Element Detectives

Read how the periodic table connects location and properties.

CHE.3.1 "Explore and communicate the organization of the periodic table, including history, groups, families, family names, metals, nonmetals, metalloids, and transition metals."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the historical change in how elements are ordered, circle each family name, and number three location clues for metals, nonmetals, and metalloids so you can use the table to predict properties.

A Phone Full of Elements

1. Imagine sorting the elements needed to build a smartphone. Copper carries current through its circuits, silicon helps control that current, and oxygen appears in its glass. A simple alphabetical list would not show why different elements behave alike. In 1869, Dmitri Mendeleev arranged known elements largely by atomic mass and repeated chemical properties. He left gaps for elements not yet discovered and predicted some of their properties. Later, Henry Moseley's work showed that atomic number, the number of protons in an atom, gives a more reliable order. Today's periodic table increases in atomic number from left to right and then continues on the next row.

2. Each horizontal row is a period, and each vertical column is a group, also called a family. Members of a group often react in similar ways because they have similar arrangements of outer electrons. Group 1 contains the alkali metals, except that hydrogen, at the top, is not a metal. Group 2 contains the alkaline earth metals. Group 17 contains the halogens, reactive nonmetals, while group 18 contains the noble gases, which are generally unreactive. A period instead tracks the repeating pattern of properties as atomic number rises. That is why a shared row does not mean shared chemical behavior.

3. Location also helps scientists sort broad types of elements. Metals occupy the left and center of the table; they usually conduct electricity and can be shaped without breaking. Nonmetals lie mainly on the right and often conduct poorly. Metalloids cluster along the boundary between those regions and have properties between typical metals and nonmetals. Silicon is a metalloid, which helps explain its use in electronic devices. The transition metals fill much of the center, in groups 3 through 12. Copper belongs there, so a phone's wiring and its silicon chips represent different regions of the same organized table.

2 ANSWER WITH EVIDENCE

Use the passage

1. How did the rule for ordering elements change after Mendeleev arranged his table?

2. Why does sharing a group tell you more about how two elements may react than sharing a period does?

3. How do the family names and typical behavior of groups 17 and 18 differ?

4. Where are copper and silicon located in the table, and how does each help a phone work?

3 YOUR TURN

Your own words

Write a four-sentence museum label for two mystery element cards: Card A is in group 17, period 5, and Card B is in group 2, period 5. Classify each by family and as a metal or nonmetal, predict one property of each, and explain why sharing a period does not mean they behave alike.

ANSWER KEY

Element Detectives

PART 1 · READ AND MARK

Underline the historical change in how elements are ordered, circle each family name, and number three location clues for metals, nonmetals, and metalloids so you can use the table to predict properties. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How did the rule for ordering elements change after Mendeleev arranged his table?	**Mendeleev arranged elements largely by atomic mass and repeating properties. The modern table orders them by atomic number.**
2	Why does sharing a group tell you more about how two elements may react than sharing a period does?	**Elements in a group have similar arrangements of outer electrons and often react similarly. A period shows a repeating pattern of properties, not shared behavior.**
3	How do the family names and typical behavior of groups 17 and 18 differ?	**Group 17 contains the halogens, which are reactive nonmetals. Group 18 contains the noble gases, which are generally unreactive.**
4	Where are copper and silicon located in the table, and how does each help a phone work?	**Copper is a transition metal in the center and carries current through circuits. Silicon is a metalloid along the boundary between metals and nonmetals and helps control current.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Card A is a group 17 halogen and a nonmetal. It is likely reactive because halogens are reactive nonmetals. Card B is a group 2 alkaline earth metal, so it likely conducts electricity like many metals. Both cards are in period 5, but sharing a period does not mean they behave alike because elements in different groups have different outer electron arrangements.

For the museum label, accept reasonable property predictions supported by the passage. Students should distinguish the two families and explain that a shared period does not imply similar behavior.