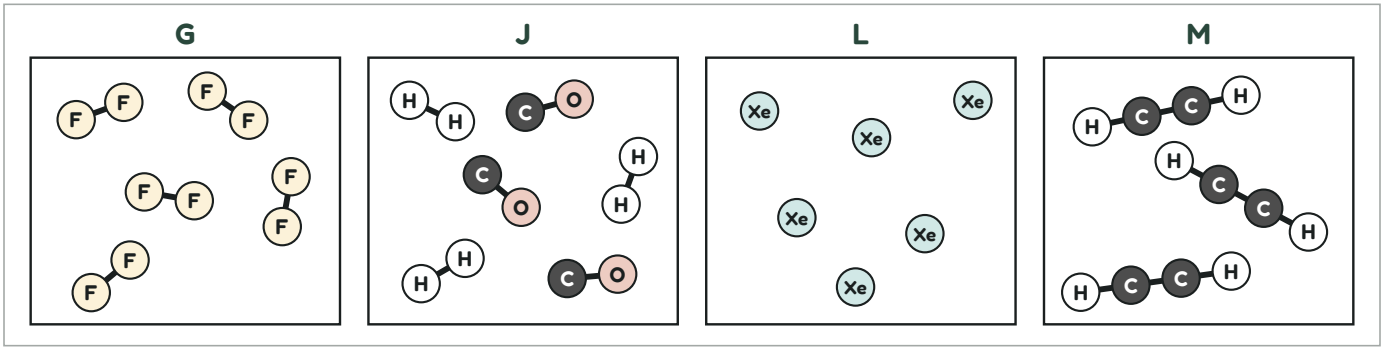
Elements and Compounds: Models and Formulas

Grades 6-8

Name _____ Date _____

Directions: An **element** is built from a single kind of atom. In a **compound,** atoms of different elements are joined to each other. A **mixture** has different particles side by side, not joined to one another. In each box below, every circle stands for an atom and is marked with its symbol, and a stick joins two atoms. In a formula, every symbol begins with one capital letter, and a **subscript** (small lowered number) is a count of atoms. When no subscript follows a symbol, read it as one atom.



Models of four sealed boxes of gas. The shading is a code chosen for this page, not the real look of an atom.

1. Label every box with one of these words: **element, compound, mixture.** box G: _____
box J: _____ box L: _____ box M: _____

2. Look only at box M. Count what is inside the whole box. molecules: _____
carbon atoms: _____ hydrogen atoms: _____ formula of one molecule: _____

3. A classmate says, "Whenever atoms are joined by a stick, the box shows a compound." Choose one box that proves the classmate wrong, and explain what its symbols show.

4. Each formula names one substance. Write **E** (element) or **C** (compound) on the line. Br_2 ____
NaF ____ Ni ____ CaO ____ ZnS ____ Hg ____

5. The white in many paints is titanium dioxide, TiO_2. Count the atoms the formula shows. Ti: _____
O: _____ in all: _____

6. Chalk cliffs are calcium carbonate, $CaCO_3$. Ca: _____ C: _____ O: _____ in all: _____

7. Caffeine, found in tea leaves, is $C_8H_{10}N_4O_2$. C: _____ H: _____ N: _____ O: _____
in all: _____

8. A green paint pigment is chromium oxide, Cr_2O_3. A classmate reads this formula as "2 oxygen atoms and 3 chromium atoms." Which element does each subscript really count? What should the classmate remember about where a subscript sits?

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Answer key

Item 1: four points. Item 2: four points. Item 3: two points (a box that fits, and the reason). Item 4: six points. Items 5 to 7: one point for each blank. Item 8: two points. Total 30.

1. **G element; J mixture; L element; M compound**
   G: F_2. J: H_2 and CO, two kinds of particles side by side. L: Xe. M: C_2H_2. Sticks alone do not decide it: read the symbols.

2. **molecules 3; carbon atoms 6; hydrogen atoms 6; formula C2H2, with each 2 written small and low**
   Formula C_2H_2. Each molecule has 2 C and 2 H, and there are 3 of them. Accept H_2C_2, HCCH and full-size numbers written low.

3. **Box G. Its atoms are joined in pairs, but every atom carries the same symbol, F. One kind of atom means an element, joined or not.**
   Also accept box J with either reason: its H_2 pairs are joined atoms of one kind, or the box holds two different particles side by side (H_2 and CO), so the box as a whole is a mixture. A compound needs atoms of different elements in the same particle.

4. **In the printed order: E, C, E, C, C, E**
   Br_2 E; NaF C; Ni E; CaO C; ZnS C; Hg E. Count the capital letters, not the letters: Ni and Hg are single two-letter symbols, while NaF, CaO, ZnS each hold two symbols. Br_2 is a pair of atoms of one element.

5. **Ti 1; O 2; in all 3**
   1 + 2 = 3. Ti is one symbol (titanium) with no subscript, so it counts once.

6. **Ca 1; C 1; O 3; in all 5**
   1 + 1 + 3 = 5. Ca and C have no subscript, so each counts once. Ca is one symbol (calcium), not a C and an a.

7. **C 8; H 10; N 4; O 2; in all 24**
   8 + 10 + 4 + 2 = 24.

8. **The 2 counts chromium (Cr) and the 3 counts oxygen (O). A subscript sits right after the symbol it counts, so it never belongs to the symbol that follows it.**
   Full credit needs both parts: 2 Cr with 3 O, and the idea "the number goes with the symbol in front of it" in any wording.