

Copper Changes Case

Trace properties, bonding, and conservation in one investigation.

PS.3 "The student will investigate and understand that matter has properties and is conserved in chemical and physical processes. Key ideas include 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 physical property used as evidence. Circle each physical or chemical change, then write P or C beside it to show whether the substance's identity changes.

From Copper Wire to Copper Oxide

- ① At a recycling lab, students compare a clean copper wire with a sample of sulfur. Each is a pure substance, made of only one kind of particle. Copper can be identified by its reddish color, shiny surface, high electrical conductivity, and melting point. Sulfur is yellow and does not conduct electricity well. These physical properties can help identify a pure substance without creating a new substance. Measurements such as density and melting point are especially useful because they do not depend on sample size.
- ② Some changes alter form but not identity. Cutting or bending copper wire changes its size or shape, so it is a physical change. The copper remains copper and can still conduct electricity. Heating copper strongly in oxygen can form black copper oxide, a chemical change with different properties. The atoms are not lost. They rearrange as copper atoms join oxygen atoms. Copper oxide is a compound, not the same pure substance as copper. Its black color and lower conductivity provide evidence of changed properties.
- ③ In copper oxide, positive and negative ions attract, so its bonding is ionic. In a covalent compound, atoms share electrons. For example, water, H_2O , contains covalent bonds between hydrogen and oxygen atoms. Chemical equations show that atoms are conserved. The balanced equation $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$ has two copper atoms and two oxygen atoms on each side. Coefficients balance atom counts. Subscripts, such as the 2 in O_2 , are part of a formula and must not be changed to balance an equation.

2 ANSWER WITH EVIDENCE Use the passage

1 Name two physical properties that can help identify the copper sample.

2 Why is bending copper wire a physical change, but heating copper in oxygen is a chemical change?

3 How is bonding in copper oxide different from bonding in water?

4 In $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$, how many oxygen atoms are on each side, and why must the subscript in O_2 stay unchanged?

3 YOUR TURN Your own words

Make a mini evidence card for pure magnesium. Write exactly two sentences: one names a physical property and a physical change, and one describes burning magnesium as a chemical change and explains how your balanced equation shows conservation. Then write the balanced equation for magnesium reacting with oxygen.

PART 1 • READ AND MARK

Underline each physical property used as evidence. Circle each physical or chemical change, then write P or C beside it to show whether the substance's identity changes. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Name two physical properties that can help identify the copper sample.	Any two: reddish color, shiny surface, high electrical conductivity, melting point, density.
2	Why is bending copper wire a physical change, but heating copper in oxygen is a chemical change?	Bending changes only the wire's size or shape, and it remains copper. Heating it in oxygen forms black copper oxide, a new substance with different properties.
3	How is bonding in copper oxide different from bonding in water?	Copper oxide has ionic bonding, in which positive and negative ions attract. Water has covalent bonds, in which atoms share electrons.
4	In $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$, how many oxygen atoms are on each side, and why must the subscript in O_2 stay unchanged?	There are two oxygen atoms on each side. The subscript is part of the oxygen formula, so it must not be changed to balance the equation.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Magnesium is a shiny, silvery metal, and cutting a magnesium ribbon is a physical change because it remains magnesium. Burning magnesium forms white magnesium oxide, and the balanced equation has the same number of each kind of atom on both sides. $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

Accept accurate physical properties and physical changes for magnesium, plus an explanation that burning forms magnesium oxide as a new substance. The balanced equation must be $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$, with optional state symbols accepted.