment to test the strength of Reynolds Wrap vs. the store brand. They will complete the Commercial Review, Scientific Method, and Apply Your Knowledge sections independently or with their group. Then, the students will follow the Claim-Evidence-Reasoning and the Scientific Method PowerPoint to complete each step in the Student Guide. Once the experiment is complete, the students will apply their knowledge to a different advertisement by critiquing the ad and determining if the evidence accurately supports the claim. Then they will independently complete the Exit Ticket questions.

Agenda

Part 1: Commercial Analysis Using Claim-Evidence-Reasoning (20 minutes)

1. Instruct the students to watch the Reynolds Wrap Commercial. As they watch, the students should be on the

lookout for any **claims** that Reynolds Wrap makes about its foil.

Commercial Description: A man forgets he left corn on the grill. He runs over to the grill only to realize that his corn is actually perfectly cooked because it is covered in Reynolds Wrap. The narrator states that Reynolds Wrap is "expert barbeque tough" and shows a demonstration of a person holding a large turkey on a sheet of Reynolds Wrap and on a sheet of store brand foil. The Reynolds Wrap holds the turkey, but the store brand does not.

2. After the first viewing, walk through the Claim-Evidence-Reasoning process.
   Note: There is a Claim-Evidence-Reasoning Guide located in Appendix A in this Educator Guide and in the Student Guide. You can choose to give this to students at the beginning or end of the Claim-Evidence-Reasoning section as a quick reference guide they can use as needed.

3. Use the PowerPoint to share the definition of a **claim** as students refer to their Student Guide, and inform them that claims can be stated, written, or shown. Ask them to watch for multiple claims, as this commercial makes more than one claim.

4. Play the video again and have the students raise their hand when they hear or see a claim. Pause the video when you see a hand, and ask the student to share the claim. Clarify their understanding if necessary, based on the image below. As you confirm the claims, the students will write them down in their Student Guide.

Claim Definition	Reynolds Wrap Commercial Claims
An assertion; a statement believed to be true	• Reynolds Wrap is stronger than the store brand foil. • Reynolds Wrap is "expert barbeque tough". • Reynolds Wrap is "the foil that can handle anything life throws at it."

5. Discuss with the students which claims are testable and which are not. Have the students circle the testable claim, as this will be the claim we will focus on today.
    a. **The testable claim: Reynolds Wrap is stronger than the store brand foil.**
    Note: The other claims have various levels of testability depending on how the claim is interpreted. If your classroom has materials to safely test additional claims, you may do so.

6. Use the PowerPoint to share the definition of **evidence**, and ask the students how they would know if a claim is true.

7. Use the PowerPoint to discuss the difference between **qualitative data** and **quantitative data**.

8. Have the students go through the example images on the slide and categorize the data as either qualitative or quantitative.
Answer: The beaker, scale, and ruler lengths are all examples of quantitative data. The image of the person looking through the microscope could indicate qualitative data if they were making observations, or quantitative data if they were making measurements in the microscope.

9. Have the students view the commercial once more after prompting them to look for evidence.

10. Have the students share their evidence in small groups and then share as a class. Discuss the evidence that was presented and have the students record it in their Student Guide. Then, discuss the strength of each piece of evidence.

Evidence Definition	Reynolds Wrap Claim Evidence

Scientific data used to support the claim	• Quantitative data: None shown
	• Qualitative data:
	  ○ A piece of Reynolds Wrap and a piece of store brand foil were shown holding a turkey. The Reynolds Wrap held the turkey. The store brand broke.
	  ■ Strength of evidence: We don't know if this was the same amount of foil or if the turkey weight was the same. So the evidence is not strong.

	If the students are interested in exploring the evidence in the untestable claims, facilitate a discussion about the qualitative and quantitative evidence presented for both.

11. Use the PowerPoint to share the definition of the term **reasoning**.

    Tip: Students often grasp the idea of claims and evidence easily with a few examples. However, reasoning can be a bit more difficult to understand, so you should provide multiple reasoning examples. An example is provided in the PowerPoint.

12. As a class, discuss whether any reasoning was offered in the commercial. Then have them record the reasoning in their Student Guide.

Reasoning Definition	Reynolds Wrap Reasoning
How the evidence connects to the claim	The Reynolds Wrap held a turkey that a store brand could not hold. Therefore, Reynolds Wrap appears to be stronger than the store brand. If the students are interested in exploring evidence in the untestable claims, facilitate a discussion about the reasoning for both.

