

THE SOLUBILITY SURPRISE MYSTERY

NO PREP

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

The Solubility Surprise Mystery

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

Case File #515 – The Solubility Surprise Mystery
Science students across several classrooms are reporting a strange observation during laboratory investigations. When different solids were added to water, some seemed to disappear completely while others stayed visible or settled at the bottom.

In some investigations, a white solid mixed into the water and the liquid looked clear again. In others, the water became cloudy, and solid pieces remained even after stirring. Students observed the materials before and after mixing and noticed that some substances dissolved while others did not, even when the same amount of water was used.

Scientists suspect that this may be related to solubility, which depends on the type of substance, the type of solvent, and how particles interact.

Solubility investigations include:

- Substances dissolving completely
- Substances remaining undissolved
- Cloudy mixtures versus clear solutions
- Effects of stirring
- Effects of temperature on dissolving

No single observation fully explains why some substances dissolve while others do not.

You are a science detective designed to investigate this solubility mystery.

Your Mission

- Explain what it means for a substance to dissolve
- Identify why some substances dissolve while others remain undissolved
- Describe what happens to particles during dissolving
- Predict differences in solubility

The type of solutions depends on what you discover.

Matter During Dissolving?
If you observe a substance dissolving, then answer the following:
1. What does the substance dissolve?
2. What is the solute and a solvent?
3. Why does it dissolve in water while others don't?

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 *solubility* 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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Marking Rubric
Criteria: Level 4, Level 3, Level 2, Level 1
Level 4: Answers are accurate, thorough, and clearly explained using correct scientific vocabulary. Consistently uses information from the background reading to support answers. Accurately identifies cause, pathway, or impact for all evidence and clearly explains reasoning. Consistent, precise scientific vocabulary. Ranking is logical and fully supported with case evidence. Cause-and-effect pathway showing how the problem spreads through the body. Thorough explanation of system-level effects. Clearly explains cellular impact. Strong connection to overall health. Thorough, logical explanation using multiple pieces of evidence. Clear, specific, scientifically accurate claim. Multiple relevant pieces of case evidence used. Clearly explains how evidence supports claim using science concepts. Thoughtful personal, community, and medical/system solutions. Deep reflection with personal connection.

Evidence Cards
Evidence Card 1 – Clear Solution Formed
A spoonful of salt stirred into water became invisible and left a clear solution with no solid remaining at the bottom.
Detective Prompt: What does this suggest about the salt particles?
Evidence Card 2 – Solid Remained Visible
A spoonful of sand stirred into the same amount of water stayed visible and settled to the bottom after stirring stopped.
Detective Prompt: What does this suggest about sand's solubility?

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 **solubility** using everyday chemistry.
4. Interrogate suspects (temperature, mixing, type of substance, 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

