

Substitute Guide: Classifying Matter by Its Properties

Grade: 6 **Subject:** Science **Time:** ~45 min core + ~15 min extension Science

Learning goal (plain language)

Students learn that every material has **physical properties** — things you can observe or measure (like density, whether a magnet sticks, whether it conducts, how shiny it is, and whether it dissolves) — and that we use those properties to **sort and identify** matter and to tell a **pure substance** from a **mixture**. They practice by reading a diagram and a data table of "unknown" samples, sorting them, and writing a short evidence-based explanation. **You do not need a science background to run this.** Everything students need is printed in their packet, and the samples were already measured for them — there is no lab, no equipment, and no safety hazard.

Standards alignment

Framework: 19 TAC §112.26 (Grade 6 Science). Knowledge & skills **6.6** — the classification of matter by its physical properties.

- **Primary — 6.6A (provisional):** compare and identify substances using physical properties such as density, magnetism, and conductivity.
- **Primary — 6.6B (provisional):** distinguish pure substances from mixtures and classify matter by its physical properties.

Provisional — pending educator verification against the current official TAC source.

(Standards are paraphrased here, not quoted. Please confirm codes and wording against your official source.)

Setup Before class (5 min)

- Count and hand out one **student packet** per student.
- Confirm each student has a **pencil**. No calculators, computers, or lab items are needed.
- Write the date on the board and remind students to fill in the name line.
- Keep the **answer key** with you — it is a separate file and is **not** in the student packet.

Materials What's needed

- Printed student packet (4–6 pages) per student.
- Pencil per student.
- This guide and the separate answer key (teacher only).
- No technology, no calculator, no lab equipment, no safety hazards.

Timing Suggested pacing (~45–60 min)

Segment	Time	What students do
Start — Notice & Wonder	5 min	Q1–Q2 warm-up
Build — Read the science	5–10 min	Read passage, word bank, Figure 1; Q3
Apply — Use the data	20–25 min	Table 1; Q4–Q8
Explain — CER	5–10 min	Q9 claim/evidence/reasoning
Close — ACE	5 min	Articulate / Connect / Extend
Continue — early finishers optional	~15 min	"Design a sorting test"

Script Read aloud to start

"Today's assignment is a paper science investigation called *Classifying Matter by Its Properties*. You will work by yourself with just a pencil — no computers or calculators, and no lab materials, because the samples have already been measured for you. First read the short passage and study the diagram and the data table. Then answer the questions in order; if one is tricky, skip it and come back. Write in complete sentences where it asks you to explain. You may quietly read the passage aloud to yourself. Put your name, class period, and date at the top now. You have about 45 minutes; raise your hand if you need help understanding a word."

Support When students ask for help

- **You may read any part aloud** to a student or the class.
- If they are stuck on classifying a sample, point them to the **Word Bank** and to the "metals are usually shiny and conduct" hint printed in Q4.
- Encourage the printed **sentence stems** for the CER (Q9) and ACE sections.
- Do **not** give answers; prompt with "What does the data show for that sample?" or "Which property is different between those two rows?"
- It is fine if a student cannot finish the optional early-finisher task.

Access Accommodations & language support

- **Read-aloud** of any passage or question is allowed for all students.
- Point students to the **sentence stems** and the **Word Bank** (definitions provided).
- Extended time is fine; the core can stop after Q9 if time runs short.
- Students may answer in phrases if writing full sentences is a barrier, as long as the idea is clear.
- The packet is grayscale-safe — it prints and reads clearly in black and white.

Tools Allowed & not allowed

Allowed: pencil, the printed packet, quiet self-read-aloud. **Not needed / not allowed:** calculator (no calculation required — densities are read directly from the table), phones, computers, lab materials.

Collect at the end: Collect every packet, whether finished or not, with names on them. Stack them for the teacher. Note on a sticky how far most students got and any questions that caused confusion.

Answer key: The **answer key is a separate file** (answerkey.html) and is for the teacher only. Please do not hand it to students.

Teacher follow-up (for the returning teacher)

Watch for two common mix-ups: treating a single property (like "shiny") as proof of what a substance is, and confusing a *mixture* with a chemically joined *compound*. A quick next-day discussion sorting a few real materials

by property, plus reviewing the observation-vs-inference item (Q6), would reinforce this well. The CER (Q9) responses show who can cite specific data as evidence and who understands that a pure substance has the same properties throughout.

