

Identifying Minerals:

Hardness, Luster, Streak, Cleavage

Welcome and Learning Objectives



Distinguish common minerals using four observable properties: hardness, luster, streak, cleavage



See why mineral identification matters in field study, classrooms, and collections



Preview the four-property suite, from concept to guided practice



How to use this training: observe, test, record, compare, confirm



Safety notes for specimens, streak plates, glass plates, and steel tools



What Minerals Are and Why Properties Matter

- A mineral is naturally occurring, inorganic, solid, with ordered atomic structure
- Definite chemical composition that stays the same everywhere it forms
- Rocks are aggregates of one or more minerals; minerals are the building blocks
- Physical properties reflect atomic arrangement and composition—reliable identification clues
- Testable with simple tools: hand lens, streak plate, hardness tools, glass plate
- Some minerals share properties; multiple tests beat a single observation



Single mineral grain

Ordered atomic structure



Rock made of several minerals

Hardness and the Mohs Scale

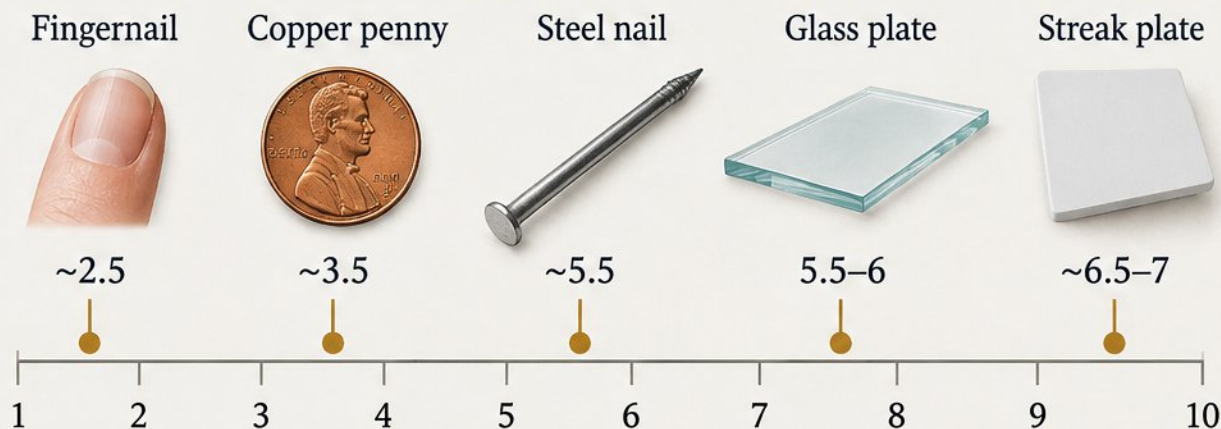
OBSERVE
TEST
IDENTIFY
UNDERSTAND

Mohs Hardness Scale

1		Talc
2		Gypsum
3		Calcite
4		Fluorite
5		Apatite
6		Orthoclase
7		Quartz
8		Topaz
9		Corundum
10		Diamond

- Hardness = resistance to scratching, not toughness or breaking
- Mohs scale: talc 1, gypsum 2, calcite 3, fluorite 4, apatite 5, orthoclase 6, quartz 7, topaz 8, corundum 9, diamond 10
- Field tools: fingernail ~2.5, copper penny ~3.5, steel nail ~5.5, glass plate 5.5–6, streak plate ~6.5–7
- Test a fresh surface both directions; rub the mark to confirm a groove, not powder
- Record a range ($H < 5.5$ or $H > 5.5$), then refine with other properties
- Special cases: kyanite is directional; diamond is hardest but cleaves easily

Field Tools and Their Hardness



Luster: Metallic, Nonmetallic, and In Between

- Luster is surface sheen, not color: brass-yellow pyrite is still metallic
- Main groups: metallic, submetallic, and nonmetallic
- Nonmetallic: vitreous, pearly, silky, greasy, resinous, adamantine, earthy, waxy
- Metallic is opaque and mirror-like; submetallic looks like dull pewter
- Examples: pyrite and galena metallic, quartz vitreous, muscovite pearly, gypsum silky
- Weathering and coatings can change luster, so pair it with other tests



