

THE MISSING MASS MYSTERY

NO PREP

Gamify your students' learning with this interactive and engaging Mystery Activity.

The Missing Mass Mystery

Part 1 – Mission Briefing & Case Overview
Name: _____ Date: _____

Case File #427 – The Missing Mass Mystery
Chemistry students across several classrooms are reporting a strange observation during laboratory experiments. When certain chemical reactions take place, the total mass of the substances appears to decrease.

In some reactions, bubbling gases form and escape into the air. In others, solids dissolve into liquids and seem to disappear completely. Students measured the mass of materials before and after these reactions and noticed that the final measured mass inside the container was sometimes lower than expected.

Scientists suspect that this may be related to the **Law of Conservation of Mass**, which states that matter cannot be created or destroyed during a chemical reaction.

Possible observations include:

- Gas formation during reactions
- Dissolving solids
- Evaporation
- Mass differences between open and closed systems
- Gas-producing reactions between liquids and solids

No single observation fully explains why the mass appears to decrease.

You are a science detective assigned to investigate this chemical mystery.

Your Mission

- Explain how matter behaves during chemical reactions
- Identify why mass may appear to decrease
- Describe what happens to particles during reactions
- Propose an explanation for the missing mass

The underlying chemical reactions depends on what you discover.

Teach With Fergy

What Happens to Matter During Reactions?
Identified, then answer:
Conservation of Mass state?

What happens to matter during a reaction?

Why is it sometimes difficult to detect during reactions?



SCROLL
to take a look inside!

**DETECTIVE FILE ON CHEMICAL
REACTIONS IN OUR LIVES**

★ A complete student case file with guided worksheets for every step of the investigation.

★ 10 detailed evidence cards based on real *conservation of mass* research and real-world examples that include images, graphs, and text.

★ A full teacher answer key AND marking rubric with sample responses.

What You Get

NO-PREP. JUST PRINT TO GO!

Full investigation breakdown

The Missing Mass Mystery
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Chemistry students across several classrooms are reporting a strange observation during laboratory experiments. When certain chemical reactions take place, the total mass of the substances appears to decrease.
In some reactions, bubbling gases form and escape into the air. In other reactions, liquids seem to disappear completely. Students measure the mass of the substances before and after these reactions and noticed that the final measure is sometimes lower than expected.
Scientists suspect that this may be related to the Law of Conservation of Mass, but they are not sure. That matter cannot be created or destroyed during a chemical reaction.
Possible observations include:
• Gas formation during reactions
• Dissolving solids
• Evaporation
• Mass differences between open and closed systems
• Gas-producing reactions between liquids
No single observation fully explains why the mass seems to change.
You are a science detective assigned to investigate the missing mass.
Your Mission:
• Explain how matter behaves during chemical reactions.
• Identify why mass may appear to decrease or increase.
• Describe what happens to particles during a chemical reaction.
Part 2 – Background Questions
Part 3 – Evidence Log
Part 4 – Suspect List: What is Causing the Missing Mass?
Part 5 – Pathway Tracking
Part 6 – Impact Analysis
Part 7 – The Big Question
Part 8 – CER
Part 9 – Solutions & Action Plan
Part 10 – Reflection

Evidence Card 7 – Mass of Escaped Gas
A balloon placed over the reaction container expanded during the reaction.

Detective Prompt: What might the balloon be collecting?

Evidence Card 8 – Repeated Trials
Each open beaker trial showed a decrease in measured mass after the reaction.

Detective Prompt: What does consistency suggest about the reaction?

Evidence Card 9 – Reaction Residue
No visible solid remained after the reaction was complete.
Detective Prompt: Does disappearance always mean destruction?

Interpretation & Recording Data
10 Evidence Cards to Determine Culprit

HOW THIS ACTIVITY HELPS YOU

- Saves prep time with a fully structured, print-and-go investigations.
- Drives high engagement while still meeting academic goals as students are interested in what they're doing.
- Builds deep understanding with **real-world relevance** as the students analyze real evidence, make connections, and using CER to explain everyday chemistry.

