

Matter Test Detectives

Compare physical properties and chemical behavior using fair tests.

S8P1.c "Plan and carry out investigations to compare and contrast chemical (i.e., reactivity, combustibility) and physical (i.e., density, melting point, boiling point) properties of matter."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline evidence of physical properties. Circle evidence of chemical properties, then number the conditions the teams kept the same so you can see how their comparison was fair.

Wax and Salt Investigation

- ① A class investigated paraffin wax and table salt to compare physical properties and chemical behavior. Their question was, "How do the samples differ in density, melting behavior, and combustibility?" For density, each team measured mass for 10 cubic centimeters of solid material, excluding air between salt grains, then divided mass by that volume. Using equal volumes made the comparison fair. Students recorded units in grams per cubic centimeter. They predicted that a lower-density sample would have less mass when both samples had the same volume.
- ② Next, teams placed small, equal masses of the samples in separate heat-safe containers. A teacher heated each container in the same hot-water bath and recorded whether a sample changed from solid to liquid. Wax melted in the bath, while salt stayed solid at that temperature. Melting is a physical change because the material remains the same substance. A teacher then held a small wax sample in a flame. It burned, forming new substances, so combustibility is a chemical property. Salt did not burn under these test conditions.

- ③ To make conclusions stronger, teams repeated every measurement three times and looked for results that agreed. They kept the sample volume, water-bath temperature, container type, and heating time the same whenever those conditions applied. Their data showed that wax had less mass than salt for the same volume, and wax melted in the bath. The class concluded that density and melting behavior are physical properties, but burning is chemical evidence because it produces new substances. A good investigation separates observations from claims and states the test conditions.

2 ANSWER WITH EVIDENCE Use the passage

1 How did the teams make their density comparison fair?

2 What physical-property difference did the hot-water-bath test show?

3 Why is burning wax evidence of a chemical property rather than a physical property?

4 Name two practices that made the teams' conclusions stronger.

3 YOUR TURN Your own words

Plan and carry out fair comparisons. Teacher supplies approved limestone chips and sand, balance, graduated cylinder, water, two clear cups, measuring tools, dilute household vinegar, goggles and recording paper. No flames or heating. Before testing, describe one physical density test, one vinegar reactivity test and the controls below.

With teacher approval, actually measure mass and displaced volume for each insoluble sample, remove trapped air, and calculate density with units. Then place 5 g of each material in separate cups, add 10 mL of the same vinegar, and observe for 3 minutes. Repeat both tests three times with fresh equal samples. Record all measured masses, displaced volumes, calculated densities and observed bubbling on extra paper, then write a comparison explaining physical versus chemical properties. Do not assume sand must react or not react.

MATERIAL	PHYSICAL TEST AND CONTROLS	CHEMICAL TEST AND CONTROLS

PART 1 • READ AND MARK

Underline evidence of physical properties. Circle evidence of chemical properties, then number the conditions the teams kept the same so you can see how their comparison was fair. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	How did the teams make their density comparison fair?	They compared equal solid-material volumes, excluding air between salt grains.
2	What physical-property difference did the hot-water-bath test show?	Wax melted in the hot-water bath, while salt stayed solid at that temperature. This showed different melting behavior.
3	Why is burning wax evidence of a chemical property rather than a physical property?	Burning wax formed new substances. A chemical change produces new substances.
4	Name two practices that made the teams' conclusions stronger.	They repeated each measurement three times and kept test conditions, such as sample volume, temperature, container type, and heating time, the same.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Illustrative plan: For each material measure mass and solid displaced volume, excluding trapped air; density = mass ÷ displaced volume. Use the same balance/cylinder and procedure. Test 5 g fresh material with 10 mL vinegar for 3 minutes in identical cups and repeat three times.

Actual outcome records must come from the learner's tests. Example calculation only: a 5.0 g sample displacing 2.0 mL has density 2.5 g/mL; this is not a supplied result for either material. Compare recorded density and bubbling patterns. Density describes a physical property; bubbling under the vinegar test can support a chemical reactivity difference. Lack of observed bubbles is limited to these conditions, not proof of no possible chemical reaction.

Preserve all four correct passage answers and existing condition limitations. Require actual approved tests, three trial records for each material, density calculations/units and a physical/chemical comparison. Use only approved insoluble specimens; salt dissolves, so water displacement is inappropriate for it. Remove trapped air without dust exposure; use goggles, no tasting, flames or heating. Accept differing sand composition and honest no-bubble results; do not impose the illustrative density on samples. Teacher supports apparatus use and checks equal masses, vinegar volume, containers and observation time. A plan alone is insufficient.