

ChemQuest 22

Covalent Bonding

Name: _____

Date: _____

Hour: _____

Information: Terminology

Recall that an ionic bond results from the combination of a metal and a nonmetal. A covalent bond is the type of bond between two nonmetals. Covalent bonds are formed by neutral atoms that share electrons rather than by charged ions. When a compound is formed by sharing electrons, the compound is called a molecule or molecular compound. It is important to note that ionic compounds are not called molecules. The largest class of molecules are called organic molecules. Carbon is the distinguishing mark of organic compounds.

Critical Thinking Questions

1. Circle any of the following compounds that would properly be called a “molecule”.

a) H₂Ob) CO₂

c) NaCl

d) Mg₃P₂e) N₂O₅

Any compound with no metal and no polyatomic ion is considered a “molecule” and covalent.

Information: Naming Covalent Compounds

There are several prefixes used to name molecules. The name “carbon oxide” is not sufficient because carbon and oxygen sometimes form CO₂ and sometimes CO. Prefixes are necessary to distinguish between them.

Formula	Name
N ₂ O ₄	dinitrogen tetroxide
SF ₆	sulfur hexafluoride
XeCl ₅	xenon pentachloride
SO ₃	sulfur trioxide
CO	carbon monoxide

Critical Thinking Questions

2. Fill in the table to indicate which prefix is used to represent the numbers. The first one is done for you.

Number	Prefix
1	mono
2	di
3	tri
4	tetra
5	penta
6	Hexa

3. Name each of the following molecules.



dinitrogen pentoxide carbon tetrafluoride sulfur trichloride sulfur monoxide

(b, c, and d do not need to start with mono because whenever a name would start with mono, the mono is dropped and we assume there is only one of the atoms.)

4. Which of the above compounds would be classified as “organic”?

Only carbon tetrafluoride (b) because it is the only one containing carbon.

Information: Empirical Formulas

Molecules can be represented by using either a molecular formula or an empirical formula. The molecular formula tells you exactly how many atoms of each element are in the compound. For example, in the table below, compound #2 has exactly 4 carbons and 8 hydrogens in each molecule. Observe the table below that shows four organic molecules along with a molecular and empirical formula for each one:

Molecule	Molecular Formula	Empirical Formula
#1	C_2H_4	CH_2
#2	C_4H_8	CH_2
#3	C_3H_8	C_3H_8
#4	C_8H_{18}	C_4H_9

Critical Thinking Questions

5. What is an empirical formula?

An empirical formula is a way to show the lowest, simplified ratio of elements in a compound. It tells us the ratio of atoms in a compound and NOT how many atoms are in the compound.

6. How can molecules #1 and #2 have the same empirical formula even though they are different molecules?

Both molecules #1 and #2 have a 1 to 2 ration of carbon to hydrogen and since an empirical formula gives the ratio, they both have the same empirical formula.

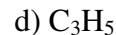
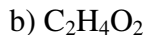
7. Given the empirical formula for a compound is it possible to determine the molecular formula? If so, explain how.

No, because the empirical formula does not tell us how many of each atom is present in a compound.

8. Given the molecular formula for a compound is it possible to determine its empirical formula? If so, explain how.

Yes, you must divide each subscript by the same number. For example if you are given the molecular formula C_4H_6 , you could reduce it by dividing each subscript by 2 to obtain C_2H_3 .

9. Give the empirical formula for each of the molecules below:



(already empirical)