Part 2: Testing the Claim Using the Scientific Method (40-60 minutes)

The purpose of this lesson is to review the Claim-Evidence-Reasoning and Scientific Method information learned last year.

Ask the students if they have heard of the Scientific Method and have them share what they know about it or any experiences they have had with it.

If the students

- **would benefit from extra support during their review of the Claim-Evidence-Reasoning and the Scientific Method**, walk them through each step as a class and come up with a class experimental design.
- **feel comfortable with Claim-Evidence-Reasoning, and the Scientific Method**, they will work independently or in small groups of 3-4 to come up with their own experiment. If you choose to

have them work in groups, instruct the groups to use the Scientific Method to design an investigation (experiment) and carry out the test that will help them conclude whether the stated claim in the commercial is true.

1. Open the PowerPoint and review slides 9-18 with the students. Use the notes section to guide class discussions and ensure understanding of each component of the Scientific Method. These slides cover the planning component of the Scientific Method and include the following steps:
    - Identifying the question
    - Creating a hypothesis
    - Brainstorming the design of the experiment
    - Listing the materials required
    - Identifying the variables

2. Direct the students to sections 1-5 of the Student Guide and review the Scientific Method steps for designing a controlled experiment in order to answer a question, or support or refute a claim.

3. Guide the students through each section of the Scientific Method by having them work as a class or in groups of 3-4 to think about what each section consists of. Then have them share their ideas.
    - If working as a class, confirm each step with the students so that all students have the same information on their template.

There are many different ways to investigate this claim. The information below shows sample setups, data, and conclusions for a sample investigation.

The Scientific Method

Reminder: If you are teaching this lesson remotely, students will view a recording of a Mosa Mack Live online event on this lesson and gather data along with the presenter.

1. Question to test (based on claim made in commercial)

Is Reynolds Wrap stronger than the store brand foil?

2. Hypothesis (If-Then Statement)

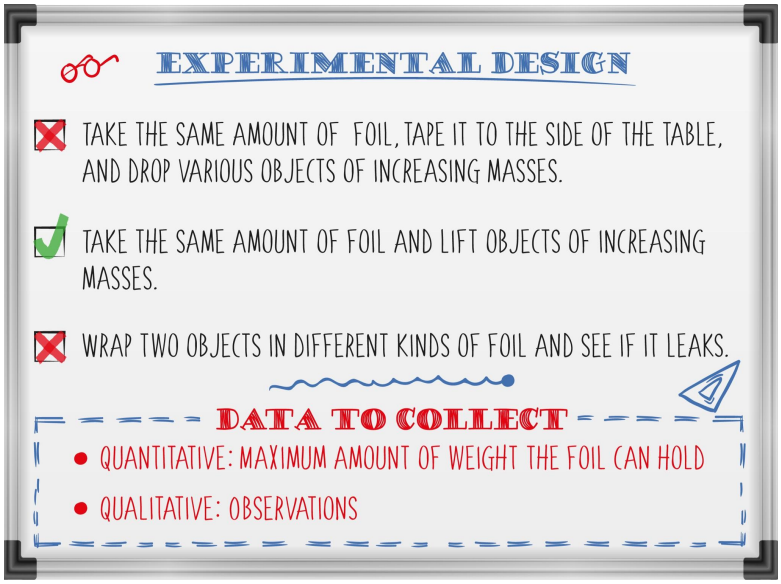
If we use the same amount of two different foil brands, then Reynolds Wrap will hold more mass than the store brand when tested for the same amount of time.

3. Experiment Design

Student ideas will vary. If completing as a class, you will come up with an experimental design as a group using the whiteboard to capture summaries of the different ideas. Steer the discussion toward deeper thinking about valid designs, crossing out the invalid or impractical, and affirming at least one valid design. Remember to prompt the students to think about the quantitative and qualitative data they need to capture. An example whiteboard is shown below.

