Bond Clue Lab

Use element groups to predict how atoms join

P.7.5C.6 "Using the periodic table, make predictions to explain how bonds (ionic and covalent) form between groups of elements (e.g., oxygen gas, ozone, water, table salt, and methane)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline clues about element groups and metals or nonmetals, circle words that describe what happens to electrons, and number the two test cases 1 and 2.

Clues on the Container Labels

1. At a science museum, visitors find a shelf of sealed containers labeled with element names. A periodic table offers clues about what could happen if those elements joined. Metals occupy the left side; most nonmetals are on the right. Hydrogen sits in group 1 but is a nonmetal. Sodium is in group 1, and magnesium is in group 2. Carbon, nitrogen, oxygen, and chlorine are nonmetals in groups 14, 15, 16, and 17, in that order. An element's position helps predict how its atoms bond.

2. Consider lithium and fluorine as a test case. Lithium, a group 1 metal, has one electron it can give away. Fluorine, a group 17 nonmetal, can gain one electron. When that electron moves from lithium to fluorine, lithium becomes Li^+ and fluorine becomes F^-. Opposite charges attract, forming an ionic bond in lithium fluoride, LiF. Ionic bonds commonly form between a metal and a nonmetal. This pattern lets you predict bonding from the periodic table without handling any chemicals.

3. For a different test case, consider sulfur and oxygen. Both are nonmetals in group 16. Rather than giving away electrons completely, their atoms share electrons in covalent bonds. Sulfur dioxide, SO_2, contains one sulfur atom bonded to two oxygen atoms. Nonmetal atoms can also bond to atoms of the same element. A chemical formula gives the kinds and numbers of atoms: a small number written after a symbol counts that kind of atom. No small number means one atom. The periodic table helps predict the bond type; the formula shows which atoms are together.

2 ANSWER WITH EVIDENCE

Use the passage

1. Sodium and chlorine can join to form table salt. Predict their bond type using their groups, and explain what happens to an electron.

2. Methane, CH_4, contains carbon and hydrogen. Predict its bond type using the periodic table clues, and explain what happens to electrons.

3. Oxygen gas, O_2, contains two oxygen atoms. Predict their bond type and explain why the atoms do not form an ionic bond with each other.

4. Water has the formula H_2O. Predict its bond type from the elements involved, and tell how many atoms of each element the formula shows.

3 YOUR TURN

Your own words

A museum plans models for magnesium with oxygen and nitrogen with hydrogen. Predict the bond type for each pair, using group or nonmetal clues and explaining whether electrons transfer or are shared. Write four sentences, two about each pair.

ANSWER KEY

Bond Clue Lab

GRADE 7 · P.7.5C.6

PART 1 · READ AND MARK

Underline clues about element groups and metals or nonmetals, circle words that describe what happens to electrons, and number the two test cases 1 and 2. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Sodium and chlorine can join to form table salt. Predict their bond type using their groups, and explain what happens to an electron.	**Sodium is a group 1 metal, and chlorine is a group 17 nonmetal. Sodium transfers an electron to chlorine, forming oppositely charged ions that attract in an ionic bond.**
2	Methane, CH_4, contains carbon and hydrogen. Predict its bond type using the periodic table clues, and explain what happens to electrons.	**Carbon and hydrogen are both nonmetals, so they form covalent bonds by sharing electrons.**
3	Oxygen gas, O_2, contains two oxygen atoms. Predict their bond type and explain why the atoms do not form an ionic bond with each other.	**The oxygen atoms form a covalent bond because both are nonmetals that share electrons rather than transfer them.**
4	Water has the formula H_2O. Predict its bond type from the elements involved, and tell how many atoms of each element the formula shows.	**Hydrogen and oxygen are nonmetals, so water has covalent bonds. Its formula shows two hydrogen atoms and one oxygen atom.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Magnesium is a group 2 metal, and oxygen is a group 16 nonmetal, so they can form an ionic bond. Magnesium transfers two electrons to oxygen, creating ions with opposite charges that attract. Nitrogen is a group 15 nonmetal, and hydrogen is a group 1 nonmetal, so they can form covalent bonds. Their atoms share electrons instead of transferring them.

Accept explanations that use metal and nonmetal locations rather than group numbers alone. For the open task, students need not name the compounds or give chemical formulas.