Properties of Minerals Lab

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Target Grade: 10th – 12th Grade Earth and Space Science

Time Required: 90 minutes

Standards

NGSS

HS-ESS2-1: Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Connection: Students explore how minerals form and change through Earth processes. The lab helps them understand how physical and chemical properties are shaped by geological conditions, reinforcing the idea that Earth's systems operate over time and space.

Common Core

CCSS.ELA-LITERACY.RST.9-10.3: Follow precisely a multistep procedure when carrying out experiments or technical tasks.

Connection: Students rotate through eight lab stations, each requiring them to follow specific procedures (e.g., using a streak plate, applying acid safely). This standard is reinforced through hands-on practice and written instructions.

CCSS.ELA-LITERACY.WHST.9-10.2: Write informative or explanatory texts to examine and convey complex ideas and information clearly.

Connection: During the post-lab reflection and conclusion, students must use their recorded data and observations to support their answers and mineral identifications. This encourages evidence-based reasoning and scientific writing.

Lesson Objectives

Students will:

- Define the five characteristics that classify a substance as a mineral using the INCCS acronym.
- Identify and describe key physical and chemical properties of minerals, including luster, streak, cleavage, fluorescence, and chemical reactivity.

- Conduct hands-on tests at lab stations to observe and record mineral properties using scientific tools and procedures.
- Analyze observational data to distinguish between minerals with similar appearances and determine mineral identity.
- Communicate scientific reasoning and conclusions through group discussion and written reflection, using evidence from lab results.

Central Focus

In this lesson, students will explore the defining characteristics of minerals and learn how to identify them through hands-on investigation. Using a lab-based approach, students will observe and test physical and chemical properties such as luster, streak, cleavage, magnetism, and chemical reactivity. Through guided analysis and comparison, students will apply their observations to determine the identity of an unknown mineral and reflect on how these properties are used in real-world applications.

Key Terms: mineral identification, mineral properties, streak test, fracture, fluorescence, acid test, optical properties

Background Information

Teacher Background Information

Scientific Concepts to Know

- Mineral Definition (INCCS): Minerals are *inorganic, naturally occurring, crystalline in structure, have a chemical composition, and are solids*. These five traits distinguish minerals from other substances.
- Physical Properties of Minerals:
    - Luster: How a mineral reflects light (metallic vs. non-metallic).
    - Streak: The color of a mineral in powdered form, tested using a streak plate.
    - Cleavage vs. Fracture: Cleavage is the tendency to break along flat planes; fracture is irregular breakage.
    - Transparency: How much light passes through a mineral (transparent, translucent, opaque).
    - Magnetism: Some minerals, like lodestone, are naturally magnetic.
    - Optical Properties: Includes transparency and birefringence (double refraction), especially in calcite.
    - Fluorescence: Some minerals glow under UV light due to trace elements called activators.
    - Chemical Reactivity: Minerals containing calcium carbonate (e.g., calcite) will fizz when exposed to acid.

Lab Safety Considerations

- Safety Goggles: Required for all students during lab activities, especially when handling acid.
- Acid Test: Use dilute hydrochloric acid or white vinegar. Instruct students to use one drop at a time and wipe the mineral clean afterward.
- UV Flashlights: Supervise use to avoid shining directly into eyes.

- Handling Minerals: Emphasize gentle handling to avoid damaging samples or causing injury.
- Rotation Management: Use a timer or bell to keep students on schedule and avoid crowding at stations.

Possible Areas of Confusion & Solutions

- Cleavage vs. Fracture: Students may confuse the two. Use clear visual examples in the PowerPoint and Think-Pair-Share activity to reinforce the difference.
- Streak vs. Surface Color: Some minerals (e.g., pyrite) have a streak color that differs from their appearance. Emphasize this during the streak station.
- Double Refraction: Students may not recognize this effect. Demonstrate with optical calcite over printed text and explain what to look for.
- Fluorescence: Not all minerals will glow. Clarify that only some minerals fluoresce and that absence of glow is still valid data.

