

Answer Key: Classifying Matter by Its Properties

Grade: 6 **Subject:** Science **For teacher use only** Science

How to use this key

Answers are grouped by section and question number. Many items are open-ended; accept any response that shows correct reasoning even if the wording differs. Notes flag where more than one answer is defensible and list common misconceptions to watch for. Estimated grading time: ~5–7 min per packet.

Sample "identities" behind Table 1 (for your reference)

Students are **not** asked to name the exact substances — only to classify and justify. The data were built from these plausible identities so the properties are internally consistent: **W** ≈ iron/steel (magnetic metal), **X** ≈ quartz/sand (nonmetal), **Y** ≈ copper (metal), **Z** ≈ a salt or sugar (soluble nonmetal), **Q** ≈ aluminum (metal). Do not require these names from students.

Start Notice & Wonder grade for effort · ~2 min

1 Sorting a penny, eraser, marble, and paper clip.

Full credit for any reasonable notice + wonder. **Ideal:** Notice — "the penny and paper clip are shiny/hard while the eraser is soft," or "a magnet might stick to the paper clip." Wonder — "how could I tell the marble from the penny if both are hard?" Accept any on-topic notice and wonder. More than one answer is defensible.

2 Two properties to sort coins, buttons, and beads.

Accept any two observable/measurable physical properties: color, size, hardness, shininess (luster), whether a magnet sticks, whether it floats/sinks (density), material, etc. Reject non-properties like "which one I like." More than one answer is defensible.

Build Read the Science ~1 min

3 How Figure 1 shows the mixture vs. the pure substance.

The pure substance has **only one kind of particle** (all identical open circles), while the mixture shows **two different kinds of particles blended together** (open circles *and* hatched squares). Accept any answer naming "more than one kind of particle" in the mixture.

Apply Use the Data ~2–3 min

4 Classify each sample M (metal) or N (nonmetal).

W — **M** (shiny, conducts, magnetic).

X — **N** (dull, does not conduct).

Y — **M** (shiny, conducts).

Z — **N** (dull, does not conduct).

Q — M (shiny, conducts).

Property relied on most: most students should cite **conductivity** and/or **luster** as the deciding metal/nonmetal properties. Accept either, or both together. (Magnetism alone is *not* a good metal test — only W is magnetic even though Y and Q are also metals; watch for students who over-rely on it — see Q6 and misconceptions.)

5 Which property tells X from Z?

Solubility (dissolves in water). X does **not** dissolve; Z **does**. Every other listed property (density 2.2, non-magnetic, non-conducting, dull) is the same for both, so solubility is the only distinguishing property in the table.

6 Observation (O) vs. Inference (I).

a) **O** — a directly measured value (7.9 g/cm³).

b) **O** — a directly observed result (the magnet sticks).

c) **I** — a reasoned conclusion about identity ("probably iron or steel because...").

d) **I** — a reasoned conclusion ("is not a metal because...").

Observation = measured/seen directly; inference = a conclusion reasoned from evidence. Any "probably..." or "because..." identity statement is an inference.

7 Which test tells W from Y (both shiny, conducting metals)?

Best answers name **density** (W = 7.9 vs. Y = 8.9 g/cm³) — measure the density and compare — **or magnetism** (a magnet sticks to W but not to Y). Either is fully correct. Luster, conductivity, and solubility are the *same* for both and cannot distinguish them, so reject those. More than one answer is defensible (density or magnetism).

8 Pure substance or mixture? (ground-up Z with varied specks + magnetic grains)

Mixture. A pure substance has the *same* properties all the way through. Here the specks **dissolve at different rates** and some grains are **magnetic while others are not** — that means more than one kind of substance is present, so it is a mixture. Award full credit for "mixture" plus at least one piece of the given evidence (different dissolving rates OR magnetic vs. non-magnetic grains). *Note:* the pure sample Z in Table 1 was uniform; this question deliberately describes a *contaminated/ground-up* version to test the concept.

Explain CER (Q9) ~1–2 min

9 Are W and Q "the same metal"? Do the data support the claim?

Model answer. Claim: The data do **not** support the idea that W and Q are the same metal. Evidence: (1) Their **densities differ** — W is 7.9 g/cm³ but Q is 2.7 g/cm³. (2) **A magnet sticks to W but not to Q.** Reasoning: A pure substance has the **same physical properties everywhere**, so two pieces of the same metal should have the *same* density and the same response to a magnet. Because W and Q differ on both, they must be different metals. *Defensible note:* Any two of the differing properties (density, magnetism) earn full evidence credit. A student who claims they *are* the same should lose credit, because the data clearly differ — but if they only cite the shared "shiny + conducts" properties, use this as a teaching moment that those are shared by *many* metals and do not prove identity.

CER scoring rubric (3 points)

Score	Claim	Evidence	Reasoning
3	Clear, correct claim ("data do not support").	Two accurate, relevant properties from Table 1 that differ (e.g., density, magnetism).	Correctly links evidence to the idea that a pure substance has the same properties throughout.
2	Claim stated, mostly clear.	One solid differing property, or two with a minor error.	Some correct linkage but incomplete or a small misconception.

Score	Claim	Evidence	Reasoning
1	Vague or partly correct claim.	Evidence weak, off-topic, or cites only shared properties.	Little or flawed reasoning; "same properties throughout" idea missing.
0	No/incorrect claim.	No evidence.	No reasoning.

Close ACE ~1 min

ACE Articulate / Connect / Extend.

Articulate: accept any accurate plain-language definition of one property (e.g., "density is how heavy something is for its size," "magnetism is whether a magnet sticks").

Connect: the cited row must actually match the chosen property (e.g., density → any row's g/cm³ value; magnetism → Sample W is "Yes"; solubility → Sample Z is "Yes"; conductivity/luster → W, Y, or Q).

Extend: any correct everyday use of that property (e.g., a magnet sorting steel cans at a recycling center; noticing sugar dissolves in tea but sand does not; a heavy object for its size sinking). More than one answer is defensible.

Watch Common misconceptions

- **Mixture vs. compound.** A mixture is only *physically* blended, so its parts keep their own properties and can be separated by a property (magnet, dissolving, filtering). A compound is *chemically joined* and cannot be separated that way. Q8's ground-up Z is a mixture, not a compound.
- **A property is not the substance.** "Shiny" or "conducts" does not by itself name a substance — W, Y, and Q are all shiny conductors yet are different metals (Q7, Q9). You must check several properties together.
- **Size vs. density.** Density does not depend on how big the piece is — a small and a large chunk of the same substance have the same density. Students may wrongly think a bigger sample is "denser."
- **Magnetism = metal.** Only some metals are magnetic. Y and Q are metals but not magnetic; a non-magnetic result does *not* mean "not a metal" (Q4).
- **Observation vs. inference (Q6).** Students often mark a reasoned identity ("probably iron") as an "observation." Any "probably..." or "because..." statement is usually an inference.

Teacher follow-up based on likely errors

If many students miss Q6c/Q6d, do a 5-minute sort of statements into "measured/seen" vs. "concluded." If Q4 shows students leaning on magnetism to decide metal/nonmetal, re-anchor with the fact that Y and Q are non-magnetic metals. If Q8 answers say "compound," clarify mixture vs. compound. If CER (Q9) evidence is thin, model citing a specific Table 1 value aloud. The "a property is not the substance" idea is the highest-value item to address next class.

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