

THE OZONE LAYER MYSTERY

NO PREP

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

The Ozone Layer Mystery

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

Case File #519 – The Ozone Layer Mystery
Communities in several regions are reporting unusual patterns in sun-related health and environmental effects. Some areas have increased reports of sunburn happening more quickly than expected, while scientists have also noticed changes in ultraviolet (UV) radiation measurements over time.

In some investigations, UV readings were higher during certain seasons and at certain locations. In other cases, satellite maps showed lower ozone levels over parts of Earth, and scientists connected those areas to higher UV exposure.

Students observed that UV radiation is invisible but can cause real effects, such as sunburn and damage to living tissues. They also noticed that Earth's atmosphere seems to play a role in how much UV reaches the surface. Scientists suspect that this may be related to the ozone layer, a region in Earth's stratosphere that absorbs much of the Sun's harmful ultraviolet radiation.

Ozone layer investigations include:

- UV radiation measurements at Earth's surface
- Ozone concentration changes over time
- Effects of increased UV on living things
- The role of the stratosphere in shielding Earth
- Human-made chemicals linked to ozone breakdown

No single observation fully explains what protects Earth from harmful radiation.

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

Your Mission

- Explain what the ozone layer is and where it is located
- Identify what type of radiation the ozone layer blocks
- Describe what happens when ozone levels decrease
- Determine for what protects Earth from harmful radiation

The protective atmosphere depends on what you discover.

Ozone Layer and Why Does It Matter?
Read, then answer the following:
1. Where is it found?
2. How does the ozone layer absorb, and why is that important?
3. How does the ozone layer and UV levels at Earth's surface?

Teach With Fergy



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 *ozone layer* 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

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In some investigations, UV readings were higher during the day than at night. In other cases, satellite maps showed lower ozone levels connected those areas to higher UV exposure.

Students observed that UV radiation is invisible but can cause damage to living tissues. They also noticed that Earth's magnetic field shields much UV radiation from reaching the surface. Scientists suspect that a region in Earth's stratosphere that absorbs much of the radiation is the culprit.

Ozone layer investigations include:

- UV radiation measurements at Earth's surface
- Ozone concentration changes over time
- Effects of increased UV on living things
- The role of the stratosphere in shielding
- Human-made chemicals linked to ozone depletion

No single observation fully explains what protects Earth from UV radiation.

You are a science detective assigned to investigate the mystery of the ozone layer. Your mission is to:

- Explain what the ozone layer is and why it is important.
- Identify what type of radiation the ozone layer protects Earth from.
- Explain what happens when ozone is depleted.
- Explain what human activities affect the ozone layer.

Part 2 – Background Questions

Part 3 – Evidence Log
For each Evidence Card, answer the questions below in 1–2 sentences in the columns provided. Choose the one category that best fits each piece of evidence.

☐ Cause
☐ Pathway
☐ Impact

Example Evidence Log Entry (Model response only)
This evidence suggests a pathway because less ozone in the stratosphere allows more radiation to reach Earth's surface.

Part 4 – Suspect List: What Is Protecting Earth from Harmful Radiation?
Rank the suspects from 1 (most responsible) to 5 (least responsible). You can only rank each suspect once.

Part 5 – Pathway Tracking
Rank the suspects from 1 (most responsible) to 5 (least responsible). You can only rank each suspect once.

Part 6 – Impact Analysis
Rank the suspects from 1 (most responsible) to 5 (least responsible). You can only rank each suspect once.

Part 7 – The Big Question
What is the most likely cause of the ozone layer depletion?

Part 8 – CER
Claim: _____
Evidence: _____
Reasoning: _____

Part 9 – Solutions & Action Plan
What actions can be taken to protect the ozone layer?

Part 10 – Reflection
What did you learn from this investigation?

Evidence Cards

Evidence Card 1 – UV Radiation Measurement
A UV sensor recorded a higher UV index at midday than in early morning, even though the sky was clear both times.

Date	Time of Day	UV Index	Sky Condition
June 15	8:00 AM	2	Clear
June 15	10:00 AM	5	Clear
June 15	12:00 PM	8	Clear
June 15	1:00 PM	9	Clear
June 15	3:00 PM	7	Clear
June 15	6:00 PM	2	Clear

Detective Prompt: What does a higher UV index suggest about radiation reaching the ground?

Evidence Card 2 – Ozone Map Pattern
A satellite map showed lower ozone levels over one region during early spring compared to summer.