What to Do If Certain Tools Aren't Available

- No HCl Acid: Use white vinegar as a safe and accessible alternative.
- No UV Flashlights: Skip the fluorescence station or show a video demonstration.
- No Streak Plates: Use unglazed porcelain tiles from a hardware store.
- No Magnets: Use a strong refrigerator magnet or borrow from a science department.
- No Newspaper: Use printed text on regular paper for optical tests.

Preparation Checklist (Before Teaching)

- ☐ Review and test all lab materials and equipment.
- ☐ Print lab packets, bellringer worksheets, and vocabulary sheets.
- ☐ Set up and label all 8 lab stations with materials and instructions.
- ☐ Pre-sort mineral kits for each group (including the unknown sample).
- ☐ Test UV flashlights and acid droppers to ensure functionality.
- ☐ Prepare the PowerPoint and Kahoot game in advance.
- ☐ Review lab safety protocols and be ready to model proper techniques.
- ☐ Have paper towels, wipes, and a clean-up plan ready for post-lab.

Student Background Information

Prior Knowledge

- Difference Between Rocks and Minerals: Students should understand that minerals are naturally occurring, inorganic solids with a definite chemical composition and crystalline structure, while rocks are made up of one or more minerals.
- Basic Scientific Observation Skills: Students should be able to make careful observations, record data accurately, and describe physical characteristics using appropriate vocabulary.
- Lab Safety Procedures: Students should be familiar with general lab safety rules, including wearing goggles, handling materials responsibly, and following instructions at each station.

- Scientific Method Foundations: Students should understand how to form hypotheses, test variables, and draw conclusions based on evidence.

Vocabulary

- **Observation** – Using the senses or tools to gather information.
- **Inference** – A conclusion based on observations and prior knowledge.
- **Physical Property** – A characteristic that can be observed or measured without changing the substance.
- **Chemical Reaction** – A process in which substances change into new substances with different properties.
- **Transparent -** A material that allows light to pass through completely, enabling clear visibility through it.
- **Translucent** - A material that allows some light to pass through but scatters it, preventing clear visibility.
- **Opaque -** A material that does not allow light to pass through, blocking visibility entirely.

Materials

- Bellringer worksheets
- Projector or board
- Writing utensils
- Popsicle sticks or random name generator (for student participation)
- "Properties of Minerals" PowerPoint file
- Student notebooks or guided notes handout
- Student devices (laptops, tablets, or phones)
- Kahoot game link: Properties of Minerals Lab
- Lab packets (with pre-lab questions, data tables, and post-lab analysis)
- Safety goggles (1 per student)
- Mineral specimen boxes (1 per group, including: lodestone, graphite, optical calcite, pyrite, talc, sodalite, selenite gypsum, and an unknown)
    - https://www.flinnsci.com/classroom-mineral-collection2/ap4883/
- Magnifying glasses
- Desk lamps or flashlights (for luster station)
- White ceramic streak plates
- UV flashlights (for fluorescence station)
- Newspaper or printed text sheets (for optical properties station)
- Strong magnets (for magnetism station)
- Dilute hydrochloric acid or vinegar (for acid test station)
- Droppers or pipettes
- Paper towels or wipes (for cleaning minerals after acid test)
- Station instruction cards (optional, for student guidance at each station)

- Timer or bell (to manage station rotations)
- Clean-up supplies (wipes, bins for goggles and tools)

Pre-Lesson Setup Note

Before class, prepare the room and materials for the Properties of Minerals Lab. Each student group will receive a specimen box with eight minerals (seven known and one unknown) and will rotate together through eight testing stations. At each station, students will use the materials provided to test all of their minerals for the listed property and record results in their data table.

Step 1: Prepare Materials

- Mineral Specimen Boxes:
    - One box per group containing: Lodestone, Graphite, Optical Calcite, Pyrite, Talc, Sodalite, Selenite Gypsum, and one unknown.
    - Clearly label each mineral and the unknown sample (you can vary the unknown among groups).
- Safety Equipment:
    - Safety goggles for all students.
    - Paper towels or napkins at the Acid Test station and trash cans for disposal.
- Shared Class Materials:
    - Magnifying glasses (1–2 per group)
    - White ceramic streak plates
    - Small desk lamps (plug-in or battery-powered)
    - Handheld UV/LED flashlights
    - Strong magnets (half-dollar size recommended)
    - Pieces of newspaper (for optical property testing)
    - Dropper bottles of 0.5M hydrochloric acid (HCl) or vinegar
    - Station number signs (1–8) and laminated direction cards with the task steps

Step 2: Set Up the Eight Testing Stations

Arrange tables or counters around the classroom and label them Stations 1–8. Students will bring their own mineral boxes to each station.