10-PART INVESTIGATION

Students:

1. Step into the role of a Science Detective.
2. Examine real scientific evidence from around the world.
3. Track the hidden pathways of ***matter conservation*** and how it's demonstrated in everyday chemical reactions.
4. Interrogate suspects (evaporation, dissolving, gas creation, etc.) and identify the main culprits.
5. Build a scientific case using Claim-Evidence-Reasoning.
6. Propose real solutions that matter.

★★★★★ The added images and graphs enhanced the activity. My students were engaged and motivated during the case study, and it was an effective introduction to the topics. - Mystery Resource Buyer

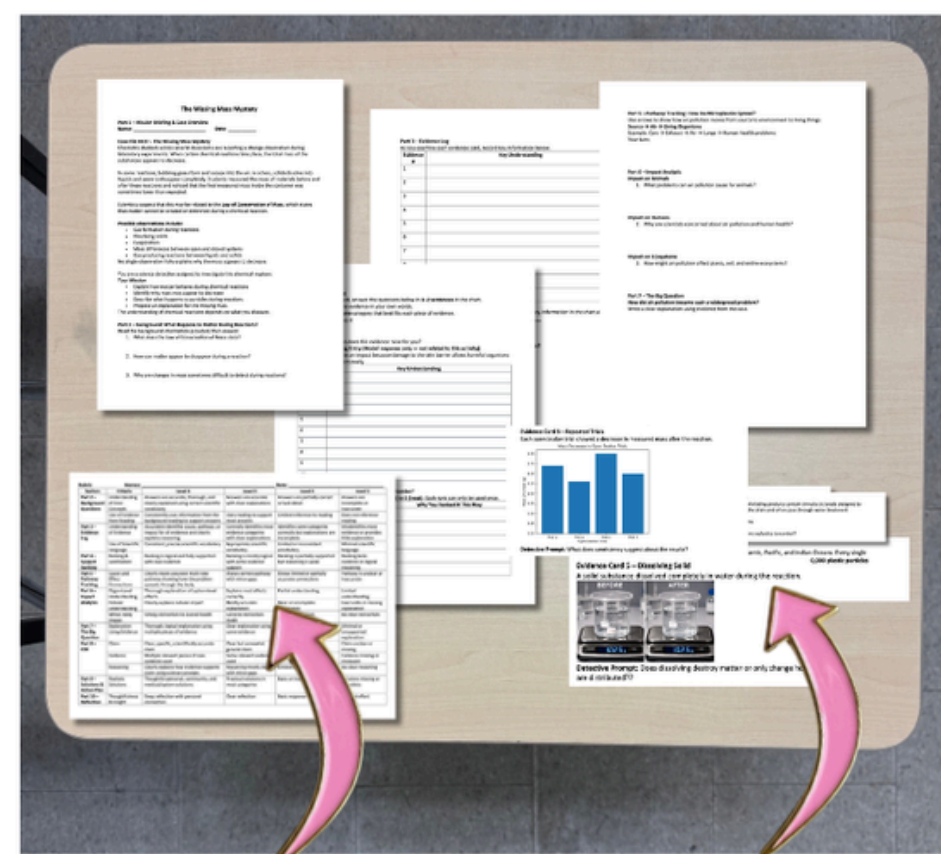
HOW THIS MYSTERY WILL HELP YOU



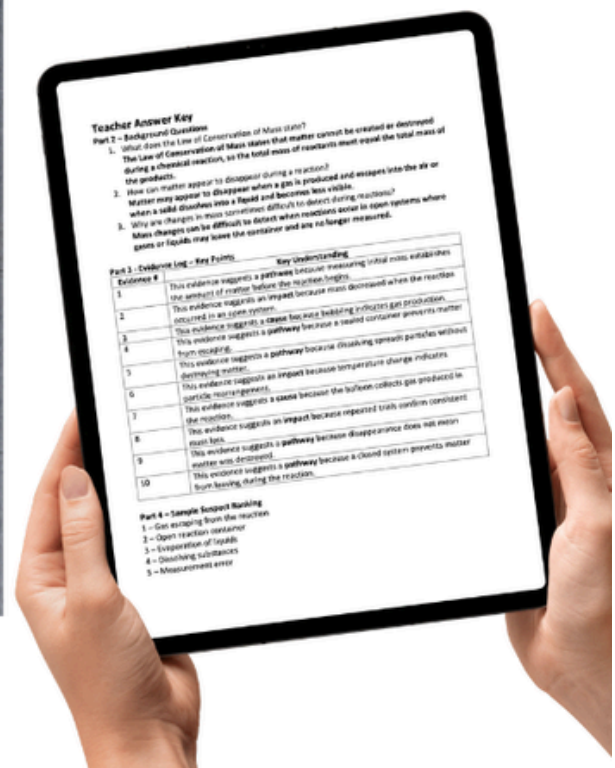
- Prep-FREE and fully editable Mystery Investigation - just print/upload and assign with no materials.
- **Evidence Cards** can be printed with and without images or projected on board.
- Engages every learner through hands-on, high-interest mystery investigations that boost motivation and participation.
- **Builds essential skills** such as graph interpretation, problem-solving, teamwork, creativity, and communication.

What Will Your Students Learn?

FULLY EDITABLE AND READY-TO-GO INVESTIGATION



FULL ANSWER KEY



RUBRIC EVIDENCE CARDS

★★★★★ This is very well crafted and it great to use for a subplan but also when I am in-class with students. They enjoy the detective layer of the work and it kept the students engaged. - Mystery Resource Buyer

- ✓ What the Law of Conservation of Mass states
- ✓ How atoms rearrange during chemical reactions
- ✓ Why mass must remain constant in a closed system
- How gas formation affects measurements in
- ✓ open systems
- Why dissolving does not destroy matter
- ✓ The difference between open and closed systems
- ✓ How particle movement explains observable
- ✓ changes
- ✓ How to use Claim–Evidence–Reasoning (CER) to support scientific explanations
- ✓ How chemistry explains what appears to be “missing” matter

Part 1 & 2

The Missing Mass Mystery

Part 1 – Mission Briefing & Case Overview

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In some reactions, bubbling gases form and escape into the air. In others, solids dissolve into liquids and seem to disappear completely. Students measured the mass of materials before and after these reactions and noticed that the final measured mass inside the container was sometimes lower than expected.