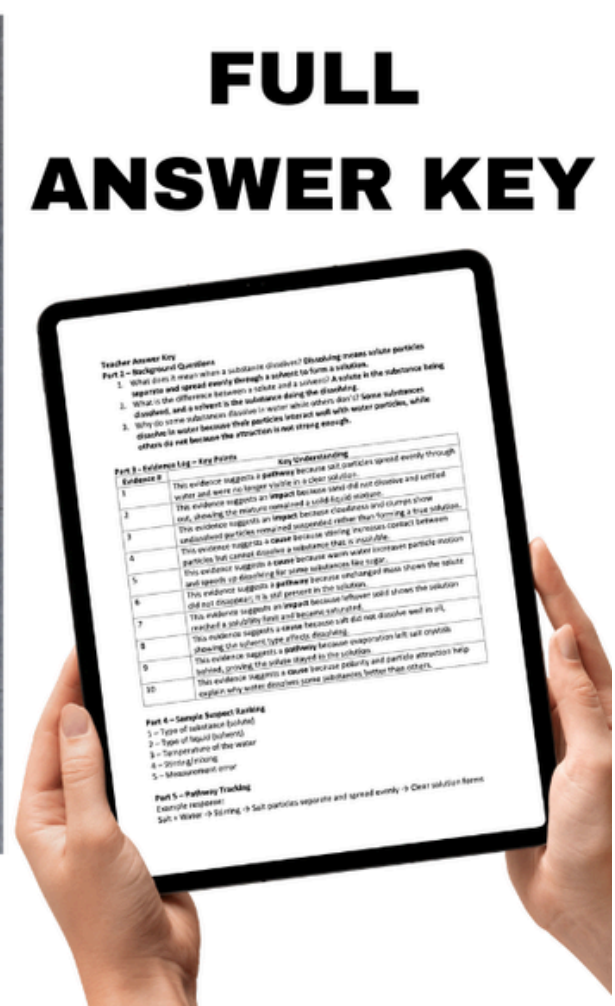
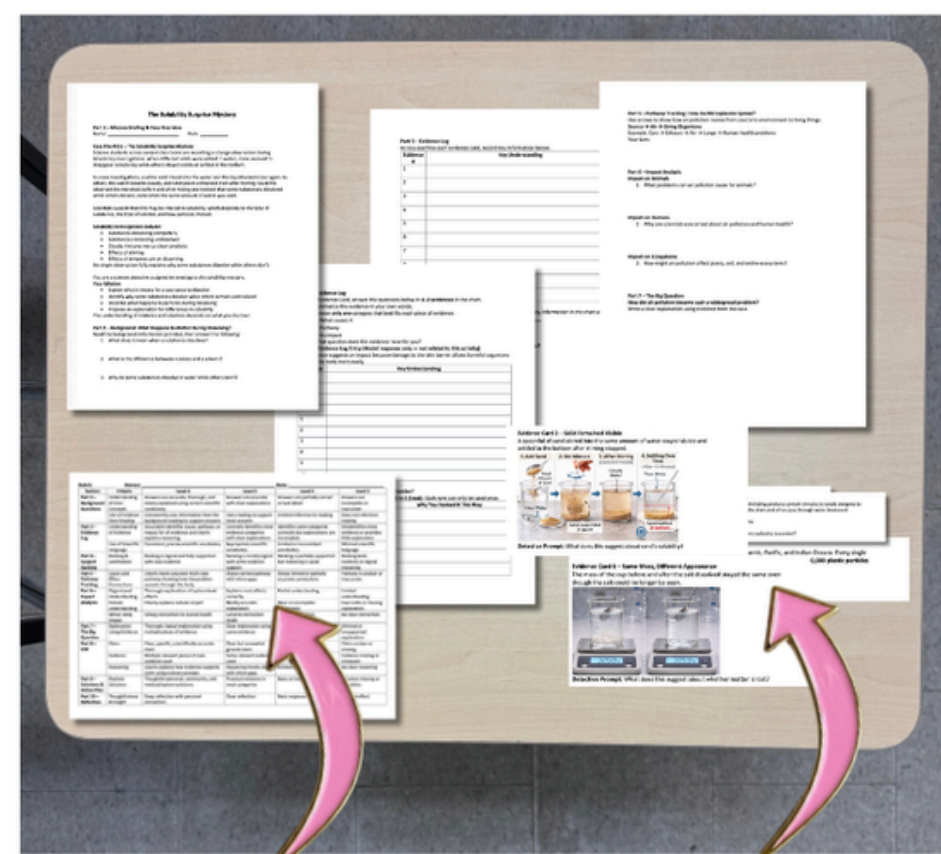
HOW THIS MYSTERY WILL HELP YOU



- 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 it means when a substance dissolves
- ✓ The difference between a solute and a solvent
- ✓ How solutions form at the particle level
- ✓ Why some substances dissolve in water while others do not
- ✓ How temperature affects dissolving
- ✓ How stirring affects particle distribution
- ✓ Why dissolved substances may become invisible but still present
- ✓ How particle interactions determine solubility
- ✓ How to use Claim–Evidence–Reasoning (CER) to support scientific explanations
- ✓ How chemistry explains everyday dissolving processes

Part 1 & 2

The Solubility Surprise Mystery

Part 1 – Mission Briefing & Case Overview

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In some investigations, a white solid mixed into the water and the liquid looked clear again. In others, the water became cloudy, and solid pieces remained even after stirring. Students observed the materials before and after mixing and noticed that some substances dissolved while others did not, even when the same amount of water was used.