- Station 1 – Color/Appearance
    - Magnifying glasses
    - Sign reminding students to observe color closely and use specific descriptive words
- Station 2 – Luster
    - Small desk lamp or flashlight for observing surface shine
    - Directions listing terms like metallic, nonmetallic, glassy, pearly, earthy, etc.
- Station 3 – Streak Color
    - White streak plates
    - Damp paper towels or wipes for cleaning plates between tests

    - Sign reminding students to rub each mineral on the streak plate and record the color of the streak (powdered form), noting if it differs from the surface color
- Station 4 – Cleavage or Fracture (How It Breaks)
    - Magnifying glasses
    - Instruction card explaining the difference between cleavage and fracture (students observe only, do not break samples)
- Station 5 – Fluorescence (Glow)
    - UV flashlight
    - Poster reminder to dim flashlight over minerals and record glow color if visible
- Station 6 – Optical Properties
    - Newspaper slips for transparency and magnification testing
    - Magnifying glasses
    - Sign describing transparent, translucent, and opaque
- Station 7 – Magnetism
    - Strong magnets
    - Directions reminding students to test by touching or moving the magnet near each mineral
- Station 8 – Chemical Reaction (Acid Test)
    - Dropper bottles of dilute HCl or vinegar
    - Paper towels or napkins for wiping samples clean
    - Safety goggles (required for all students at this station)
    - Trash can for used paper towels
    - Safety sign reminding students to apply only 2–3 drops per test

Important Notes

- Group Size: Pre-assign groups of 2–3 students with mixed ability levels.
- Rotation: Students carry their mineral boxes and data tables to each station. Allow 4 minutes per station and signal when to rotate.

Instruction

Introduction/Hook (8 minutes total)

Bellringer Activity (5 minutes):

- As students enter the classroom, direct them to begin the “5 Questions in 5 Minutes” bellringer activity.
- Provide each student with the bellringer worksheet or display the questions on the board. Questions and answer key can be found at the end of this document.
- Instruct students to:
    - Select the best answer for each multiple-choice question (4–5 answer choices per question).
    - Write a brief explanation under each question explaining why they chose that answer or how they know it is correct.

Bellringer Review (3 minutes):

- After time is up, begin a quick review of the bellringer. Use popsicle sticks or another random selection method to call on students to share their answers and reasoning.
    - Encourage students to explain their thought process aloud to reinforce critical thinking and peer learning.
    - Clarify any misconceptions and provide brief feedback as needed.

Direct Instruction & Interactive Review (30 minutes total)

Properties of Minerals PowerPoint Presentation (20 minutes):

- Transition from the bellringer to the main lesson by introducing the topic: Properties of Minerals.
    - In this presentation, students will learn what defines a mineral, how minerals form, and how to identify them using key physical and chemical properties. The slides introduce terms like luster, streak, cleavage, fluorescence, and chemical reactivity, and explain how each helps distinguish one mineral from another. Real-world connections are also highlighted to show the relevance of minerals in everyday life.
- Begin the PowerPoint presentation. As you go through the slides:
    - Pause at key points to ask oral probing questions that check for understanding and encourage student engagement.
- Prompt students to highlight or write down the following key vocabulary and concepts in their notes. Be sure to define and explain each term as it appears:
    - INCCS – An acronym to help students remember the five defining characteristics of a mineral: Inorganic, naturally occurring, crystalline structure, chemical composition, solid.
    - Streak plate – A white ceramic tile used to determine the color of a mineral in powdered form, which can differ from its surface color.
    - Activators – Trace elements within a mineral that absorb UV light and cause the mineral to fluoresce (glow).
    - Transparent, Translucent, Opaque – Terms describing how light passes through a mineral:
        - Transparent: Light passes through clearly.
        - Translucent: Some light passes through, but not clearly.
        - Opaque: No light passes through.
    - Birefringence (Double Refraction) – An optical property where a mineral splits light into two rays, making objects viewed through it appear doubled.
    - Acid Test – A chemical test used to identify minerals containing calcium carbonate; these minerals will bubble or fizz when exposed to acids like hydrochloric acid or vinegar.
- On Slide 11, initiate a Think-Pair-Share activity:
    - Ask students to compare cleavage vs. fracture using the examples shown.
    - Have them discuss with a partner and then share out with the class.