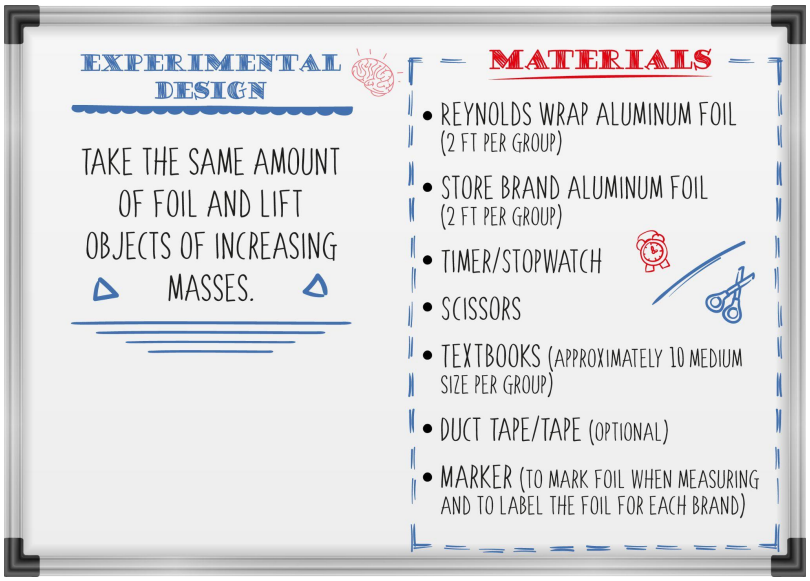
Use the same amount of foil to hold objects of increasing masses. Add textbooks to create weights of different increments.

Example: Whiteboard Ideas for Experimental Design



4. Materials Required

Record the required materials next to your agreed experimental design and discuss them as a group. An example whiteboard is shown below.



Optional: If students prefer to create a 'holding structure' instead of holding the foil, you can place the foil over an 18-gallon sterilite bin and secure it on the sides with duct tape. The students would measure the mass and place the textbooks in the center of the foil one at a time to determine the strength. Note that the materials would include a bin and duct tape to tape the foil to the bin if needed.

5. Variables

Ask the students what kind of things they need to consider as they design their experiment to ensure that it is as fair and accurate as possible. Encourage them to think of anything that could possibly impact the accuracy of their test, then have them share as a class.

Example Questions to Consider

- Should we get a new piece of foil each time?
- When the new textbook is added, what should we do with the foil: keep it in the air or rest it on the table?
- How should we hold the foil to ensure holding consistency?
- Will the same student lift the textbooks in each trial to ensure that the lift is the same each test?
- How can we be sure that the textbooks are positioned in the center of the foil the same way in each test?

Types of Variables

As a class, identify the independent, dependent, and control variables. Allow the students time to think through the definitions and identify each type of variable in this experiment. Then have them share the information in small groups before sharing their answers and confirming the answers as a class.

Example Variables

- Independent Variable: Brand of foil
- Dependent Variable (measured): Maximum mass of textbooks supported successfully

Example Controlled Variables

- Hold the foil sheet for 30 seconds each time.
- Use textbooks of the same size.
- Lift each foil sheet to the same height.
- Use the same size foil sheets (2 ft sheets)
- Place the textbooks on the foil the same way each time.
- Fold the tape in the same loop for each test.
- Hold the foil sheets in the same place each time between tests.
- Have the same student lift the foil for each trial and position their hands in the same place on the foil for each trial.
- Place the textbooks on the foil sheet while the foil rests on the table.

4. Review slides 19-20 from the PowerPoint with the students. In this section, they will design their actual procedure and conduct their investigation. Use the notes section in the PowerPoint to guide class discussions and ensure understanding of each component.
5. Direct the students to the Scientific Method Template in section 6-7 of their Student Guide, and guide them through each section by reviewing definitions and descriptions.
6. Gather all materials.

Materials

- Reynolds Wrap aluminum foil (2 ft per group)
- Store brand aluminum foil (2 ft per group)
- Timer/Stopwatch
- Scissors
- Textbooks (approximately 10 medium size per group)
- Duct Tape/Tape (optional)

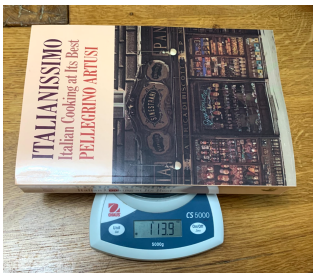
- Marker (to mark foil when measuring and to label the foil for each brand)

6. Procedure

The purpose of the procedure is to first determine the maximum amount of mass that 2 ft of store brand foil can hold. Then, we will determine whether Reynolds Wrap can hold more.