G06_SCI_ClassifyMatter_01 — Classifying Matter by Its Properties Substitute Guide

Classifying Matter by Its Properties

Grade: 6 **Subject:** Science **Time:** ~45 min core + ~15 min extension **Work mode:** Independent · pencil only
Science

Start Here

This is a **paper investigation**. Scientists have already measured the samples for you, so you do **not** need any lab materials, a computer, or a calculator — just a pencil and this packet. You will read a short passage, study a diagram and a data table, sort samples into groups, and explain your thinking. Work by yourself and do your best. Write in complete sentences where you are asked to explain. If a question is hard, skip it, keep going, and come back. Reading the passage quietly aloud to yourself is allowed and encouraged.

Start Notice & Wonder 5 min

Think about how you already sort everyday materials without even trying.

1 Imagine a bin holding a copper penny, a rubber eraser, a glass marble, and a paper clip. You pick up each one. Write **one thing you notice** that could help you sort them into groups, and **one thing you wonder** about telling them apart.

2 A "property" is a trait you can observe or measure about a material — for example, its color, how hard it is, or whether a magnet sticks to it. Name **two properties** you could use to sort a pile of coins, buttons, and beads into groups.

Build Read the Science 5–10 min

Using physical properties to classify matter

Matter is anything that has mass and takes up space. Every kind of matter has **physical properties** — traits you can observe or measure *without* changing what the substance is made of. We use these properties to identify and sort, or **classify**, matter. Useful physical properties include:

- **Density** — how much mass is packed into a certain amount of space ($\text{mass} \div \text{volume}$). Every pure substance has its own density no matter how big the piece is. A small gold ring and a large gold bar have the *same* density.
- **Magnetism** — whether a magnet is attracted to the material. Iron and steel are magnetic; copper, aluminum, and glass are not.
- **Electrical & thermal conductivity** — how easily electricity or heat passes through. Most metals conduct well; plastic, wood, and glass do not.
- **Solubility** — whether a material dissolves in water (like salt) or does not (like sand).
- **State** — solid, liquid, or gas at room temperature.
- **Luster** — how shiny a surface is. Metals are usually shiny (metallic luster); nonmetals are often dull.

Matter can also be sorted by **what it is made of**. A **pure substance** is made of only one kind of particle all the way through (for example, pure copper or pure water), so it has the *same* properties everywhere. A **mixture** combines two or more substances that are physically blended but not chemically joined (for example, salt water,

or sand mixed with iron filings). The parts of a mixture keep their own properties and can often be separated using a property — a magnet can pull iron out of sand.

Remember: a property is a *clue* about a substance, not the substance itself. "Shiny" alone does not tell you it is a metal — you check several properties together.

Word Bank

physical property

a trait you can observe or measure without changing what the matter is made of.

density

the amount of mass in a given volume ($\text{mass} \div \text{volume}$).

conductivity

how easily heat or electricity passes through a material.

solubility

whether a material dissolves in a liquid such as water.

pure substance

matter made of only one kind of particle throughout.

mixture

two or more substances physically blended but not chemically joined.