Detective Prompt: How might lower ozone affect UV exposure?

Evidence Card 3 – Sunburn Time Comparison
Students reported faster sunburn during a high UV day than on a low UV day with similar temperature.

Detective Prompt: What does this suggest about UV versus heat?

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 pathway of *what protects Earth from harmful radiation* using everyday chemistry.
4. Interrogate suspects (water vapor, magnetic fields, 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

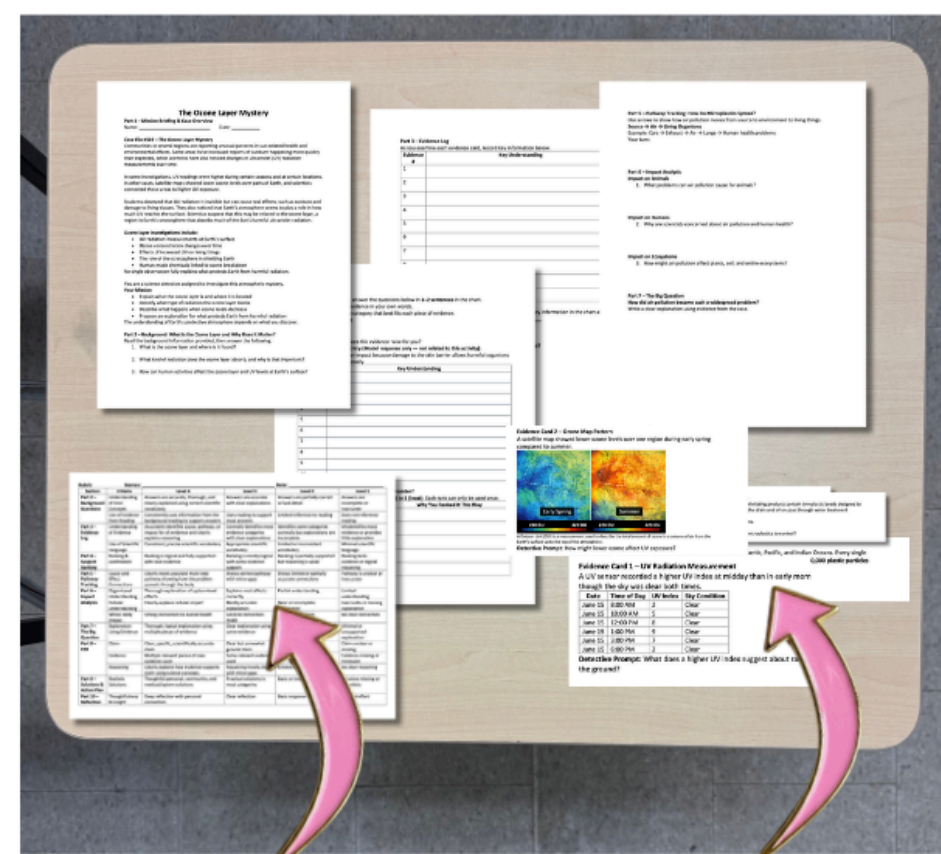
HOW THIS MYSTERY WILL HELP YOU



- 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



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 ozone layer is and where it is located
- ✓ What ultraviolet (UV-B) radiation is
- ✓ How ozone absorbs harmful radiation
- ✓ How CFCs release chlorine in the stratosphere
- ✓ How chlorine breaks down ozone molecules
- ✓ Why ozone depletion increases UV exposure
- ✓ How environmental regulations protect the ozone layer
- ✓ How to use Claim–Evidence–Reasoning (CER) to support scientific explanations
- ✓ How atmospheric chemistry affects life on Earth

Part 1 & 2

The Ozone Layer Mystery

Part 1 – Mission Briefing & Case Overview

Name: _____ Date: _____

Case File #519 – The Ozone Layer Mystery

Communities in several regions are reporting unusual patterns in sun-related health and environmental effects. Some areas have increased reports of sunburn happening more quickly than expected, while scientists have also noticed changes in ultraviolet (UV) radiation measurements over time.

In some investigations, UV readings were higher during certain seasons and at certain locations. In other cases, satellite maps showed lower ozone levels over parts of Earth, and scientists connected those areas to higher UV exposure.

Students observed that UV radiation is invisible but can cause real effects, such as sunburn and damage to living tissues. They also noticed that Earth's atmosphere seems to play a role in how much UV reaches the surface. Scientists suspect that this may be related to the ozone layer, a region in Earth's stratosphere that absorbs much of the Sun's harmful ultraviolet radiation.

