

Property Detectives

Use evidence from properties to identify pure substances.

PS.3.a "pure substances can be identified based on their chemical and physical properties;"

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each complete sentence that gives a specific physical property or a physical-property measurement. Circle each complete sentence that gives a specific chemical property or describes a reaction that shows one.

Clues in a Sample

- ① Scientists identify a pure substance by comparing its characteristic properties with reliable reference information. A pure substance contains one kind of particle, so a sample has the same set of properties wherever it is collected. For example, pure copper has a reddish color, a density of about 8.96 grams per cubic centimeter, and conducts electricity well. Color, density, and electrical conductivity are physical properties because they can be observed or measured without changing copper into a different substance. One property alone may not identify a sample, but several matching properties provide stronger evidence.
- ② Melting point is another useful physical property. At standard pressure, pure water melts at 0°C , while pure sodium chloride melts at 801°C . These temperatures help distinguish the substances, even though both may be clear or white in some forms. A scientist must control conditions such as pressure and use a pure sample, because impurities can change a measured melting point. A result close to a reference value supports an identification, but scientists usually check more than one property before deciding.
- ③ Chemical properties describe how a substance can form different substances during a chemical change. Iron reacts with oxygen and water to form rust, so its tendency to rust is a chemical property. Ethanol is flammable, meaning it can react with oxygen during burning to form new substances. Testing a chemical property may use only a tiny sample and careful safety procedures. A scientist can identify an unknown by comparing its physical and chemical properties with those of known pure substances, then looking for a consistent match.

2 ANSWER WITH EVIDENCE Use the passage

1 Why are copper's density and electrical conductivity physical properties?

2 Which pure substance has a melting point of 801°C, and which property does this value describe?

3 Name any two physical properties the passage uses to help identify pure substances.

4 What chemical property of iron does the passage describe? Include the reactants and product.

3 YOUR TURN Your own words

An unknown metal is silvery, has a density of 2.71 grams per cubic centimeter, and conducts electricity. A reference card says pure aluminum is silvery, has a density of 2.70 grams per cubic centimeter, and conducts electricity, while pure copper is reddish and has a density of 8.96 grams per cubic centimeter. Write 2 to 3 sentences identifying the most likely pure substance, using at least two physical properties as evidence. Explain why one matching property would not be enough.

PART 1 • READ AND MARK

Underline each complete sentence that gives a specific physical property or a physical-property measurement. Circle each complete sentence that gives a specific chemical property or describes a reaction that shows one. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Why are copper's density and electrical conductivity physical properties?	They can be observed or measured without changing copper into a different substance.
2	Which pure substance has a melting point of 801°C, and which property does this value describe?	Pure sodium chloride. The value describes its melting point.
3	Name any two physical properties the passage uses to help identify pure substances.	Answers include color, density, electrical conductivity, and melting point.
4	What chemical property of iron does the passage describe? Include the reactants and product.	Iron can react with oxygen and water to form rust.

PART 3 • YOUR TURN (SAMPLE ANSWER)

The unknown is most likely pure aluminum. Its silvery color and density of 2.71 grams per cubic centimeter closely match aluminum's reference properties, and it conducts electricity. More tests would strengthen the identification because one matching property is not enough.

Accept accurate paraphrases and any two physical properties named in the passage for Question 3. For the open response, accept aluminum as the most likely identification when the student supports the claim with matching physical-property evidence and explains that several properties give stronger evidence.