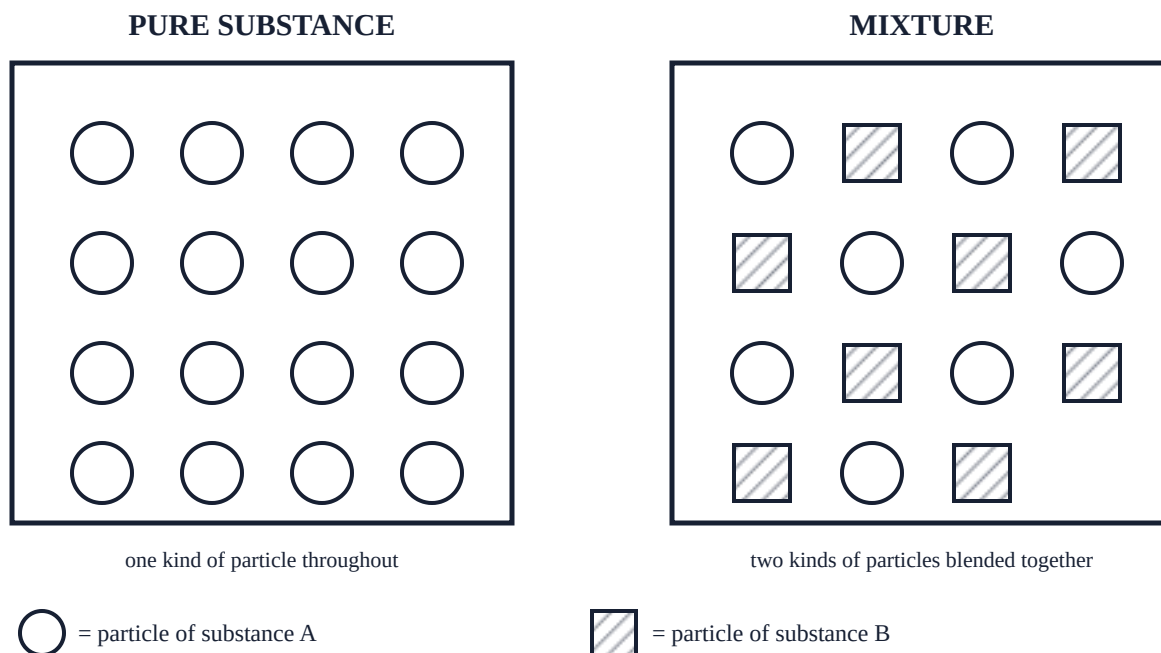


Figure 1. Particle model of a pure substance versus a mixture. In the pure substance every particle is the same (open circles). In the mixture, two kinds of particles are blended (open circles and hatched squares). Shapes and patterns — not color — show the difference, so the figure reads clearly in grayscale.

3Using Figure 1, explain in one sentence **how you can tell** the mixture apart from the pure substance just by looking at the particles.

Apply Use the Data 20–25 min

A lab team measured five unknown solid samples and recorded their physical properties. Study Table 1, then answer the questions. All samples were solid at room temperature.

Table 1. Measured physical properties of five unknown samples (original class data).

Sample Density (g/cm³) Magnet sticks? Conducts electricity? Luster Dissolves in water?

W	7.9	Yes	Yes	Shiny	No
X	2.2	No	No	Dull	No
Y	8.9	No	Yes	Shiny	No
Z	2.2	No	No	Dull	Yes
Q	2.7	No	Yes	Shiny	No

4Classify each sample. Metals are usually shiny and conduct electricity; nonmetals usually do not. Write **M** (metal) or **N** (nonmetal) for each sample, then name the **one property** from the table you used most to decide.

___ W · ___ X · ___ Y · ___ Z · ___ Q

Property I relied on most:

5Samples X and Z have the same density, magnetism, conductivity, and luster. They are not identical, though. **Which single property in the table tells them apart,** and how does it distinguish them?

6Observation vs. inference. Read each statement. Write **O** if it is an observation (something directly measured or seen) or **I** if it is an inference (a conclusion you reason out).

- ___ a) Sample W has a density of 7.9 g/cm³.
___ b) A magnet sticks to Sample W.
___ c) Sample W is probably iron or steel because it is magnetic and shiny.
___ d) Sample X is not a metal because it is dull and does not conduct.

7Which test would you use? Samples W and Y are both shiny metals that conduct electricity, so those tests cannot tell them apart. Name **one property** from Table 1 that *could* tell W from Y, and explain in a sentence how you would use it.

8Pure substance or mixture? A scientist grinds up part of Sample Z and finds that different specks dissolve at different rates, and a few dark grains can be pulled out with a magnet. Using the ideas from the Build section, is this ground-up Z best described as a **pure substance** or a **mixture**? Justify your answer with the evidence given.

Explain Claim–Evidence–Reasoning 5–10 min

Question 9. A student claims, "Sample W and Sample Q are the same metal." Using Table 1, decide whether the data **support** or **do not support** that claim. Write a claim of your own, back it with **two pieces of evidence** from the table, then explain your reasoning.

Sentence stems you may use: "The data do / do not support the idea that..." · "One piece of evidence is... (from Table 1)." · "A second piece of evidence is..." · "This matters because a pure substance has the same properties everywhere, so..."

Claim

Evidence (two pieces)

Reasoning

Close ACE Wrap-Up 5 min

Articulate

Explain **one** physical property (density, magnetism, conductivity, solubility, state, or luster) in your own words, as if teaching a friend.

Connect

Point to one row of Table 1 where that property helped you sort a sample. Name the sample.

Extend

Give a **new** example of using that property to sort or identify something in everyday life.

Continue Early Finisher optional • ~15 min

If you finish early (no new materials needed):

Design a sorting test. On the back of this page, imagine a jar holding a mixture of salt, sand, and iron filings all stirred together. Design a step-by-step plan to separate the three, using a different **physical property** at each step (think magnetism, solubility, and filtering). For each step, name the property you are using. Then **predict** which material comes out first and explain why.

Turn in: Hand in this whole packet with your name, class period, and date filled in. Make sure questions 1–9 and the ACE box are answered. The early-finisher plan is optional but turn it in too if you did it.

G06_SCI_ClassifyMatter_01 — Classifying Matter by Its Properties Student Packet



TEACHER ANSWER KEY FOLLOWS

Do not copy the pages after this divider for students.

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.

G06_SCI_ClassifyMatter_01 — Classifying Matter by Its Properties Teacher Answer Key