Ozone layer investigations include:

- UV radiation measurements at Earth's surface
- Ozone concentration changes over time
- Effects of increased UV on living things
- The role of the stratosphere in shielding Earth
- Human-made chemicals linked to ozone breakdown

No single observation fully explains what protects Earth from harmful radiation.

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

Your Mission

- Explain what the ozone layer is and where it is located
- Identify what type of radiation the ozone layer blocks
- Describe what happens when ozone levels decrease
- Propose an explanation for what protects Earth from harmful radiation

The understanding of Earth's protective atmosphere depends on what you discover.

Part 2 – Background: What Is the Ozone Layer and Why Does It Matter?

Read the background information provided, then answer the following:

1. What is the ozone layer and where is it found?
2. What kind of radiation does the ozone layer absorb, and why is that important?
3. How can human activities affect the ozone layer and UV levels at Earth's surface?

Part 1 – Mission Briefing & Case Overview

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

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.

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 less ozone in the stratosphere allows more UV radiation to reach Earth's surface.

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

Part 4 – Suspect List: What Is Protecting Earth from Harmful Radiation?

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

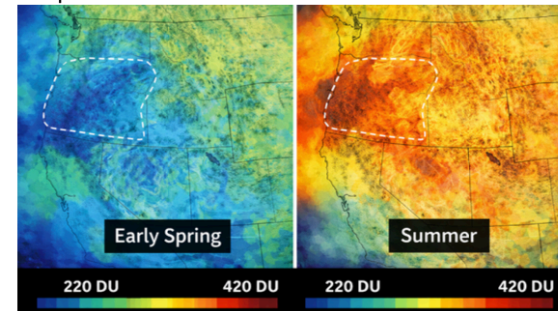
Suspect	Rank	Why You Ranked It This Way
The ozone layer in the stratosphere		
Carbon dioxide in the atmosphere		
Earth's magnetic field		
Cloud cover blocking sunlight		
Water vapor in the atmosphere		

Part 3 – Evidence Log

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

Evidence Card 2 – Ozone Map Pattern

A satellite map showed lower ozone levels over one region during early spring compared to summer.



A Dobson Unit (DU) is a measurement used to describe the total amount of ozone in a column of air from the Earth's surface up to the top of the atmosphere.

Detective Prompt: How might lower ozone affect UV exposure?

Evidence Card 1 – UV Radiation Measurement

A UV sensor recorded a higher UV index at midday than in early morning though the sky was clear both times.

Date	Time of Day	UV Index	Sky Condition
June 15	8:00 AM	2	Clear
June 15	10:00 AM	5	Clear
June 15	12:00 PM	8	Clear
June 15	1:00 PM	9	Clear
June 15	3:00 PM	7	Clear
June 15	6:00 PM	2	Clear

Detective Prompt: What does a higher UV index suggest about radiation reaching the ground?

Evidence Card 10 – Cloud Cover Comparison

On a cloudy day, the UV sensor recorded a lower UV index than on a clear day at the same time.

Date	Time	Sky Condition	Cloud Cover (%)	UV Index
July 10	12 PM	Clear	5%	9
July 11	12 PM	Mostly Clear	20%	8
July 12	12 PM	Partly Cloudy	45%	6
July 13	12 PM	Mostly Cloudy	75%	4
July 14	12 PM	Overcast	95%	2

Detective Prompt: How might clouds affect UV measurements compared to clear skies?

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.

Part 5-7

Part 5 – Pathway Tracking: How Does the Ozone Layer Protect Earth?

Use arrows to show how radiation moves from the Sun to Earth.

Sun → UV radiation travels toward Earth → Ozone absorbs UV → Less UV reaches surface → Reduced harm to living things

Example:

Sun → UV rays → Ozone layer absorbs UV → Less UV reaches skin → Less chance of sunburn

Your Turn: Choose one example from the case and trace what happened.

Part 6 – Impact Analysis

Impact on Particles

What happens at the particle level when ozone absorbs UV radiation?

Impact on the System

What happens to living things when more UV reaches Earth's surface?

Impact on Measurements

Why might scientists measure higher UV levels in areas with lower ozone?

Part 7 – The Big Question

What protects Earth from harmful radiation? 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 how *the Earth's atmosphere protects us from harmful radiation from the Sun*.