Kahoot Review Game (10 minutes):

- After the PowerPoint, launch the Kahoot Live Game titled *Properties of Minerals Lab*.
    - Premade Kahoot: https://create.kahoot.it/share/properties-of-minerals-lab/1507c2f2-6b76-49fa-933a-f198bb3fdfa5
- Instruct students to:
    - Use their notes during the game.
    - Compete individually or in teams, depending on your classroom setup.
- Use the game as a formative assessment to gauge understanding and reinforce key concepts.

Properties of Minerals Pre-Lab & Lab Activities (38 minutes total)

Pre-Lab Setup and Introduction (6–7 minutes):

- Instruct students to go to their lab groups and stations.
- Begin the activity by distributing the lab packets, mineral specimen boxes, and safety goggles to each group.
- Instruct students to complete Pre-Lab Questions 1 & 2 on page 1 of the packet. Briefly review the questions as a class to ensure understanding.
    - How will you figure out what each mineral is in today's lab? What will you look for?
    - Some minerals look alike. How do you think you can tell them apart? What will you do to find the differences?
- Explain the rotation procedure and review the instructions printed on page 2 (2–3 minutes). Emphasize safety protocols and proper handling of materials.

Lab Station Rotations (32 minutes):

- Students will rotate through the following eight stations, spending 4 minutes per station:
    - Color/Appearance – Use magnifying glasses to observe surface features.
    - Luster – Use a small desk lamp to examine how the mineral reflects light.
    - Streak – Rub the mineral on a streak plate to observe the powdered color.
    - Cleavage/Fracture – Use magnifying glasses to examine how the mineral breaks.
    - Fluorescence – Use a UV flashlight to test for glowing properties.
    - Optical Properties – Use newspaper to test for transparency, magnification, and birefringence.
    - Magnetism – Test minerals with a strong magnet to detect magnetic properties.
    - Chemical Reactivity (Acid Test) – Carefully apply a drop of HCl to test for bubbling or fizzing. Remind students to wipe minerals clean after testing to prevent damage.
- As students rotate, circulate the room to:
    - Model proper techniques (e.g., using a streak plate, performing the acid test, observing birefringence).
    - Facilitate group discussions and clarify instructions as needed.
    - Ensure safety and proper use of materials at each station.

Instruction – Post-Lab Reflection & Closure (15 minutes total)

Post-Lab Analysis & Group Discussion (10 minutes):

- Once students have completed all lab stations, instruct them to clean up their area and return supplies.
- Instruct students to work with their lab group partners to complete the Post-Lab Analysis questions on the next page of the packet. Encourage students to discuss their observations and compare data to support their answers.
- Circulate the room to check for understanding, clarify misconceptions, and guide students toward using evidence from their data tables. The questions and answers can be found at the end of this document.

Independent Reflection (5 minutes):

- After group discussions, have students complete the Post-Lab Conclusion section independently.
- Ask students to reflect on what they learned, which station they enjoyed most, and how the lab could be improved.
- If time allows, invite a few students to share their favorite part of the lab or one interesting thing they learned.

