Bonding Clues

Use periodic-table patterns to predict bonds and formulas

P.7.5C "Students will demonstrate an understanding of the proper use of the periodic table to predict and identify elemental properties and how elements interact. Develop and use models that explain the structure of an atom..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the group patterns that tell how atoms use electrons, and circle each chemical formula so you can use both clues to predict bonds.

What a Formula Reveals

1. At a saltworks, workers separate a salty solution into useful substances. The periodic table helps explain why some atoms join and what formulas their products have. Columns are called groups, and elements in one group often act alike. Lithium and sodium are group 1 metals; each usually loses one electron when bonding. Magnesium and calcium are group 2 metals; each usually loses two. Fluorine and chlorine are group 17 nonmetals; each can gain one electron when bonding with a metal. These patterns offer clues even before an experiment begins.

2. Oxygen and sulfur are group 16 nonmetals; each can gain two electrons when bonding with a metal. When a metal gives electrons to a nonmetal, the atoms become charged ions. Opposite charges attract, making an ionic bond. In sodium fluoride, NaF, one sodium atom gives one electron to one fluorine atom. In magnesium oxide, MgO, one magnesium atom gives two electrons to one oxygen atom. Each formula shows the smallest whole-number ratio of ions with balanced charges. A missing subscript means one atom of that element in a formula unit.

3. Nonmetals can also bond by sharing electrons instead of transferring them. A shared pair of electrons makes a covalent bond. In water, H_2O, two hydrogen atoms share electrons with one oxygen atom. Hydrogen can share one electron to fill its first shell, while a group 17 atom can share one to fill its outer shell. A subscript tells how many atoms of the element just before it are in a molecule. When predicting a formula, first decide whether electrons are transferred or shared. Then check how many atoms or ions are needed.

2 ANSWER WITH EVIDENCE

Use the passage

1. Lithium and chlorine form a compound. Predict its formula and bond type. Explain your prediction using their group patterns.

2. Calcium and sulfur form a compound. Predict its formula and explain why the ratio of their ions is 1 to 1.

3. Predict the formula when magnesium and chlorine bond. How many chlorine atoms are shown in one formula unit?

4. When hydrogen and chlorine bond, do they transfer or share electrons? Predict their formula and name the bond type.

3 YOUR TURN

Your own words

A science museum needs labels for two samples: one made from sodium and sulfur, and one made from hydrogen and fluorine. In 4 or 5 sentences, predict each formula, count each element's atoms, and explain how electrons make each bond.

ANSWER KEY

Bonding Clues

PART 1 · READ AND MARK

Underline the group patterns that tell how atoms use electrons, and circle each chemical formula so you can use both clues to predict bonds. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Lithium and chlorine form a compound. Predict its formula and bond type. Explain your prediction using their group patterns.	**LiCl has an ionic bond. Group 1 lithium loses one electron, and group 17 chlorine gains one, so they combine in a 1 to 1 ratio.**
2	Calcium and sulfur form a compound. Predict its formula and explain why the ratio of their ions is 1 to 1.	**CaS. Group 2 calcium loses two electrons, and group 16 sulfur gains two, so one ion of each balances the charges.**
3	Predict the formula when magnesium and chlorine bond. How many chlorine atoms are shown in one formula unit?	**$MgCl_2$; one formula unit shows two chlorine atoms. Each chlorine gains one of the two electrons magnesium loses.**
4	When hydrogen and chlorine bond, do they transfer or share electrons? Predict their formula and name the bond type.	**They share electrons in a covalent bond. Their formula is HCl.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Sodium and sulfur form Na_2S, which shows two sodium atoms and one sulfur atom per formula unit. Each sodium atom gives one electron to sulfur, so the ions attract in an ionic bond. Hydrogen and fluorine form HF, which shows one hydrogen atom and one fluorine atom per molecule. These nonmetals share electrons, so their bond is covalent.

Accept explanations that correctly balance electrons lost and gained for ionic compounds. For covalent compounds, accept descriptions of atoms sharing electrons.