Part 7 – Impact Analysis

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

Part 8-10

Part 8 – Claim–Evidence–Reasoning (CER)

Claim

What is the main factor protecting Earth from harmful UV radiation in this case?

Evidence

1.

2.

Reasoning

Explain how your evidence supports your claim.

Part 9 – Solutions & Action Plan

Personal Actions

Classroom Actions

Scientific / Environmental Actions

Part 10 – Reflection

One thing that surprised me in this case was:

One change I would make after learning this information is:

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.

Full Teacher Answer Key

Teacher Answer Key

Part 2 – Background Questions

1. What is the ozone layer and where is it found? **The ozone layer is a region of the stratosphere with a higher concentration of ozone (O₃) gas.**
2. What kind of radiation does the ozone layer absorb, and wh **absorbs much of the Sun’s harmful UV-B radiation, which h**
3. How can human activities affect the ozone layer and UV leve **activities can affect the ozone layer when chemicals like CF**

Part 3 - Evidence Log – Key Points

Evidence #	Key Understanding
1	This evidence suggests an impact because higher UV ir radiation reaching Earth’s surface at certain times of d
2	This evidence suggests a cause because lower ozone le increased UV exposure.
3	This evidence suggests an impact because faster sunb radiation can harm skin even if temperature is similar.
4	This evidence suggests a pathway because ozone is co where it can absorb incoming UV before it reaches the
5	This evidence suggests a pathway because ozone absc much harmful radiation reaches living things.
6	This evidence suggests an impact because higher rates ozone areas show reduced protection from UV.
7	This evidence suggests an impact because extra UV ex and slow growth.
8	This evidence suggests a cause because CFCs can relea ozone molecules in the stratosphere.
9	This evidence suggests a pathway because reduced CF showing human actions can change ozone levels over t
10	This evidence suggests a cause because cloud cover ca affecting UV measurements even when ozone is uncha

Part 4 – Sample Suspect Ranking

- 1 – The ozone layer in the stratosphere
- 2 – Cloud cover blocking sunlight
- 3 – Earth’s magnetic field
- 4 – Water vapor in the atmosphere
- 5 – Carbon dioxide in the atmosphere

Part 5 – Pathway Tracking

Sun → UV radiation travels toward Earth → Ozone in stratosphere a surface → Reduced harm to things

Part 6 – Impact Analysis

Impact on Particles: When ozone absorbs UV radiation, the energy is transferred to ozone molecules. This absorption reduces the amount of UV-B that continues traveling toward Earth’s surface. Water vapor and carbon dioxide do not absorb UV-B in the same protective way.

Impact on the System: When ozone levels decrease, more UV-B radiation reaches Earth’s surface. Increased UV exposure can damage skin cells, harm eye tissues, and affect plant leaves. Cloud cover may reduce UV temporarily, but long-term protection depends on ozone levels in the stratosphere.

Impact on Measurements: Scientists measure higher UV index values in areas with lower ozone concentrations because less UV radiation is absorbed before reaching the ground. Cloud cover can influence UV readings, but ozone levels have a stronger long-term

Part 7 – The Big Question

Earth is protected from harmful UV radiation mainly by the ozone layer. The ozone layer absorbs much of the Sun’s UV-B radiation before it reaches Earth’s surface. Clouds scatter sunlight temporarily, and greenhouse gases trap heat. However, the ozone layer provides the primary protection against harmful UV radiation.

Part 8 – Claim–Evidence–Reasoning

Claim: The main factor protecting Earth from harmful UV radiation is the ozone layer in the stratosphere.

Evidence:

1. Scientists explained that ozone absorbs the Sun’s UV-B radiation before it reaches Earth’s surface.
2. Areas with lower ozone levels have higher rates of UV-related skin and eye damage over time.

Reasoning: If ozone absorbs UV-B radiation in the stratosphere, then less harmful radiation reaches living things at Earth’s surface. When ozone levels decrease, more UV reaches the ground and increases biological damage. Cloud cover may reduce UV temporarily, but it does not provide the consistent, long-term protection that ozone does. This supports the ozone layer as Earth’s primary UV shield.

Part 9 – Solutions & Action Plan

Personal Actions

Check daily

appliances to

Classroom /

Compare the

gases affect

Scientific /

Continue m

agreements

substances

Part 10 – Re

One thing t

That not all

radiation.

One change

greenhouse gases and the ozone layer when discussing climate and atmospheric science.