Scientists suspect that this may be related to the **Law of Conservation of Mass**, which states that matter cannot be created or destroyed during a chemical reaction.

Possible observations include:

- Gas formation during reactions
- Dissolving solids
- Evaporation
- Mass differences between open and closed systems
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No single observation fully explains why the mass appears to decrease.

You are a science detective assigned to investigate this chemical mystery.

Your Mission

- Explain how matter behaves during chemical reactions
- Identify why mass may appear to decrease
- Describe what happens to particles during reactions
- Propose an explanation for the missing mass

The understanding of chemical reactions depends on what you discover.

Part 2 – Background: What Happens to Matter During Reactions?

Read the background information provided, then answer:

1. What does the Law of Conservation of Mass state?
2. How can matter appear to disappear during a reaction?
3. Why are changes in mass sometimes difficult to detect during reactions?

Part 1 – Mission Briefing & Case Overview

Students take on the role of science detectives and are introduced to the everyday chemistry of *mass conservation*.

Part 2 – Background: Understanding the Conservation of Mass in Chemical Reactions

Students read a short background passage and answer guiding questions to build foundational understanding before analyzing evidence.

Part 3 & 4

Part 3 – Evidence Log

For each Evidence Card, answer the questions below in 1–2 sentences in the chart.

- Summarize the evidence in your own words.
- Choose the one category that best fits each piece of evidence.
 - ☐ Cause
 - ☐ Pathway
 - ☐ Impact
- What question does this evidence raise for you?

Example Evidence Log Entry (Model response only)

This evidence suggests a **pathway** because gases produced during reactions may leave the system and are no longer measured on the balance.

Evidence #	Key Understanding
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Part 4 – Suspect List: What Is Causing the Missing Mass?

Rank the suspects from 1 (most responsible) to 5 (least responsible). Each rank can only be used once.

