

The Case of the Shrinking Balloon

Engage students with real-world scientific investigations that build critical thinking, data analysis, and evidence-based reasoning.

SCROLL
to take a look inside!



PHYSICAL & CHEMICAL CHANGE REAL-WORLD WHODUNNIT INVESTIGATION

★ Complete student investigation with a real-world scenario and data analysis

★ Guided questions and suspect elimination process

★ Collaborative group roles for discussion and teamwork

★ Full teacher answer key with CER examples

★ Extension activities for deeper learning and early finishers

What You Get

NO-PREP. JUST PRINT TO GO!

Student checklists to determine suspect

Part A — Evidence Check by Suspect

Suspect	Lowest Temperature ? (Y/N)	Evidence from text or data	Leads to Gas Contraction ? (Y/N)	Evidence from text or data	Matches "Gas Contraction" condition? (Y/N)	Keep or Eliminate?
Air Conditioning System						
Open Window						
Sunlight						
Humidifier						

Rule: If a suspect does not explain a decrease in temperature, explain why the balloon shrank.

Part B — Conditions Checklist (Eliminate with Lo)

Condition Needed	Evidence in Text (YES/NO)
Gas (air) is present in the balloon	
Temperature decreased over time	
Gas particles lost thermal energy	
Gas particles moved closer together	
Balloon volume decreased	

Part C — Final Elimination Decision

1. Which suspect clearly lowered the temperature?
Answer: _____

2. Which suspect may have introduced gas?
Answer: _____

3. Which suspect best explains why the balloon shrank?
Answer: _____

4. Final Decision: Who (or what) caused the balloon to shrink?
Class: _____

Classroom Air Temperature (Friday-Sunday)

Time	Temperature (°C)
Fri 3 PM	24°C
Fri 6 PM	22°C
Sat 8 AM	20°C
Sat 2 PM	19°C
Sun 8 AM	18°C
Sun 12 PM	18°C

Balloon Size Observation

Time	Balloon Size
Fri 3 PM	Large
Sat 8 AM	Slightly smaller
Sun 8 AM	Smaller
Mon 8 AM	Smaller

The Location of Balloon

Location	Condition
Near window (Friday)	Warm from sunlight
Center of room (Saturday)	Cooler, stable temperature
Near vent (Sunday)	Exposed to cool air

Suspect List

- Air Conditioning System
- Open Window
- Sunlight
- Humidifier

The Investigators know that:

- Gas particles move faster when heated
- Gas particles slow down when cooled
- Cooling causes gas to contract (take up less space)
- Temperature changes can affect the volume of a gas

The Case of the Shrinking Balloon

On Monday morning, students entered the classroom and noticed something unusual on the teacher's desk. A balloon that had been large and fully inflated on Friday afternoon now appeared smaller and slightly wrinkled. It had not popped, and there were no visible holes or tears in the rubber.



At first, some students thought the balloon must have slowly leaked air over the weekend. However, when the teacher gently pressed on the balloon, it still felt full of air. This suggested that the air inside had not escaped but had changed in some way.

Gases are made up of tiny particles that are constantly moving. The speed of these particles depends on temperature. When a gas is heated, its particles move faster and spread out, causing the gas to expand. When a gas cools, its particles slow down and collide less forcefully, causing the gas to take up less space (contract).

This means that changes in temperature can affect the size of objects filled with gas, such as balloons. If the temperature of the air inside the balloon decreases, the balloon may shrink even though no air has been lost.

The classroom balloon had been tied tightly over the weekend. Investigators knew that the change in size must be related to environmental conditions that affected the temperature of the air inside the balloon. The teacher visited her classroom throughout the weekend and collected some data.

Over the weekend, several events occurred in the classroom.

- On Friday afternoon, the balloon was placed near a window where it was exposed to direct sunlight for several hours. The sunlight warmed the air inside the balloon, causing it to expand slightly before the end of the school day.
- Later that evening, the school's air conditioning system automatically turned on to maintain cooler temperatures inside the building. The system remained active throughout the weekend, lowering the classroom temperature.
- On Saturday morning, the classroom windows were briefly opened by a janitor staff to allow fresh air to circulate. The outdoor air temperature at that time was significantly cooler than the indoor temperature.
- In addition, a humidifier was used in the classroom over the weekend to maintain moisture levels for several plants. While the humidifier added water vapor to the air, it did not significantly change the air temperature, but increased moisture in the air.