Differentiation

- Pre-teach key vocabulary (e.g., luster, cleavage, fluorescence) before the PowerPoint presentation for students who may need language support. Consider using visuals or real-life examples to reinforce meaning.
- Provide guided notes or a vocabulary reference sheet during the slideshow to help students follow along and stay engaged.
- Allow students to work in mixed-ability lab groups, ensuring that each group includes a peer who can help explain directions or clarify tasks as needed.
- Offer sentence starters or writing frames for students who may need help organizing their thoughts during the Post-Lab Analysis and Conclusion sections.
- For students who need more time, allow them to complete the Post-Lab Conclusion as homework or during a follow-up class period.
- For students who finish early, direct them to the “If You Finish Early” reading passage and comprehension questions at the back of the lab packet. This activity extends learning and reinforces key concepts about mineral formation and structure.
- Consider using verbal check-ins or small group support during the lab to monitor understanding and provide real-time clarification.

Assessment

Formative Assessment

- Bellringer Responses: Evaluate students' multiple-choice answers and written explanations to assess prior knowledge and reasoning skills.
- Oral Probing During PowerPoint: Ask questions throughout the presentation to check for understanding and clarify misconceptions in real time.
- Think-Pair-Share (Slide 11): Listen to student discussions comparing cleavage and fracture to assess their ability to apply vocabulary and visual analysis.
- Pre-Lab Questions: Review student responses to gauge readiness and understanding of the lab's purpose.
- Lab Observations: Monitor students as they rotate through stations to assess their ability to follow procedures, collaborate, and record accurate data.
- Group Discussions During Post-Lab Analysis: Observe how students use evidence from their data tables to support their answers.

Summative Assessment

- Lab Packet Completion: Collect and review the full lab packet, including:
    - Data Table 1 (observations from all 8 stations)
    - Post-Lab Analysis questions (written explanations using evidence)
    - Post-Lab Conclusion (reflection on learning and application)
- Unknown Mineral Identification: Evaluate students' ability to use observed properties to correctly identify the unknown mineral and justify their reasoning.
- Optional Extension: Use the "If You Finish Early" reading and comprehension questions as an additional assessment of reading comprehension and science application.

Post-Lab Analysis Questions and Answers

1. Which minerals exhibited metallic luster? Which ones did not? How did you describe the appearance of the non-metallic minerals?

   Metallic luster: Lodestone and Pyrite both exhibited metallic luster. Lodestone appeared dark gray and shiny, while Pyrite had a brassy, gold-like appearance.

   Non-metallic luster:

   - Graphite had a dull, earthy sheen.
   - Talc appeared pearly and greasy.
   - Sodalite was dull to vitreous with a deep blue color.
   - Selenite Gypsum had a silky to pearly luster.
   - Optical Calcite was vitreous and clear.

2. What streak colors did you observe during testing? Were there any minerals whose streak color differed significantly from their external appearance?

   - Lodestone: Dark gray streak
   - Graphite: Black streak
   - Optical Calcite: White streak
   - Pyrite: Greenish-black streak (different from its gold appearance)
   - Talc: White streak
   - Sodalite: White streak
   - Selenite Gypsum: White streak

Observation: Pyrite's streak was notably different from its shiny gold appearance, which helped confirm its identity.

3. Which minerals demonstrated cleavage, and which showed fracture? Since you didn't physically break the minerals, how were you able to distinguish between the two types of breakage?

Cleavage: Talc, Selenite Gypsum, and Optical Calcite showed cleavage. This was evident from their smooth, flat surfaces and the way light reflected off them in consistent planes.

Fracture: Lodestone, Graphite, Pyrite, and Sodalite showed fracture. Their surfaces were uneven or rough, with irregular breakage patterns.

We identified cleavage vs. fracture by examining the mineral surfaces under light and noting whether they broke along flat planes (cleavage) or irregular surfaces (fracture).

4. Based on your observations, which minerals would be suitable for use in soft, glowing outdoor lighting? Explain your reasoning.

Selenite Gypsum and Optical Calcite would be suitable.

- Selenite is translucent and can diffuse light softly, creating a warm glow.
- Optical Calcite is clear and can transmit light effectively, especially when polished.

Both minerals also have a gentle appearance and can glow under certain lighting conditions, making them ideal for ambient lighting.

5. Which minerals were transparent, translucent, or opaque? How did you determine the level of light transmission for each?