To determine the maximum amount of mass that the foil can hold, we will:

1. Measure 2 ft of store brand foil on a clean flat table.
2. Using the electric balance, measure the mass in grams of each textbook and record the data.
3. Hold the foil with two hands. One hand should be on each side of the foil 2 inches in from each side (*see image to the right*). Try not to dig your nails into the foil.



4. Place the textbook in the exact center of the foil.
5. Holding the store brand foil on both ends, lift the store brand foil with the texbook 2 inches over the tabletop for 30 seconds.
6. In a data table, have a partner record whether the foil holds the mass of the textbook for at least 30 seconds. We will also record observations including:
    - Any bulging or thinning of the foil
    - Sounds made by the foil
7. If the foil holds, add additional textbooks until we find the maximum mass the foil can hold. Record this number in the data table.
8. Repeat steps 1–7 for Reynolds Wrap.
9. Create a bar graph to illustrate the maximum lift strengths of each foil brand. *Note: When selecting a title for the graph, it is helpful to use the title format "the effect of y on x."*

7. Conduct the Test

When the students are ready to conduct the test, have them work in teams of 3-4 to conduct scientific tests on Reynolds Wrap vs. the store brand foil and record data. Make sure the materials are available in a central location.

7. Review slides 21-22 from the PowerPoint with the students, and use the notes section to guide class discussions and ensure understanding of each component. These slides cover data and observations, and analysis.

8. Direct the students to the Scientific Method Template in section 8-9 of their Student Guide and review any definitions and descriptions. Collaborate on an appropriate answer for each section. A few sample answers are included below.

8. Data

Note: Results may vary in this experiment based on environmental conditions. Room temperature and humidity may have an impact on the results. The data provided in the table below is sample data for reference.

Example Data Tables for Evidence/Observations

*Data Table 1: How Much Mass Can **Store Brand Foil** Hold?*

Quantitative Data	**Total Mass After Addition of Each Book**	**Qualitative Data for 30-second Hold Time**	
Total Mass (in Grams)		**Did the System Hold? (Y/N)**	**Observations**
Book #1	1270 g	Yes	Slight bend in foil
Book #2 485.9 g	1,755.9 g	Yes	A little more bend
Book #3 550 g	2305.9 g	Yes	More bend
Book #4 417 g	2722.9 g	Yes	More bend
Book #5 519 g	3241.9 g	Yes	More bend
Book #6 513 g	3754.9	Yes	Starting to look like it may break any second
Book #7 507 g	4261.9	Yes	Barely holding on—edges of foil very stressed **This was the maximum mass/threshold held for 30 seconds.**

Book #8 383 g	4644.9 g	NO	Foil ripped! When this book was added, the foil ripped from the left side.