Real-World Data to be Analyzed

Background on topic & investigation introduction

HOW THIS ACTIVITY HELPS YOU

➤ Saves prep time with a fully structured, print-and-go investigation

➤ Drives high engagement as students actively solve real-world science problems

➤ Builds deeper understanding through data analysis and evidence-based reasoning

➤ Strengthens scientific writing using Claim–Evidence–Reasoning (CER)

➤ Encourages collaboration and meaningful discussion in small groups

A REAL-LIFE SCIENCE WHODUNNIT

Students:

1. Read the Case

Something strange has happened...

2. Gather the Clues

Examine data and study tables

3. Eliminate Suspects

Who/what doesn't fit the science?

4. Solve the Case

Make your claim and prove it using evidence from the story.

The Case of the Shrinking Balloon

On Monday morning, students entered the classroom and noticed something unusual on the teacher's desk. A balloon that had been large and fully inflated on Friday afternoon now appeared smaller and slightly wrinkled. It had not popped, and there were no visible holes or tears in the rubber.

At first, some students thought the balloon must have slowly leaked air over the weekend. However, when the teacher gently pressed on the balloon, it still felt full of air. This suggested that the air inside had not escaped but had changed in some way.

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- Later that evening, the school's air conditioning system automatically turned on to

To better understand what may have caused the balloon to shrink, investigators examined temperature data collected from the classroom.

Time	Temperature (°C)
Fri 3 PM	24°C
Fri 4 PM	22°C
Sat 8 AM	20°C
Sat 2 PM	18°C
Sun 8 AM	16°C
Sun 12 PM	18°C

Temperature measures how fast particles are moving. Lower temperatures mean slower particle motion.

Time	Balloon Size
Fri 3 PM	Large
Sat 8 AM	Slightly smaller
Sun 8 AM	Smaller
Mon 8 AM	Smaller

As temperature decreases, gas particles lose energy causing them to slow down.

Investigators also considered where the balloon had been placed in the classroom.

Location	Condition
Near window (Friday)	Warm from sunlight
Center of room (Saturday)	Cooler, stable temperature
Near vent (Sunday)	Exposed to cool air

Air vents release cooled air when the air conditioning system is running.

After reviewing the timeline and environmental data, the investigation team created a list of possible suspects responsible for causing the balloon to shrink.

Suspect	Condition	Evidence	Eliminate?
Air Conditioning System	Open window	Open window	
Sunlight	Humidifier		

The investigators know that:

- Gas particles move faster when heated
- Gas particles slow down when cooled
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- Temperature changes can affect the volume of a gas

Part A -- Evidence Check by Suspect

Suspect	Condition	Evidence	Eliminate?
Air Conditioning System	Open window	Open window	
Sunlight	Humidifier		

Part B -- Conditions Checklist (Eliminate with Logic)

Condition	Eliminate with Logic	What proves it? (quote or table reference)
Gas (air) is present in the balloon		
Temperature decreased over time		
Gas particles lost thermal energy		
Gas particles moved closer together		
Balloon volume decreased		

Part C -- Final Elimination Decision

1. Which suspect clearly lowered the temperature in the classroom?

Answer: _____

2. Which suspect may have introduced cooler air from outside?

Answer: _____

3. Which suspect best explains why the balloon shrank (not just that it changed)?

Answer: _____

4. Final Decision: Who (or what) "did it"?

Claim: _____

HOW THIS ACTIVITY WILL HELP YOU



- **Prep-FREE and fully editable Whodunnit Investigation** - just print/upload and assign with no materials.
- **Data tables and graphs** are embedded directly into the activity for easy implementation
- **Engages every learner** through real-world, high-interest scientific investigations
- **Builds essential skills** such as data analysis, problem-solving, collaboration, and scientific reasoning
- **Supports CER (Claim–Evidence–Reasoning)** to strengthen student writing and understanding

What Will Your Students Learn?