Metallic



Submetallic



Nonmetallic

Common Nonmetallic Lusters



Vitreous



Pearly



Silky



Greasy



Resinous



Adamantine



Earthy



Waxy

Key Identification Properties



Hardness



Luster



Streak



Cleavage

Streak: The Color of Powdered Mineral

- Streak is the color of a mineral's powder, tested on unglazed porcelain
- Often more consistent and diagnostic than the mineral's overall color
- Most useful for metallic, oxide, and sulfide minerals; less useful for silicates
- Hardness limits the test: minerals harder than ~6.5 scratch the plate instead
- True streak rubs off with a finger; a plate scratch does not
- Powder from the streak plate can support acid testing for carbonates



Cleavage, Fracture, and Crystal Form

- Cleavage: breaking along flat, parallel planes of weak atomic bonding
- Describe by quality, number of directions, and angles between planes
- One direction: muscovite; two: pyroxene $\sim 90^\circ$, amphibole $60^\circ/120^\circ$
- Three directions: halite and galena 90° ; calcite not 90° ; fluorite four
- Fracture types: conchoidal, uneven, fibrous, splintery, hackly
- Quartz and olivine show conchoidal fracture, not cleavage



Putting It All Together: A Step-by-Step Identification Workflow

- 1 Observe first:**
color, luster, transparency, crystal habit
- 2 Test least destructive first:**
streak, then hardness, then cleavage
- 3 Examine fresh, unweathered surfaces with a 10x hand lens**
- 4 Start decision trees with luster and streak, then hardness and breakage**
- 5 Confirm with an identification key;**
record sample number, tests, and confidence
- 6 Pitfalls:** color-only calls, misread luster, powder vs. scratch, cleavage vs. crystal faces



KEY PROPERTIES TO OBSERVE AND TEST



Hardness



Luster



Streak



Cleavage

Guided Practice Lab: Quartz, Calcite, Halite, Muscovite, Pyrite, Hematite, Galena, and Fluorite

- Test each specimen for hardness, luster, streak, and cleavage
- Quartz: H 7, vitreous, white streak, no cleavage, conchoidal fracture
- Calcite: H 3, rhombohedral cleavage, white streak, fizzes in dilute HCl
- Halite: H 2.5, cubic cleavage, salty taste; muscovite: H 2–2.5, pearly, flexible sheets
- Pyrite and galena look metallic; hematite gives a red-brown streak
- Record all results, then compare with the reference table in groups



Quartz



Calcite



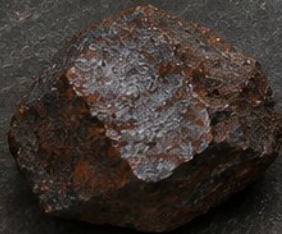
Halite



Muscovite



Pyrite



Hematite



Galena



Fluorite

A blank, spiral-bound notebook with a grid pattern. The grid has five columns labeled 'Mineral', 'Hardness', 'Luster', 'Streak', and 'Cleavage'. A yellow pencil is lying diagonally across the bottom right of the grid.

Self-Check: Reading Test Results and Avoiding Misidentifications



Specimen scratches glass, white streak, no cleavage: likely quartz (H 7)



Hardness



Luster



Streak



Cleavage



Soft metallic, cubic cleavage, gray-black streak, high luster: galena



Hardness



Luster



Streak



Cleavage



Red-brown streak with metallic or earthy luster: hematite, even if color varies



Hardness



Luster



Streak



Cleavage

- Match hardness ranges, luster types, streak colors, and cleavage to minerals
- Revisit misconceptions: color alone, hardness vs. toughness, streak vs. plate scratches

- Resolve conflicts: retest fresh surfaces, repeat, use a hand lens, eliminate



Quick Quiz: Match Minerals to Their Properties

1

Item 1: match each mineral to its hardness range and streak

2

Item 2: identify the mineral from test results, justify with two properties

3

Item 3: select the mineral from luster and cleavage; explain eliminations

4

Item 4: correct flawed statements, such as identifying by color alone

5

Answer key models reasoning: observation, property, elimination, confirmation

6

Graded on accuracy, quality of evidence, and recognizing uncertainty

Minerals



Properties

Hardness Range



Streak



Test Results

- _____
- _____
- _____

Flawed Statement

"This mineral is _____ because it's this color."