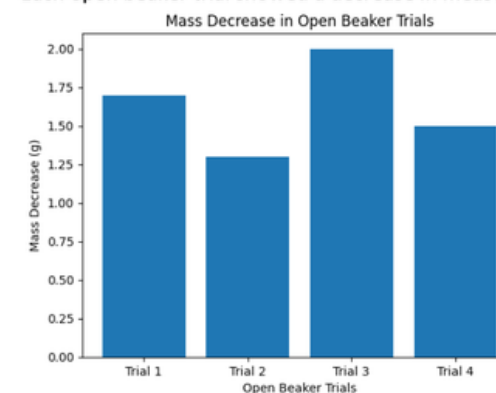
Suspect	Rank	Why You Ranked It This Way
Gas escaping from the reaction		
Evaporation of liquids		
Open reaction container		
Dissolving substances		
Measurement error		

Part 3 – Evidence Log

Students begin examining the evidence cards and record key information, observations, and insights in their evidence log.

Evidence Card 8 – Repeated Trials

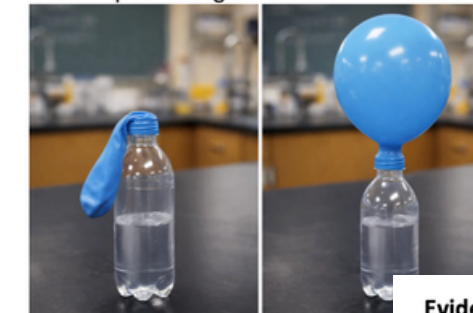
Each open beaker trial showed a decrease in measured mass after the reaction.



Detective Prompt: What does consistency suggest about the results?

Evidence Card 4 – Expansion Observed

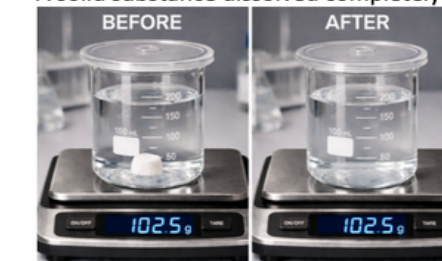
A balloon filled with one reactant was placed over the bottle containing a second reactant. When the two reactants were mixed, the balloon expanded as the reaction produced gas.



Detective Prompt: What might the bubbles indicate?

Evidence Card 5 – Dissolving Solid

A solid substance dissolved completely in water during the reaction.



Detective Prompt: Does dissolving destroy matter or only change how particles are distributed??

Part 4 – Evidence Analysis

Students summarize each piece of evidence, identify what it reveals about how **mass is conserved in chemical reactions**, and generate questions, building critical thinking and reasoning skills.

EVIDENCE CARDS

➤ **All Evidence Cards** come in two versions - ***With images and graphs and Without*** and can be printed or projected as needed. Note: Both contain data tables.

➤ Students analyze each Evidence Card and record the following in their **Evidence Log**

1. Summarize the evidence in their own words.
2. Determine what this evidence suggests

- ☐ What causes it
- ☐ Pathway
- ☐ Its impact

3. Explain what question(s) this evidence raises for them?

Images & Graphs

Part 3 – Evidence Log

For each Evidence Card, answer the questions below in 1–2 sentences in the chart.

1. Summarize the evidence in your own words.
2. Choose the one category that best fits each piece of evidence.
 - ☐ Cause
 - ☐ Pathway
 - ☐ Impact
3. What question does this evidence raise for you?

Example Evidence Log Entry (Model response only)
This evidence suggests a **pathway** because gases produced during reactions may leave the system and are no longer measured on the balance.

[illegible]

Inspect List: What Is Causing the Missing Mass?
 Inspects from 1 (most responsible) to 5 (least responsible). Each rank can only be used

Aspect	Rank	Why You Ranked It This Way
Sampling from the population		
Selection of liquids		
Measurement		
Identifying substances		
Instrument error		

Text Only

Part 5-7

Part 5 – Pathway Tracking: How Does Matter Move During a Reaction?

Use arrows to show how matter moves during a reaction.