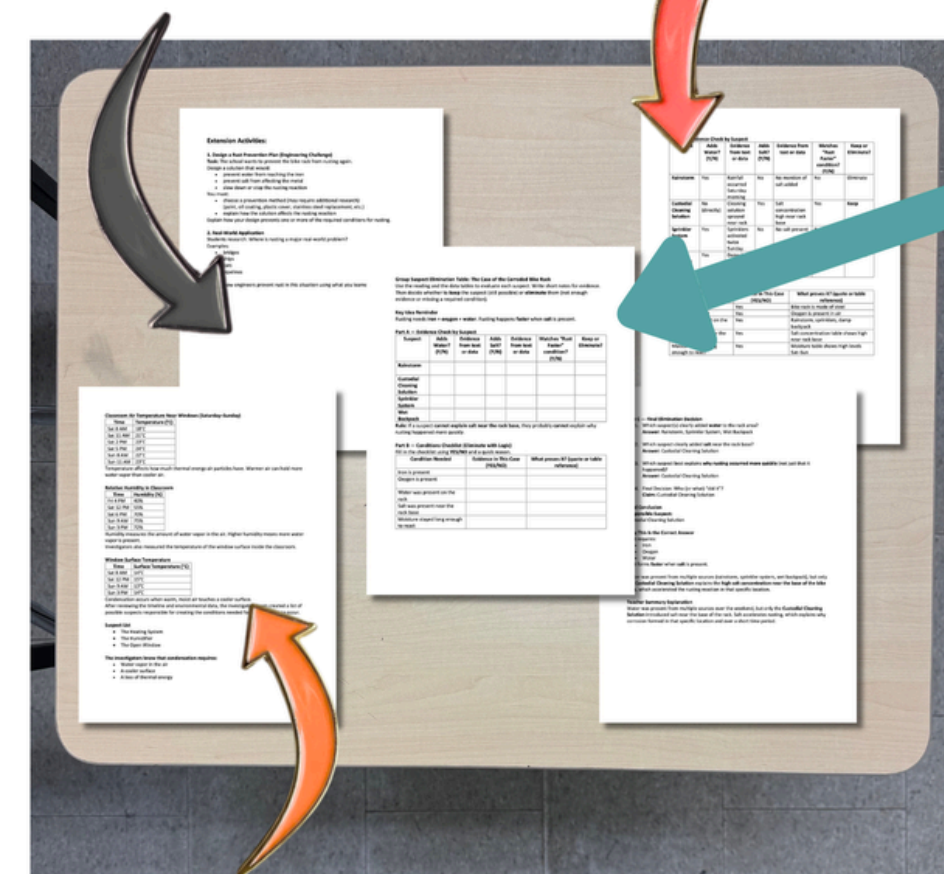
INVESTIGATION INCLUDES

**EXTENSION
ACTIVITIES +
ANSWER KEY**

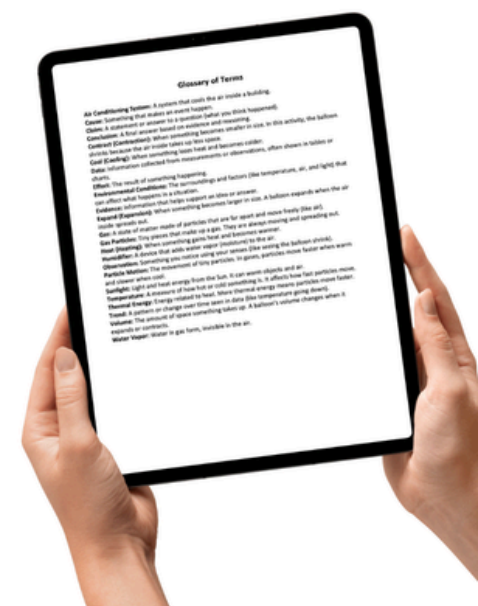
**FULL TEACHER
ANSWER KEY**

**SUSPECT
ELIMINATION
TABLE**

**GLOSSARY
OF TERMS**



**OPPORTUNITIES FOR
STUDENTS TO ANALYZE DATA**



- ✓ How temperature affects gas behavior
- ✓ How gas particles move faster when heated and slower when cooled
- ✓ Why cooling causes gases to contract (take up less space)
- ✓ How changes in temperature affect the volume of a gas
- ✓ How particle motion explains changes in the size of a balloon
- ✓ How thermal energy influences the behavior of gases
- ✓ How environmental conditions can cause physical changes in matter
- ✓ How to use data to identify patterns between temperature and volume
- ✓ How to analyze real-world data to determine cause-and-effect relationships
- ✓ How to use Claim–Evidence–Reasoning (CER) to explain scientific phenomena

The Case of the Shrinking Balloon

On Monday morning, students entered the classroom and noticed something unusual on the teacher's desk. A balloon that had been large and fully inflated on Friday afternoon now appeared smaller and slightly wrinkled. It had not popped, and there were no visible holes or tears in the rubber.