    - Transparent: Optical Calcite (letters were clearly visible through it)
    - Translucent: Selenite Gypsum, Talc, Sodalite (light passed through but not clearly)
    - Opaque: Lodestone, Graphite, Pyrite (no light passed through)

We tested this by placing the minerals over printed text and shining a flashlight behind them to observe how much light passed through.

6. Which mineral(s) could potentially be used to create a magnifying glass? What properties support your conclusion?

Optical Calcite could be used.
It is transparent and exhibits double refraction, which means it bends light in a way that can magnify or distort images. Its clarity and optical properties make it a candidate for simple magnification tools.

7. Which minerals displayed double refraction? Describe what you observed and how it helped you identify this property.

Optical Calcite displayed double refraction.
When placed over printed text, the letters appeared doubled. This optical illusion is a hallmark of calcite and helped confirm its identity.

8. Which minerals could be used in the production of magnets? What evidence from your tests supports this conclusion?

Lodestone could be used.
It was the only mineral that attracted a magnet during testing, indicating it contains magnetite, a naturally magnetic mineral.

9. Which minerals reacted with acid, indicating the presence of calcium carbonate? What signs did you observe that confirmed this reaction**?**

Optical Calcite reacted with acid.
When a drop of dilute hydrochloric acid was applied, it fizzed and bubbled, confirming the presence of calcium carbonate.

Bellringer: 5 Questions in 5 Minutes

1. Which of the following is *not* one of the five characteristics that define a mineral?
A. Naturally occurring
B. Inorganic
C. Liquid at room temperature
D. Has a definite chemical composition
E. Solid

2. A student finds a rock that contains shiny, metallic-looking crystals. Which property is the student most likely observing?
A. Streak
B. Cleavage
C. Luster
D. Hardness
E. Transparency

3. Which tool would be most useful for determining the streak color of a mineral?
A. Hand lens
B. Streak plate
C. Magnet
D. Graduated cylinder
E. Thermometer

4. Which of the following best explains why two minerals might look similar but are actually different substances?
A. They have the same streak color
B. They have different chemical compositions
C. They are both metallic
D. They are both found in the same location
E. They are both transparent

5. A student places a clear mineral over a newspaper and sees two overlapping images of the text. Which property is the student most likely observing?
A. Fluorescence
B. Magnetism
C. Double refraction
D. Cleavage
E. Transparency

KEY: 5 Questions in 5 Minutes

1. Which of the following is *not* one of the five characteristics that define a mineral?

A. Naturally occurring
B. Inorganic
C. Liquid at room temperature
D. Has a definite chemical composition
E. Solid

Correct Answer: C
Rationale: Minerals must be solids at room temperature.

2. A student finds a rock that contains shiny, metallic-looking crystals. Which property is the student most likely observing?

A. Streak
B. Cleavage
C. Luster
D. Hardness
E. Transparency

Correct Answer: C
Rationale: Luster describes how a mineral reflects light, including metallic shine.

3. Which tool would be most useful for determining the streak color of a mineral?

A. Hand lens
B. Streak plate
C. Magnet
D. Graduated cylinder
E. Thermometer

Correct Answer: B
Rationale: A streak plate is used to observe the color of a mineral in powdered form.

4. Which of the following best explains why two minerals might look similar but are actually different substances?

A. They have the same streak color
B. They have different chemical compositions
C. They are both metallic
D. They are both found in the same location
E. They are both transparent

Correct Answer: B
Rationale: Minerals are defined by their unique chemical composition and crystal structure.

5. A student places a clear mineral over a newspaper and sees two overlapping images of the text. Which property is the student most likely observing?
A. Fluorescence
B. Magnetism
C. Double refraction
D. Cleavage
E. Transparency

Correct Answer: C
Rationale: The clue about seeing two images suggests double refraction, a property of minerals like calcite.

Properties of Minerals Lab

PRE-LAB

Answer in 2-3 COMPLETE sentences.

1. How will you determine the identity of each mineral during today's lab? What specific properties will you observe to guide your conclusions?

2. Many minerals share similar physical characteristics. How do you plan to distinguish between minerals that appear alike? What strategies or tests will help you identify their differences?