Scientists suspect that this may be related to solubility, which depends on the type of substance, the type of solvent, and how particles interact.

Solubility investigations include:

- Substances dissolving completely
- Substances remaining undissolved
- Cloudy mixtures versus clear solutions
- Effects of stirring
- Effects of temperature on dissolving

No single observation fully explains why some substances dissolve while others don't.

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

Your Mission

- Explain what it means for a substance to dissolve
- Identify why some substances dissolve while others remain undissolved
- Describe what happens to particles during dissolving
- Propose an explanation for differences in solubility

The understanding of mixtures and solutions depends on what you discover.

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

Read the background information provided, then answer the following:

1. What does it mean when a substance dissolves?
2. What is the difference between a solute and a solvent?
3. Why do some substances dissolve in water while others don't?

Part 1 – Mission Briefing & Case Overview

Students take on the role of science detectives and are introduced to the everyday chemistry of *why certain substances dissolve while others don't*.

Part 2 – Background: Understanding Solubility and Dissolving

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 the solute particles spread evenly through the solvent and were no longer visible.

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

Part 4 – Suspect List: What Is Causing the Solubility Differences?

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
Temperature of the water		
Type of liquid (solvent)		
Measurement error		
Stirring/mixing		
Type of substance (solute)		

Part 3 – Evidence Log

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

Evidence Card 2 – Solid Remained Visible

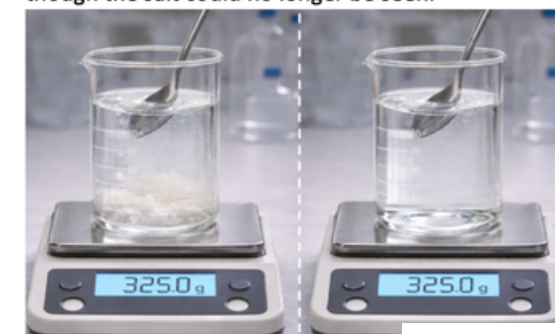
A spoonful of sand stirred into the same amount of water stayed visible and settled to the bottom after stirring stopped.



Detective Prompt: What does this suggest about sand's solubility?

Evidence Card 6 – Same Mass, Different Appearance

The mass of the cup before and after the salt dissolved stayed the same even though the salt could no longer be seen.



Detective Prompt: What does this suggest about the mass of the solution?

Evidence Card 5 – Temperature Change

Sugar dissolved much faster in warm water than in cold water, even when the same amount of sugar was used.



Part 4 – Evidence Analysis

Students summarize each piece of evidence, identify what it reveals about how ***why substances dissolve***, 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?

Evidence Cards

Evidence Card 1 – Clear Solution Formed
A spoonful of salt stirred into water became invisible and left no solid remaining at the bottom.



Detective Prompt: What does this suggest about the salt particles?

Evidence Card 2 – Solid Remained Visible
A spoonful of sand stirred into the same amount of water stayed visible and settled to the bottom after stirring stopped.

1. Add Sand


2. Stir Mixture


3. After Stirring
(Sand Still Visible)


4. Settling Over Time
(After ~5 Minutes)
Clear Water


Detective Prompt: What does this suggest about sand's solubility?

Evidence Cards – No Images

Evidence Card 1 – Clear Solution Formed
A spoonful of salt stirred into water became invisible and left a clear solution with no solid remaining at the bottom.
Detective Prompt: What does this suggest about the salt particles?

Evidence Card 2 – Solid Remained Visible
A spoonful of sand stirred into the same amount of water stayed visible and settled to the bottom after stirring stopped.
Detective Prompt: What does this suggest about sand's solubility?

Card 3 – Cloudy Mixture
A spoonful of flour mixed into water made the water cloudy and formed small clumps that did not fully disappear.
Detective Prompt: Is this a solution or a mixture with undissolved particles?