At first, some students thought the balloon must have slowly leaked air over the weekend. However, when the teacher gently pressed on the balloon, it still felt full of air. This suggested that the air inside had not escaped but had changed in some way.

Gases are made up of tiny particles that are constantly moving. The speed of these particles depends on temperature. When a gas is heated, its particles move faster and spread out, causing the gas to expand. When a gas cools, its particles slow down and collide less forcefully, causing the gas to take up less space (contract).

This means that changes in temperature can affect the size of objects filled with gas, such as balloons. If the temperature of the air inside the balloon decreases, the balloon may shrink even though no air has been lost.

The classroom balloon had been tied tightly over the weekend. Investigators knew that the change in size must be related to environmental conditions that affected the temperature of the air inside the balloon. The teacher visited her classroom throughout the weekend and collected some data.

Over the weekend, several events occurred in the classroom.

- On Friday afternoon, the balloon was placed near a window where it was exposed to direct sunlight for several hours. The sunlight warmed the air inside the balloon, causing it to expand slightly before the end of the school day.
- Later that evening, the school's air conditioning system automatically turned on to maintain cooler temperatures inside the building. The system remained active throughout the weekend, lowering the classroom temperature.
- On Saturday morning, the classroom windows were briefly opened by custodial staff to allow fresh air to circulate. The outdoor air temperature at that time was significantly cooler than the indoor temperature.
- In addition, a humidifier was used in the classroom over the weekend to maintain moisture levels for several plants. While the humidifier added water vapor to the air, it did not significantly change the air temperature, but increased moisture in the air.

Case Overview

- Introduces a **real-world** science scenario or problem
- Provides important **background information** about events leading up to the situation
- Explains **key science concepts & terms** needed to understand the investigation
- Highlights the **conditions or factors** involved in the phenomenon
- Sets the stage for students to begin **analyzing possible causes**

To better understand what may have caused the balloon to shrink, investigators examined temperature data collected from the classroom.

Classroom Air Temperature (Friday–Sunday)

Time	Temperature (°C)
Fri 3 PM	24°C
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Temperature measures how fast particles are moving. Lower temperatures mean slower particle motion.

Balloon Size Observation

Time	Balloon Size
Fri 3 PM	Large
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As temperature decreases, gas particles lose energy causing them to slow down.

Investigators also considered where the balloon had been placed in the classroom.

The Location of Balloon

Location	Condition
Near window (Friday)	Warm from sunlight
Center of room (Saturday)	Cooler, stable temperature
Near vent (Sunday)	Exposed to cool air

Air vents release cooled air when the air conditioning system is running.

After reviewing the timeline and environmental data, the investigation team created a list of possible suspects responsible for causing the balloon to shrink.

Suspect List

- Air Conditioning System
- Open Window
- Sunlight
- Humidifier

The investigators know that:

- Gas particles move faster when heated
- Gas particles slow down when cooled
- Cooling causes gas to contract (take up less space)
- Temperature changes can affect the volume of a gas

Data & Evidence Analysis

- Presents **data tables, charts, or graphs** related to the investigation
- Allows students to **analyze patterns, trends, and changes** over time
- Connects **real-world data** to key science concepts
- Encourages students to **gather evidence to support their thinking**
- **Prepares** students to begin evaluating possible explanations

Now the team must determine which suspect created the conditions that caused the balloon to shrink over the weekend.

Task #1: Answer the Following Questions

1. What happens to gas particles when temperature decreases?
2. How does cooling affect the volume of a gas?
3. According to the temperature data, what happened to the classroom temperature over the weekend?
4. What happened to the size of the balloon between Friday and Monday?
5. Where was the balloon located over the weekend?
6. Which suspect could have lowered the temperature in the classroom?
7. Which suspect may have introduced cooler air from outside?
8. Does adding moisture (humidity) change the temperature of a gas significantly?
9. Can a balloon shrink without losing air? Explain.
10. Which suspect created the conditions needed for the balloon to shrink?

Task #2: Work with your group to decide: What is responsible for the balloon shrinking?