Substance → Chemical Reaction → Particle Rearrangement → Product

Example:

Solid + Liquid → Reaction occurs → Gas forms → Gas escapes into air

Your Turn:

Choose one reaction from the case and trace what happens to the matter.

Part 6 – Impact Analysis

Impact on Particles

How are atoms rearranged during a chemical reaction?

Impact on the System

What happens when a reaction takes place in an open container?

Impact on Measurements

Why might the measured mass decrease after a reaction in an open system?

Part 7 – The Big Question

Why does it sometimes appear that matter disappears during chemical reactions?

Use evidence from the case to explain.

Part 5 – Suspect List

Students rank possible issues, defend their choices, and determine which suspect is most responsible for the problem.

Part 6 – Pathway Tracking

Students determine why *the mass stays constant in certain reactions (closed system) and changes in others (open)*.

Part 7 – Impact Analysis

Students analyze how *mass conservation* is governed by everyday chemistry using evidence from the case to support their answers.

Part 8-10

Part 8 – The Big Question

Students synthesize all their learning to explain the main cause of the problem in this case.

Part 9 – Claim-Evidence-Reasoning (CER)

Students write a structured scientific argument, making a claim, supporting it with evidence, and explaining their reasoning.

Part 10 – Reflection and Solutions

Students propose realistic actions at the personal, school/community, and scientific/environmental system levels, moving from awareness to problem-solving.

Part 8 – Claim–Evidence–Reasoning (CER)

Claim

What is the main cause of the missing mass in this case?

Evidence

List two pieces of evidence from the case.

1.

2.

Reasoning

Explain how your evidence supports your claim.

Part 9 – Solutions & Action Plan

Personal Actions

Classroom Actions

Scientific / Experimental Actions

Part 10 – Reflection

One thing that surprised me in this case was:

One change I would make after learning this information is:

Full Teacher Answer Key

Teacher Answer Key

Part 2 – Background Questions

- What does the Law of Conservation of Mass state?
The Law of Conservation of Mass states that matter is conserved during a chemical reaction, so the total mass of reactants equals the total mass of products.
- How can matter appear to disappear during a reaction?
Matter may appear to disappear when a gas is produced and escapes the container, or when a solid dissolves into a liquid and becomes less visible.
- Why are changes in mass sometimes difficult to detect?
Mass changes can be difficult to detect when reactions occur in open systems where matter can enter or leave the container and are not measured.

Part 3 - Evidence Log – Key Points

Evidence #	Key Understanding
1	This evidence suggests a pathway because it shows the amount of matter before the reaction and after the reaction.
2	This evidence suggests an impact because it shows matter disappearing in an open system.
3	This evidence suggests a cause because bubbles are formed.
4	This evidence suggests a pathway because it shows matter leaving from escaping.
5	This evidence suggests a pathway because it shows matter disappearing and being destroyed.
6	This evidence suggests an impact because it shows particle rearrangement.
7	This evidence suggests a cause because it shows the reaction occurring.
8	This evidence suggests an impact because it shows mass loss.
9	This evidence suggests a pathway because it shows matter being destroyed.
10	This evidence suggests a pathway because it shows matter leaving during the reaction.

Part 4 – Sample Suspect Ranking

- Gas escaping from the reaction
- Open reaction container
- Evaporation of liquids
- Dissolving substances
- Measurement error

Part 5 – Pathway Tracking: How Does Matter Move During a Reaction?

Reactants (solid + liquid) → Chemical reaction occurs → Particles rearrange → Gas is produced → Gas bubbles form → Gas escapes into the air → Measured mass decreases

Part 6 – Impact Analysis

Impact on Particles: Atoms are rearranged into new substances during a reaction, but the total number of atoms remains the same.

Impact on the System: In an open container, gas or vapor produced can leave the system and is no longer included in the measured mass.

Impact on Measurements: The measured mass decreases because matter is moved outside of the container being measured.

Part 7 – The Big Question

Matter may appear to disappear when products such as gases leave the system being measured. Even though mass decreases in open systems, the total amount of matter is conserved because atoms are rearranged rather than destroyed.