Card 4 – Stirring Effect
Stirring helped some substances dissolve faster, but it did not make the sand disappear.
Detective Prompt: What does stirring change, and what does it not change?

Card 5 – Temperature Change
Sugar dissolved much faster in warm water than in cold water, even when the same amount of sugar was used.
Detective Prompt: How might temperature affect particle motion and dissolving?

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.
3. Write down the question(s) this evidence raises for you?

Example Evidence Log (Model response only)
This evidence suggests that the solute particles spread evenly through the solvent.

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

Part 4 – Suspect List: What Is Causing the Solubility Differences?
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
Temperature of the water		
Type of liquid (solvent)		
Measurement error		
Stirring/mixing		
Type of substance (solute)		

Images & Graphs

Text Only

Part 5-7

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

Use arrows to show how matter moves during dissolving.

Example: Salt + Water → Stirring → Salt particles spread out → Clear solution forms

Your Turn: Choose one substance from the case and trace what happens to the matter.

Part 6 – Impact Analysis

Impact on Particles

What happens to solute particles when a substance dissolves?

Impact on the System

What happens when a substance does not dissolve in water?

Impact on Measurements

Why might a dissolved substance seem to “disappear” even though it is still present?

Part 7 – The Big Question

Why do some substances dissolve while others don't?

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 *some substances dissolve while others don't or take longer to do so.*

Part 7 – Impact Analysis

Students analyze how *plastic breakdown* 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 cause of the solubility differences 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:

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 plastic made of, and why is it strong? **Plastic is made of polymers, and the strong bonds in these chains make plastic strong.**
2. What is the difference between biodegradation and physical breakdown? **Biodegradation is when living organisms break material down into simpler substances, while physical breakdown is when a material breaks into smaller pieces without becoming a new, harmless substance.**
3. Why can plastic last so long in the environment? **Plastic can last so long because decomposers cannot digest it, and sunlight or weather often breaks it into microplastics instead of fully decomposing it.**

Part 3 - Evidence Log – Key Points

Evidence #	Key Understanding
1	This evidence suggests a cause because paper biodegraded, showing plastics are not easily biodegradable.
2	This evidence suggests a cause because decomposers cannot digest plastic, showing microorganisms cannot digest most plastics.
3	This evidence suggests a pathway because sunlight tearing into fragments rather than true biodegradation.
4	This evidence suggests an impact because plastic remains in the environment over time.
5	This evidence suggests a cause because long polymer chains are strong and difficult to break apart.
6	This evidence suggests a pathway because plastic can break down into microplastics that remain in soil.
7	This evidence suggests an impact because persistent plastic can harm organisms that ingest it.
8	This evidence suggests a pathway because plastic can break down into microplastics while biodegradable material breaks down quickly.
9	This evidence suggests a cause because recyclable plastics can still persist as litter.
10	This evidence suggests an impact because the same plastic item showing long-term persistence.

Part 4 – Sample Suspect Ranking

- 1 – Strong polymer bonds
- 2 – Microbes can't digest plastic
- 3 – Sunlight causes cracking only
- 4 – Microplastics persist
- 5 – Biodegradable materials break down faster

Part 5 – Pathway Tracking

Plastic item → Sunlight/weather exposure → Plastic becomes brittle
Microplastics spread in soil/water → Plastic remains for long periods

Part 6 – Impact Analysis

Impact on Particles: Plastic does not usually turn into simpler natural substances; instead, polymer pieces break into smaller fragments and microplastics that keep the same material identity.
Impact on the System: Long-lasting plastic can build up in ecosystems, be eaten by animals, and spread through soil and water, which can harm organisms and habitats.
Impact on Measurements: Scientists can still find plastic years later because plastics biodegrade very slowly, and even when they crack, they remain as plastic fragments rather than disappearing.

Part 7 – The Big Question

Plastic lasts so long because it is made of strong polymer chains that most decomposers cannot break down. Weathering from sunlight, water, and friction may crack plastic into smaller pieces, but it usually does not biodegrade into harmless substances. This allows plastic to persist in the environment for years.