Real-World Applications: Fieldwork, Teaching, and Collections



Field geology: identify minerals in hand sample without advanced equipment



Classroom teaching: build low-cost kits that develop observation and reasoning



Museums and collections: describe specimens accurately and note weathering effects



Everyday connections: minerals in household products, building materials, and technology



Economic relevance: ore and industrial minerals link identification to resource use



Adapt the four-property approach to small grains within rocks



Tools, Kits, and Field Safety

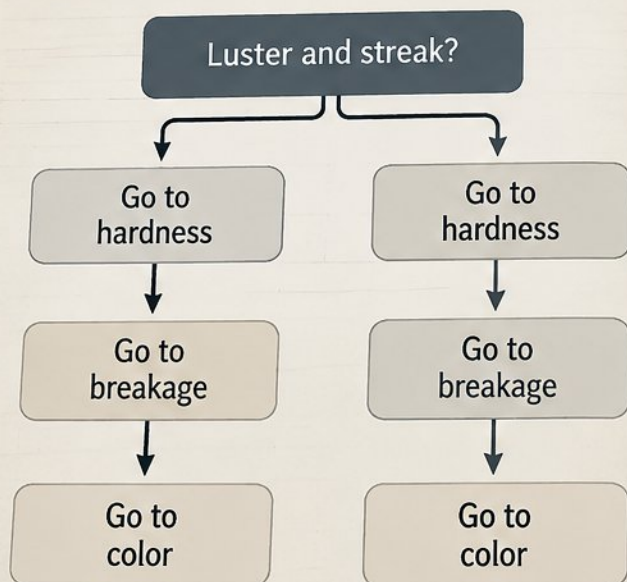
- **Core kit:** 10x hand lens, porcelain streak plate, fingernail, copper penny, steel nail, glass plate, small magnet
- **Optional:** dilute HCl dropper bottle, steel file, quartz point, ceramic tile, tweezers, specimen labels
- **Field hardness references:** fingernail ~2.5, penny ~3.5, glass plate ~5.5, steel file ~6.5
- **Lay glass plates flat on a table** — never scratch while holding them in your hand
- **Sharp tools and acid:** wear eye protection, avoid skin contact, and never taste specimens
- **Test on inconspicuous or fresh surfaces;** avoid damaging good crystals



Reference Tables and Identification Keys

- Read tables left to right: color, luster, streak, hardness, cleavage, special properties
- Dichotomous key order: luster and streak, then hardness, then breakage, then color
- Test least destructive first; confirm every ID with multiple properties
- Reference minerals: talc 1, gypsum 2, calcite 3, fluorite 4, apatite 5, orthoclase 6, quartz 7, topaz 8, corundum 9, diamond 10
- Record sample number, visual and testable properties, mineral name, and confidence
- If it won't key out, retest and check common look-alikes before rare species

Dichotomous Key (Example Flow)



Mohs Reference Minerals

Mineral	Hardness	Typical Luster	Typical Streak
talc	1	pearly	white
gypsum	2	silky	white
calcite	3	vitreous	white
fluorite	4	vitreous	white
apatite	5	vitreous	white
orthoclase	6	vitreous	white
quartz	7	vitreous	white
topaz	8	vitreous	white
corundum	9	vitreous	white
diamond	10	adamantine	white

OBSERVE
TEST
IDENTIFY
RECORD

Next Steps: Practice, Resources, and Keeping a Mineral Journal



Keep practicing with new specimens and unknown samples to build fluency



Start a mineral journal: sketches, test results, locality notes, what failed



Key resources: MSA Mineral ID Key, Mindat, Handbook of Mineralogy, survey guides



Online practice: virtual collections, flow charts, and photo banks for comparison



Closing challenge: identify one unfamiliar specimen and document your reasoning



PersonWise.

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Scan the code or click anywhere to watch this course live, with voice Q&A

personwise.ai/t/6ba63fad/public