Part 8 – Claim–Evidence–Reasoning (CER)

Claim

The main cause of the missing mass in this case is gas escaping from the reaction in an open system.

Evidence

- Bubbles formed
- The mass decreased

Reasoning

The bubbling shows that gas is being produced and the mass decrease shows that the gas has escaped, but moved out of the container.

Understanding the Conservation of Mass in Chemical Reactions

Matter is a part of everything around us. It makes up the air we breathe, the water we drink, and the objects we use every day. Matter is anything that has mass and takes up space. During chemical reactions, matter can change form when substances mix together to create new materials. Sometimes, these reactions produce solids, liquids, or gases that look very different from the original substances.

Scientists follow an important rule called the Law of Conservation of Mass. This law states that matter cannot be created or destroyed in a chemical reaction. This means that the total mass of the reactants must equal the total mass of the products. Even when a reaction causes a change in appearance, the amount of matter stays the same. The substances are rearranged into new substances.

It sometimes appears that matter disappears during a reaction. This can happen when a gas is produced and escapes into the air. For example, when certain solids and liquids react, a gas is created. If the reaction occurs in an open container, the gas can escape the container and move into the surrounding air. When this happens, the measured mass of the container may decrease even though the matter has not actually been destroyed. Matter can also seem to disappear when a solid dissolves into a liquid. When substances dissolve, their particles spread out and become less visible. Even though the solid can no longer be seen, its particles are still present in the solution. This change in appearance can make it seem like matter is missing when it is actually just distributed differently.

Changes in mass are sometimes difficult to detect because many reactions take place in open systems. An open system is a container where substances such as gases or liquids can enter or leave. If a reaction produces a gas that escapes or a liquid that evaporates, some of the matter will leave the system. Scientists must carefully observe and measure to reach a correct conclusion that matter is conserved.

When scientists conduct a reaction in a closed container, they can measure the mass before and after the reaction to see if it changes.

Scientists explain why matter is conserved through careful observation and measurement. They observe the form, spreads out, or changes during a reaction.

Background Reading

Optional Marking Rubric

Rubric		Names:		Date:	
Section	Criteria	Level 4	Level 3	Level 2	Level 1
Part 2 – Background Questions	Understanding of Core Concepts	Answers are accurate, thorough, and clearly explained using correct scientific vocabulary	Answers are accurate with clear explanations	Answers are partially correct or lack detail	Answers are incomplete or inaccurate
	Use of Evidence from Reading	Consistently uses information from the background reading to support answers	Uses reading to support most answers	Limited reference to reading	Does not reference reading
Part 3 – Evidence	Understanding of Evidence	Accurately identifies cause, pathway, or impact for all evidence and clearly explains reasoning	Correctly identifies most evidence categories with clear explanations	Identifies some categories correctly but explanations are incomplete	Misidentifies most evidence or provides little explanation
	Use of Scientific Language	Consistent, precise scientific vocabulary	Appropriate scientific vocabulary	Limited or inconsistent vocabulary	Minimal scientific language
	Ranking & Explanation	Ranking is logical and fully supported with case evidence	Ranking is mostly logical with some evidence support	Ranking is partially supported but reasoning is weak	Ranking lacks evidence or logical reasoning
		Clearly traces accurate multi-step pathway showing how the problem leads through the body with explanation of system-level impact	Shows correct pathway with minor gaps	Shows limited or partially accurate connections	Pathway is unclear or inaccurate
		Explains most effects correctly	Explains most effects correctly	Partial understanding	Limited understanding
		Mostly accurate explanation	Mostly accurate explanation	Basic or incomplete explanation	Inaccurate or missing explanation
		General connection made	General connection made	Limited connection	No clear connection
		Clear explanation using some evidence	Clear explanation using some evidence	Basic explanation with limited evidence	Minimal or unsupported explanation
		Scientifically accurate	Clear but somewhat general claim	Claim present but vague	Claim unclear or missing
		Some relevant pieces of case evidence used	Some relevant evidence used	Limited or weak evidence	Evidence missing or irrelevant
		Clearly explains how evidence supports claim using science concepts	Reasoning mostly clear with minor gaps	Limited reasoning connection	No clear reasoning
		Thoughtful personal, community, and medical/system solutions	Practical solutions in most categories	Basic or incomplete solutions	Solutions missing or unrealistic
	Thoughtfulness & Insight	Deep reflection with personal connection	Clear reflection	Basic response	Minimal effort

Upgrade to the Chemistry in Everyday Life Detective Mystery Bundle

Get all my Chemistry in Everyday Life Activities in one spot.