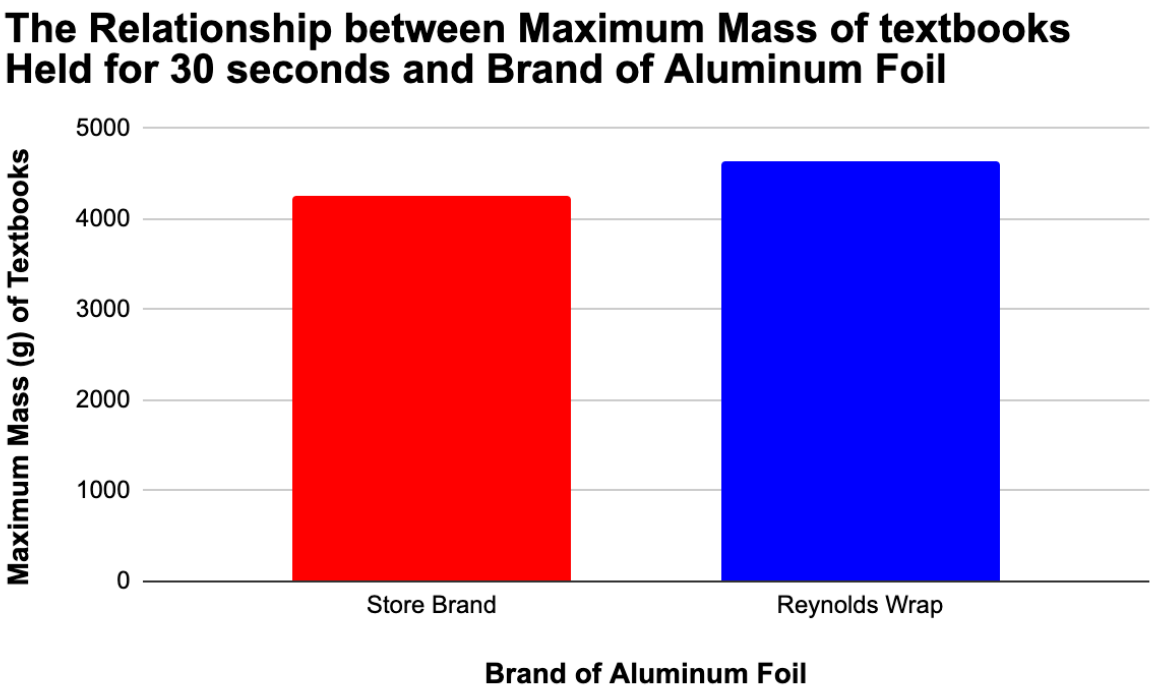
Threshold for store brand foil = 4261.9

*Data Table 2: How Much Mass Can **Reynolds Wrap** Hold?*

Total Mass (in Grams)	**Total Mass After Addition of Each Book**	**Did the System Hold? (Y/N)**	**Observations**
Book #1 1270 g	1270 g	Yes	Slight bend in foil
Book #2 485.9 g	1,755.9 g	Yes	Slight bend in foil
Book #3 550 g	2305.9 g	Yes	A little more bend
Book #4 417 g	2722.9 g	Yes	More bend
Book #5 519 g	3241.9 g	Yes	More bend
Book #6 513 g	3754.9	Yes	More bend
Book #7 507 g	4261.9	Yes	Starting to look like it may break any second
Book #8 383 g	4644.9 g	Yes	Barely holding on—edges of foil very stressed **This was the maximum mass/threshold held for 30 seconds.**
Book #9 516 g	5160 g	NO	Foil ripped but held more mass than the store brand! When this book was added, the Reynolds Wrap foil also ripped from the left side.

Threshold for Reynolds Wrap foil = 4644.9

Difference in mass threshold between Reynolds Wrap and the store brand = 383 g



9. Conclusion & Reasoning

Ask the students to analyze their results. Did their scientific test help to prove or disprove the claim made in the commercial? Encourage the students to support their analysis by using their scientific data (evidence). An example analysis is shown below.

Example Analysis

In this experiment, we tested to see if Reynolds Wrap foil could support more mass than a store brand foil. Based on experimental data, the maximum mass the store brand could hold was 4261.9 grams, whereas the maximum mass that Reynolds Wrap could hold was 4644.9 grams. The claim that Reynolds Wrap can hold more mass compared to a store brand was supported by our data.

III. Apply Your Knowledge (20–30 minutes)

Read through the Moldaway experiment twice. During your second read, annotate the experiment as follows:

1. *A claim is an assertion or a statement believed to be true.* **Circle** the claim.

2. *Evidence is scientific data used to support the claim.* Put a **box** around the evidence.

3. *Reasoning is a statement or statements that connect the evidence to the claim.* Draw an **arrow** to the reasoning.

4. *A hypothesis is the expected outcome of an experiment that is used as a starting point for further investigation. It is written as an If-Then Statement.* Draw a **star** next to the hypothesis.

5. *An independent variable is a factor that the scientist changes.* **Underline** the independent variable and label it with "**IV**".

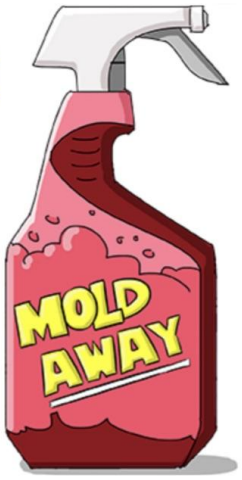
6. *A dependent variable is a factor that is measured by the scientist and depends on the independent variable.* **Underline** the dependent variable and label it with "**DV**".

7. *Qualitative data is data that is not measurable. It is collected using the senses (touch, smell, taste, hearing, and sight).* Draw an **eyeball** next to the qualitative data.

8. *Quantitative data is measurable data that is collected with instruments (examples: temperature, height, mass, and volume).* Draw a **number sign** next to the quantitative data.