Complete:

Part A — Evidence Check by Suspect

Part B — Conditions Checklist (Eliminate with Logic)

Part C — Final Elimination Decision

Part D — Group CER that includes:

- Your claim
- Evidence from the data tables
- Reasoning that explains how the suspect caused the balloon to shrink

Group Suspect Elimination Table: The Case of the Shrinking Balloon

Use the reading and the data tables to evaluate each suspect. Write short notes for evidence. Then decide whether to **keep the suspect (still possible)** or **eliminate them (not enough evidence or missing a required condition)**.

Key Idea Reminder: Gas behavior depends on temperature.

- Gas particles move faster when heated
- Gas particles slow down when cooled
- Cooling causes gas to contract (take up less space)

A balloon shrinks when the air inside cools and gas particles move closer together.

Guided Questions & Decision-Making

- Provides **targeted questions** to guide students' understanding of the science concepts
- Helps students **connect information** from the reading and data tables
- **Reinforces key ideas** needed to explain the phenomenon
- Encourages students to **apply evidence** to evaluate possible causes
- Prompts **group discussion** to determine the most likely explanation
- Prepares students to move into **evidence-based decision-making** and justification

Evidence Organization & Logical Elimination

- Provides a structured table for students to **organize evidence** for each possible explanation
- **Guides students to evaluate** which conditions are met using data and the reading
- Helps students **identify which factors** are missing or unsupported
- Encourages **logical elimination of possibilities** based on scientific criteria
- **Reinforces understanding** of required conditions for the phenomenon
- **Supports collaborative discussion** and evidence-based decision-making

Part A — Evidence Check by Suspect

Suspect	Lowers Temperature ? (Y/N)	Evidence from text or data	Leads to Gas Contraction ? (Y/N)	Evidence from text or data	Matches "Gas Contraction" condition? (Y/N)	Keep or Eliminate?
Air Conditioning System						
Open Window						
Sunlight						
Humidifier						

Rule: If a suspect does not explain a decrease in temperature over time, they probably cannot explain why the balloon shrank.

Part B — Conditions Checklist (Eliminate with Logic)

Fill in the checklist using **YES/NO** and a quick reason.

Condition Needed	Evidence in This Case (YES/NO)	What proves it? (quote or table reference)
Gas (air) is present in the balloon		
Temperature decreased over time		
Gas particles lost thermal energy		
Gas particles moved closer together		
Balloon volume decreased		

Part C — Final Elimination Decision

- Which suspect clearly lowered the temperature in the classroom?
Answer: _____
- Which suspect may have introduced cooler air from outside?
Answer: _____
- Which suspect best explains why the balloon shrank (not just that it changed)?
Answer: _____
- Final Decision: Who (or what) "did it"?
Claim: _____

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Part D — Final Investigation: Claim – Evidence – Reasoning Claim

Who is responsible for the balloon shrinking?

Our Claim:

Evidence

Use at least two pieces of evidence from:

- the reading
- the classroom air temperature table
- the balloon size observation table
- the location of balloon table

Evidence 1:

Evidence 2:

Evidence 3 (optional):

Reasoning

Explain how your evidence supports your claim using science ideas about gas behavior.

Gas particles move slower when _____

Cooling causes gas to _____

The suspect caused the balloon to shrink because _____

Guides students to finalize their conclusion by selecting the most supported explanation

- Prompts students to **justify their decision** using evidence gathered from the investigation
- Provides a **structured Claim–Evidence–Reasoning (CER) framework**
- Encourages students to **connect data, observations, and science concepts**
- **Reinforces** clear, evidence-based scientific writing
- Serves as both a **collaborative and individual** assessment opportunity

Full Teacher Answer Key

Extension Activities:

1. Design a Temperature Control Plan (Engineering Challenge)

Task:

The school wants to prevent balloons in the classroom from shrinking overnight.

Design a solution that would:

- prevent large drops in temperature
- keep the air inside the balloon warm and stable
- reduce changes in gas particle motion

You must:

- choose a prevention method (may require additional materials)
- explain how your solution affects the behavior of the gas particles

Explain how your solution prevents one or more of the following:

Real-World Application

Students research:

Where is gas behavior affected by temperature a most?

Example:

- hot air balloons
- car tires in winter vs summer
- sports: losing air pressure in cold weather
- aerosols
- weather balloons

Task:

Explain how temperature affects gas behavior in the classroom.
Explain how people adjust for or prevent these changes.

Teacher Section and Answer Key

Concept Specialist

Your Job: Focus on the science concepts in the reading.