THE OZONE LAYER MYSTERY

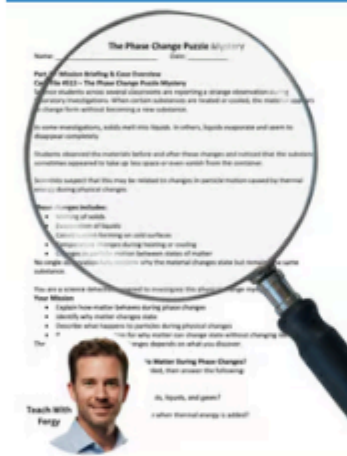
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DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE PHASE CHANGE PUZZLE MYSTERY

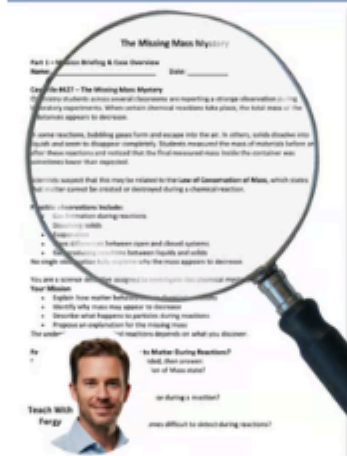
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DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE MISSING MASS MYSTERY

NO PREP



DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE SOLUBILITY SURPRISE MYSTERY

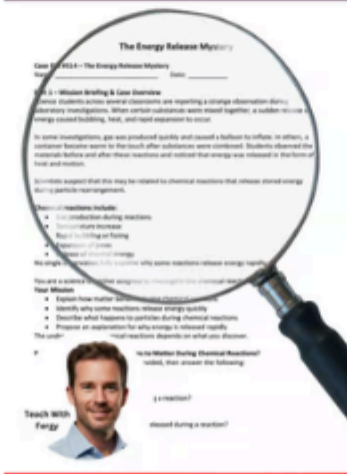
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DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE ENERGY RELEASE MYSTERY

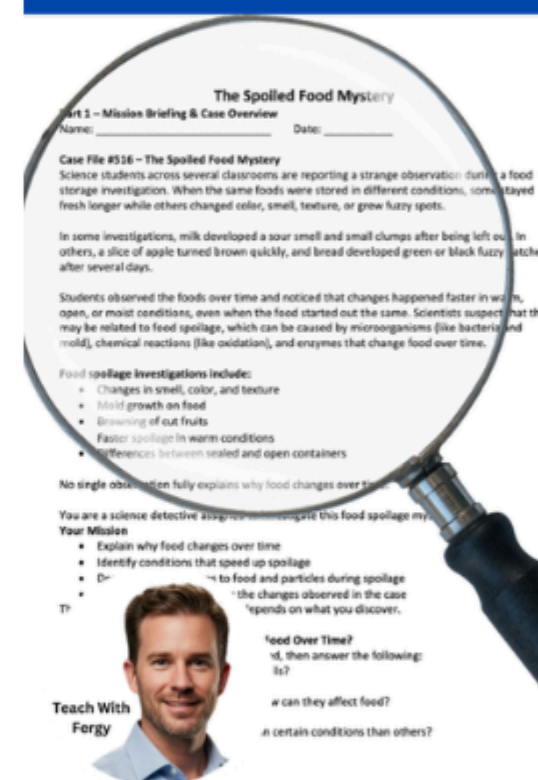
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DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

CHEMISTRY IN EVERYDAY LIFE DETECTIVE MYSTERY BUNDLE

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20 DETECTIVE FILES ON
COMMON CHEMISTRY OUR LIVES



Plus Many More!
Click Here

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

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



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TWF

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*Let's
Connect!*