Understanding the Ozone Layer and Earth’s Protection from UV Radiation

Sunlight provides the energy that makes life on Earth possible. It warms the planet, allows plants to make food through photosynthesis, and supports weather patterns and ecosystems. However, sunlight also contains ultraviolet (UV) radiation, which is invisible but can be harmful to living things. Some types of UV radiation can damage skin cells, harm eyes, and affect plant tissues. Earth is protected from much of this harmful radiation by a special part of the atmosphere called the ozone layer.

The ozone layer is a region of the stratosphere with a higher concentration of ozone (O₃) gas. The stratosphere is located above the layer where most weather occurs. Ozone molecules are bonded together. While ozone near the ground can be harmful, ozone in the stratosphere plays an important protective role.

The ozone layer absorbs the Sun’s harmful UV-B radiation before it reaches Earth’s surface. When UV-B radiation enters the atmosphere, ozone molecules absorb the energy. This absorption reduces the amount of harmful UV that continues traveling toward the ground. Because of this absorption, less UV-B reaches living things. This protection is important because UV-B radiation can cause sunburn, increase the risk of skin cancer, damage eyes, and harm plant growth. Scientists often measure UV exposure using a tool called the UV index, which shows how strong UV radiation is at a certain place and time.

Not all parts of the atmosphere protect Earth in the same way. Clouds can temporarily block or scatter some sunlight, lowering UV levels for short periods. However, clouds do not consistently absorb UV-B the way ozone does. Greenhouse gases such as carbon dioxide and water vapor trap heat in the atmosphere, helping regulate temperature, but they do not absorb UV-B radiation. Earth’s magnetic field protects the planet from charged particles from space, but it does not block ultraviolet radiation from the Sun.

ray propellants, when CFCs rise into the stratosphere, chlorine can react with ozone available to absorb UV radiation at Earth’s surface.

ive observed that increased UV radiation harms plants. In some places, over time, increased UV radiation can damage crops and other plants.

l radiation. The ozone layer provides protection from UV radiation. Protecting the ozone layer helps protect life on Earth.

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	Shows correct pathway with minor gaps	Shows limited or partially accurate connections	Pathway is unclear or inaccurate
		Provides a clear explanation of system-level impact	Explains most effects correctly	Partial understanding	Limited understanding
		Explains the cellular impact	Mostly accurate explanation	Basic or incomplete explanation	Inaccurate or missing explanation
		Explains the overall health impact	General connection made	Limited connection	No clear connection
		Explains the reasoning	Clear explanation using some evidence	Basic explanation with limited evidence	Minimal or unsupported explanation
		Provides scientifically accurate evidence	Clear but somewhat general claim	Claim present but vague	Claim unclear or missing
		Uses relevant pieces of case evidence	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

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

Teach With Fergy

*Let's
Connect!*



Upgrade to the Chemistry in Everyday Life Detective Mystery Bundle

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THE OZONE LAYER MYSTERY

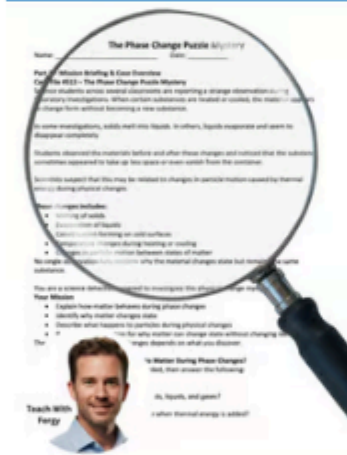
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DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE PHASE CHANGE PUZZLE MYSTERY

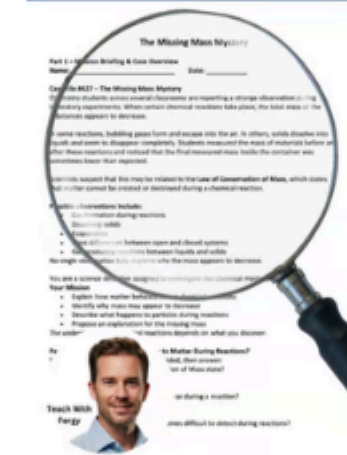
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DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE MISSING MASS MYSTERY

NO PREP



DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE SOLUBILITY SURPRISE MYSTERY

NO PREP



DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE ENERGY RELEASE MYSTERY

NO PREP



DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

CHEMISTRY IN EVERYDAY LIFE DETECTIVE MYSTERY BUNDLE

NO PREP



20 DETECTIVE FILES ON COMMON CHEMISTRY OUR LIVES



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