Lab Safety Reminder: Before you begin the lab, remember to follow these safety rules:

1. **Always wear your safety goggles** while working at the lab stations.
2. **Handle all minerals and tools carefully**—do not throw, scratch, or break them.
3. **Only use the acid when told to**, and never touch it with your hands.
4. **Wipe off minerals after the Acid Test** and throw used paper towels in the trash.
5. **Stay with your group** and follow directions at each station.

Lab Instructions

You will receive a specimen box with 8 minerals. Seven of them are known, and one is unknown. Your job is to test each mineral at 8 different lab stations and use your observations to figure out which mineral is the unknown. The names of the known minerals are listed in Data Table 1 on the next page.

At each station, follow the directions below and record your observations in the chart.

Lab Stations

1. **Color/Appearance:** Look closely at the mineral. What colors do you see? Be as specific as you can.
2. **Luster:** Does the mineral shine or look dull?
    a. Use words like:
        i. Metallic – shiny, reflects light like metal
        ii. Nonmetallic – dull, does not reflect light
        iii. You can also use: pearly, milky, silky, waxy, glassy, greasy, earthy
3. **Streak**: Rub the mineral on the white streak plate. What color is the powder it leaves behind? *Wipe the plate clean after each use.*
4. **How It Breaks:** Look at how the mineral breaks. Use a magnifying glass to help. You will not break the minerals, just observe them.
    a. Cleavage – breaks in smooth, flat shapes (like cubes or sheets)
    b. Fracture – breaks in rough or jagged pieces
5. **Fluorescence**: Shine the UV flashlight on the mineral. Does it glow under the light? If yes, what color?
6. **Optical Properties**: Is the mineral:
    a. Transparent – clear, you can see through it
        i. If it's transparent, hold it over newspaper. Does it make the words look bigger or show two images? Write what you see.
    b. Translucent – some light passes through
    c. Opaque – no light passes through
7. **Magnetism**: Rub the mineral on the magnet. Does it stick or move the magnet? Write what happens.
8. **Chemical Reaction** (Acid Test): Test one mineral at a time. Take the mineral out of your box and place it on the lab counter. Use the labeled squirt bottle to carefully squeeze 2–3 drops of dilute hydrochloric acid (HCl) onto the mineral. Watch the mineral closely for 30 seconds. Does it bubble or fizz? That means it has a chemical reaction. When you're done, use a small paper towel or napkin to gently wipe the mineral clean. Throw the used paper towel in the trash can at your station.

Be sure to record all your data in Data Table 1 on the next page.

DATA TABLE 1

Mineral	Color/ Appearance	Luster	Streak Color	How It Breaks (Cleavage or Fracture)	Fluorescence (Glow?)	Optical Properties	Magnetism	Acid Test (Bubbles?)
Lodestone								
Graphite								
Optical Calcite								
Pyrite								
Talc								
Sodalite								
Selenite Gypsum								
Unknown								

Post-Lab: Analysis

Answer each question in 2–3 complete sentences.

1. Which minerals exhibited metallic luster? Which ones did not? How did you describe the appearance of the non-metallic minerals?

2. What streak colors did you observe during testing? Were there any minerals whose streak color differed significantly from their external appearance?

3. Which minerals demonstrated cleavage, and which showed fracture? Since you didn't physically break the minerals, how were you able to distinguish between the two types of breakage?

4. Based on your observations, which minerals would be suitable for use in soft, glowing outdoor lighting? Explain your reasoning.

5. Which minerals were transparent, translucent, or opaque? How did you determine the level of light transmission for each?

6. Which mineral(s) could potentially be used to create a magnifying glass? What properties support your conclusion?

7. Which minerals displayed double refraction? Describe what you observed and how it helped you identify this property.

8. Which minerals could be used in the production of magnets? What evidence from your tests supports this conclusion?

9. Which minerals reacted with acid, indicating the presence of calcium carbonate? What signs did you observe that confirmed this reaction?

10. What did you conclude your unknown mineral was? Use specific evidence from your data to justify your identification.

Post-Lab: Conclusion

1. Identify three key concepts or skills you learned from this lab. For each one, explain why it was meaningful or how it helped deepen your understanding of mineral properties.

   A.