Part 8 – CER

Claim: Plastic lasts so long mainly because of its strong polymer chains and the slow natural processes to break down plastics.

Evidence:

1. Paper and food decompose quickly in compost and soil.
2. Sunlight made plastic brittle and crack into smaller pieces.

Reasoning:

Biodegradable materials can be digested by organisms and turned into simpler substances, so they disappear faster. Plastic polymers are hard and strong, so decomposers cannot break them down easily. Sunlight and weather can physically break plastic into smaller pieces, but the material stays plastic, allowing it to persist for long periods.

Part 9 – Solutions & Action Plan

Personal Actions

Reduce single-use plastics, reuse containers, and dispose of plastic waste properly to prevent it from entering the environment.

Classroom Actions

Sort waste correctly, encourage recycling, and use reusable materials.

Scientific / Technological

Improve recycling processes, develop biodegradable alternatives, and research better waste management.

Part 10 – Reflection

One thing that surprised me was how long plastic can last in the environment.

One change I can make is to use fewer single-use plastics.

Understanding Why Plastic Lasts So Long

Plastic is used in many parts of everyday life. People use plastic bottles, food wrappers, bags, toys, and containers because plastic is lightweight, flexible, and strong. These useful qualities come from how plastic is made. Plastic is made of long-chain molecules called polymers. A polymer is a very large molecule made from many smaller repeating units linked together. The strong bonds in these long polymer chains make plastic durable and hard to break apart.

Many natural materials, such as food scraps, are made from substances that decomposers can break down. Living organisms, like bacteria and fungi, that feed on dead plants and animals break down organic material, the process is called biodegradation. When living organisms break material down into simpler substances, it is called biodegradation. The material then enters the soil and becomes part of natural cycles.

Microorganisms cannot digest plastic polymers because the long polymer chains are difficult to break. Even in compost bins, where organic matter breaks down quickly, plastic often remains unchanged. This is one reason plastic can last so long in the environment.

Plastic can still change over time, but usually through physical breakdown instead of biodegradation. Physical breakdown happens when a material breaks into smaller pieces without becoming a new, harmless substance. Sunlight, especially ultraviolet (UV) light, can weaken plastic in a process called weathering. UV light can cause plastic to become brittle and crack. Wind, friction, and moving water can also break plastic into smaller fragments. However, these fragments are still plastic.

As plastic continues to break apart, it can form tiny pieces called microplastics. Microplastics are small plastic particles that can mix into soil, rivers, lakes, and oceans. Even though they are tiny, they can still cause harm.

Original plastic items, like bottles and containers, are not biodegradable. They can break into smaller pieces, but they do not disappear. These pieces can stay in the environment for a long time.

Biodegradable materials, like paper and food, break down naturally. They are recycled by organisms and do not remain in the environment for long.

Decomposers, like bacteria and fungi, break down organic matter. They use only physical processes, like chewing, to break down food. They do not use chemical processes to break down plastic.

Plastics, like bottles and containers, are not biodegradable. They can break into smaller pieces, but they do not disappear. These pieces can stay in the environment for a long time.

Microplastics are tiny pieces of plastic. They can be found in soil, water, and air. They can harm organisms that ingest them.

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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

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

NO PREP



DETECTIVE FILE ON CHEMICAL REACTIONS IN OUR LIVES

THE PHASE CHANGE PUZZLE MYSTERY

NO PREP



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

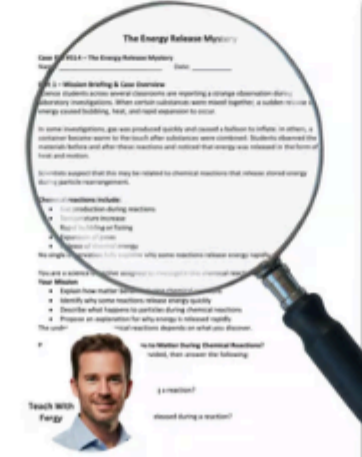
NO PREP



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



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

Teach With Fergy

*Let's
Connect!*

