

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.

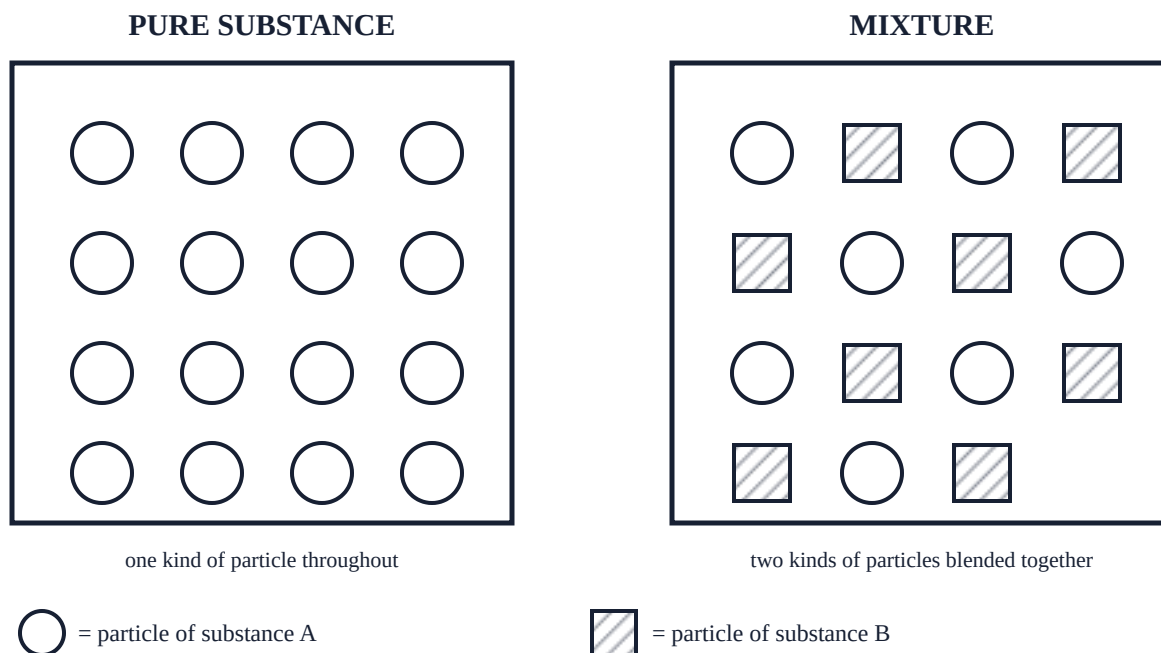


Figure 1. Particle model of a pure substance versus a mixture. In the pure substance every particle is the same (open circles). In the mixture, two kinds of particles are blended (open circles and hatched squares). Shapes and patterns — not color — show the difference, so the figure reads clearly in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