   B.

   C.

2. Which lab station did you find most engaging or informative? Explain what made it stand out and how it contributed to your learning.

3. Suggest two specific ways this lab experience could be improved for future students. Consider materials, instructions, timing, or station setup.

   A.

   B.

If You Finish Early…
Read the passage below and respond to the questions that follow.

Diamonds and Graphite
Diamonds and graphite are both composed of carbon, yet they have very different physical properties. Graphite is soft and commonly used in pencils, while diamonds are the hardest known natural material on Earth.
This difference is due to the conditions under which each forms. Diamonds are created deep within the Earth's mantle, more than 150 kilometers below the surface, where temperatures and pressures are extremely high. These intense conditions cause the carbon atoms to bond in a strong, repeating crystal structure, giving diamonds their exceptional hardness.
Diamonds reach the Earth's surface through volcanic eruptions. Occasionally, other minerals such as garnet are found trapped inside diamonds. These are known as inclusions, and they provide scientists with valuable information about the composition and conditions of Earth's interior.

Questions:
1. How do the structural properties of diamonds allow them to remain intact as they travel from deep within the Earth to the surface?

2. If graphite were exposed to the same high-pressure, high-temperature conditions found in the mantle, what changes might occur? Explain your reasoning.

3. Why are inclusions inside diamonds important to scientists? What can they reveal about Earth's interior?

Station Instruction Cards

Station 1 – Color / Appearance

Materials: Magnifying glass
Instructions:

1. Pick up each mineral and look closely at its surface.
2. Use the magnifying glass to observe details like color variations, patterns, or shine.
3. Record the color(s) in your data table. Be specific (e.g., “light gray with black specks” instead of just “gray”).

Station 2 – Luster

Materials: Desk lamp or flashlight
Instructions:

1. Shine the light on the mineral’s surface.
2. Observe how the mineral reflects light.
3. Record the luster using terms like:
    - **Metallic** – shiny like metal
    - **Nonmetallic** – dull
    - Other options: glassy, pearly, silky, waxy, greasy, earthy
4. Write your observation on the data table.

Station 3 – Streak Color

Materials: White streak plate, damp paper towel
Instructions:

1. Rub the mineral firmly across the streak plate.
2. Observe the color of the powder left behind.
3. Record the streak color in your data table.

4. Wipe the plate clean before testing the next mineral.
   Sign Reminder: "Test the streak color (powder form). It may differ from the mineral's surface color!"

Station 4 – How It Breaks (Cleavage or Fracture)

Materials: Magnifying glass
Instructions:

1. Examine the edges and surfaces of the mineral.
2. Do NOT break the mineral—just observe.
3. Decide if it shows:
   - **Cleavage** – breaks along smooth, flat surfaces
   - **Fracture** – breaks in rough, jagged pieces
4. Record your observation on the data table.

Station 5 – Fluorescence

Materials: UV flashlight
Instructions:

1. Shine the UV light on the mineral in a dim area.
2. Look for any glow or color change.
3. If it glows, record the color on your data table.
4. If no glow, write "none."

Station 6 – Optical Properties

Materials: Newspaper slip, magnifying glass
Instructions:

1. Hold the mineral up to the light. Is it:
   - **Transparent** – clear, you can see through

- **Translucent** – some light passes through
- **Opaque** – no light passes through

2. If transparent, place it over newspaper:
    - Does it make letters look bigger?
    - Do you see double images?
3. Record your observations on the data table.

Station 7 – Magnetism

Materials: Strong magnet
Instructions:

1. Touch the magnet to the mineral or move it nearby.
2. Does the mineral stick to the magnet or move it?
3. Record “yes” or “no” on your data table.

Station 8 – Chemical Reaction (Acid Test)

Materials: Dropper bottle of dilute HCl or vinegar, paper towels, trash can
Safety: Wear goggles at this station!
Instructions:

1. Place the mineral on the counter.
2. Apply 2–3 drops of acid to the mineral.
3. Watch for bubbling or fizzing for 30 seconds.
4. If it reacts, record “yes” on your data table.
5. Wipe the mineral clean and throw the paper towel in the trash.