You are responsible for:

- Identifying how temperature affects gas particles
- Explaining why shrinking is related to a physical change
- Making sure your group understands the relationship between temperature and volume
- Explaining what happens when gas particles lose thermal energy

Ask your group:

- What happens to gas particles when temperature decreases?
- How does cooling affect the size (volume) of a gas?
- Can a balloon shrink without losing air?
- Why do gas particles move closer together when cooled?

Data Analyst

Your Job: Study the tables and interpret the data.

You are responsible for:

- Identifying trends in classroom air temperature over time
- Analyzing changes in balloon size
- Comparing temperature changes to changes in balloon size
- Connecting data from the tables to possible suspects
- Sharing data-based evidence with your group

Ask your group:

- How did the temperature change over the weekend?
- When was the temperature lowest?
- What happened to the balloon size as temperature decreased?
- Which suspect matches the data best?

Evidence Tracker

Your Job: Connect events from the story to the scientific conditions.

You are responsible for:

- Determining which suspects could have lowered the temperature
- Determining which suspect could have affected the balloon's environment
- Recording evidence in the elimination table
- Helping your group decide which suspects to eliminate

Ask your group:

- What did each suspect do to the temperature of the room?
- Did the temperature go up or down?
- Did the balloon expand or shrink?

Conclusion Manager

Your Job: Help the group reach a final decision.

- Presenting their ideas
- Explaining the elimination process
- Writing the final CER response
- Using evidence from the reading or data tables

What caused the temperature decrease?
How does this explain the balloon shrinking?
What is your claim?

Teacher Answer Key — Short Answer Questions

1. What happens to gas particles when temperature decreases?
Gas particles slow down and move closer together.
2. How does cooling affect the volume of a gas?
Cooling causes the gas to contract, so the volume decreases.
3. According to the temperature data, what happened to the classroom temperature over the weekend?
The classroom temperature decreased over time.
4. What happened to the size of the balloon between Friday and Monday?
The balloon became smaller (it shrunk).
5. Where was the balloon located over the weekend?
It was moved away from the window and was near the center of the room where cooler air was present.
6. Which suspect could have lowered the temperature in the classroom?
The Air Conditioning System
7. Which suspect may have introduced cooler air from outside?
The Open Window
8. Does adding moisture (humidity) change the temperature of a gas?
No — adding moisture does not significantly change the temperature.
9. Can a balloon shrink without losing air? Explain.
Yes — when temperature decreases, gas particles slow down and move closer together, causing the balloon to shrink without losing air.
10. Which suspect created the conditions needed for the balloon to shrink?
The Air Conditioning System

Glossary of Terms

Air Conditioning System: A system that cools the air inside a building.

Cause: Something that makes an event happen.

Claim: A statement or answer to a question (what you think happened).

Conclusion: A final answer based on evidence and reasoning.

Contract (Contraction): When something becomes smaller in size. In this activity, the balloon contracts because the air inside takes up less space.

Cooling: When something loses heat and becomes colder.

Data: Information collected from measurements or observations, often shown in tables or graphs.

Effect: The result of something happening.

Environmental Conditions: The surroundings and factors (like temperature, air, and light) that affect an object.

Part A — Evidence Check by Suspect (Answer Key)

Suspect	Lowers Temperature? (Y/N)	Evidence from text or data	Changes Gas Volume? (Y/N)	Evidence from text or data	Matches "Gas Contraction" condition? (Y/N)	Keep or Eliminate?
Air Conditioning System	Yes	AC was running all weekend, cooling the classroom	Yes	Balloon size decreased as temperature decreased	Yes	Keep
Open Window	Yes	Window opened briefly; cooler outside air may have entered	Yes (possible)	Could allow cooler air in temporarily	No (not consistent)	Eliminate
Sunlight	No	Sunlight warmed the balloon on Friday	Yes (expands, not contracts)	Heating causes expansion, not shrinking	No	Eliminate
Humidifier	No	Adds moisture, not temperature change	No	Does not affect gas temperature significantly	No	Eliminate

Teacher Note:

- The **Air Conditioning System** is the only suspect that explains a **continuous temperature decrease**, which matches the data and the balloon shrinking over time.
- Other suspects either **do not lower temperature** or do not explain the **consistent pattern** seen in the data.

Extension Activity and Answers

Thanks
**for your interest
in this resource!**

I am a real person and if
you have any questions,
suggestions, or concerns,
please reach out.



devon@teachwithfergy.com

TWF

Teach With Fergy

*Let's
Connect!*