Moldaway's Scientific Experiment

Are you tired of the moldy and mildewy smell in your bathroom? One weekly spray of Moldaway prevents mold from growing on your bathroom tiles better than a home remedy like vinegar and water.



If Moldaway is applied to your bathroom tiles, then less mold will appear than on tiles that are sprayed with a homemade solution.

To test this claim, on the back wall of the shower where the water doesn't reach, I sprayed the bathroom tiles with different types of cleaning solutions:

IV

- I sprayed 10 bathroom tiles with 1 spray of Moldaway once per week.
- I sprayed another 10 bathroom tiles in the same area with a homemade vinegar and water solution once per week.

I showered daily with the vent on and left the bathroom door open when not in use. Every other week, I measured the number of tiles with mold.

DV

Data/Observations

	Week 2	Week 4	Week 6	Week 8	Week 10
Tile Set A *Treated with Moldaway*	No mold present	No mold present	1 tile displays mold *Mold is light green, slimy*	1 tile displays mold *Mold is light green, slimy*	1 tile displays mold *Mold is light green, slimy*
Tile Set B *Treated with a homemade vinegar and water solution*	No mold present	No mold present	1 tile displays mold *Mold is light green, slimy*	2 tiles display mold *Mold is dark green, slimy*	3 tiles display mold *Mold is very dark green, slimy*

As shown in the data, tiles treated with Moldaway had less mold over a 10-week period than tiles treated with the homemade solution.

Because tiles treated with Moldaway had less mold than the tiles treated with the homemade solution, this supports the idea that Moldaway prevents mold from growing on bathroom tiles better than a home remedy like vinegar and water.

Part 4: Quiz: Exit Ticket (10 minutes)

This quiz can be done in groups, pairs, individually, or more formally as an online quiz.

Students will complete the exit ticket to check for understanding. This can be done in the Student Guide or online by selecting the **Quiz** button in Lesson 1. The answers are provided in the answer key below.

1. The statement "Charmin is the softest 2-ply paper towel ever made" is an example of:
    a. Evidence
    b. Reasoning
    c. A claim
    d. A hypothesis

2. Which of the following could be a hypothesis for an experiment testing washable watercolor markers?
    a. Washable watercolor markers come in various colors.
    b. If watercolor markers are washable, then you should be able to wipe the marker ink from a wall with a wet sponge.
    c. The average length of time that washable watercolor markers last is 2 weeks.
    d. Draw one line with each of the colors of washable watercolor markers on the wall.

3. Joey wants to determine if Dawn dishwashing soap is more effective than Palmolive. In order to conduct an accurate experiment, what will be the independent variable?
    a. Type of pan
    b. Type of pan, size of pan, type of dishwashing soap, amount of dishwashing soap, amount of time soaked
    c. Amount of time soaked and amount of dishwashing soap
    d. Type of dishwashing soap

4. True or **False**: In a controlled experiment, more than one variable should be changed in order to conduct an accurate experiment.

5. Your class is conducting a chemistry experiment to test whether Mentos makes larger geyers in Coke or Diet Coke. All of the following are **quantitative** observations in a chemistry experiment *except* for:
    a. **As the Mentos sank to the bottom of the bottle, the Diet Coke appeared to fizz more.**
    b. The starting temperature of Diet Coke was 85 degrees F.
    c. The height of the Diet Coke geyser reached 1.5 meters.
    d. 900 mL of Diet Coke remained in the bottle after the eruption.

6. Charlie claims that Dove Body Wash leaves skin more moist than all other brands. Which of the following should be documented as evidence to support this claim?
    a. The size of body
    b. The type of skin
    c. The moisture of the skin before and after using each body wash
    d. The amount of body wash used

Appendix A: Claim-Evidence-Reasoning Guide

Term	Definition
	**An assertion; a statement believed to be true**

	**Scientific data used to support the claim**
	
	Evidence can include:
	
	• Quantitative Data such as:
	  ○ Measurements
	  ○ Calculations
	  ○ Statistics (survey results)
	
	• Qualitative Data such as:
	  ○ Microscopic drawings
	  ○ Written observations
	  ○ Labeled diagrams

	**How the evidence connects to the claim** Sentence starters that can help you connect your evidence to your reasoning: • Because the evidence shows _____, this means _____. • Because the evidence demonstrates _____, this confirms _____. • If _____, therefore _____.