SNC2D1

Molecular (Covalent) Compounds

Molecular compounds are neutral groups of atoms bonded together through covalent bonding. These compounds have properties distinct from ionic compounds:

- Molecular compounds usually have lower boiling and melting points. Many are found as liquids or gases.
- These compounds usually do not conduct electricity when dissolved in water since they do not separate into separate ions.
- Molecular compounds contain covalent bonds.
- Covalent bonds are formed when 2 non-metal atoms *share* electrons.

Diatomic Elements

For example, hydrogen atoms can bond together by sharing their single electrons to produce hydrogen gas (H_2 (g)):

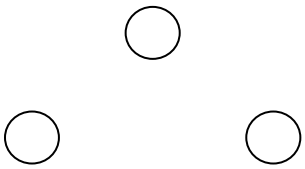
This arrangement allows each hydrogen atom to "fee" as though it has a full outer shell. Many non-metallic elements exist as covalently-bonded diatomic molecules (e.g. O_2, N_2, F_2, Cl_2, Br_2, I_2).

Molecular Compounds

Water (H_2O) is another molecular compound composed of covalent bonds. Each hydrogen shares its one electron with an oxygen atom.

O has 6 valence electrons. Therefore it has a combining capacity of 2, since it needs to gain 2 electrons by sharing.

H has 1 valence electron. It has a combining capacity of 1 since it needs to gain 1 electron by sharing.



Formulas of Molecular Compounds

Since metallic elements cannot form a full shell (a stable octet) simply through sharing electrons, covalent bonding usually involves only hydrogen and other non-metal elements. The combining capacity is the number of covalent bonds an atom will need to form a stable molecule:

Table 1: Combining Capacity of Non-metals

4	**3**	**2**	**1**
			H
C	N	O	F
Si	P	S	Cl
	As	Se	Br
			I

Based on this number, we can use the "crisscross rule" to determine the formula for the formula of some simple compounds.

For methane: C H ∴the formula = _____

For silicon dioxide: Si O ∴ the formula = _____

Naming Molecular Compounds

Many molecular compounds are simply known by their common names:

H_2O_2 = _____ NH_3 = _____

Since molecular compounds can come in a variety of combinations, Greek prefixes are sometimes used. The Greek prefix tells us the number of each type of atom in the compound.

e.g. CO = _____

CO_2 = _____

CF_4 = _____

Table 2: Greek Prefixes 1 – 9

#	Prefix	#	Prefix	#	Prefix	#	Prefix
1*	mon(o)-	3	tri-	5	penta-	7	hepta-
2	di-	4	tetra-	6	hexa	8	octa-

* Note: The prefix mono is often dropped from the first element in the name.

Questions:

1. Referring to the examples of covalent bonding in hydrogen and water, draw diagrams to represent covalent bonding in these compounds. Circle the pair(s) of shared electrons.

a) methane (CH_4)
b) fluorine gas (F_2)
c) nitrogen trifluoride (NF_3)
d) hydrogen sulfide (H_2S)

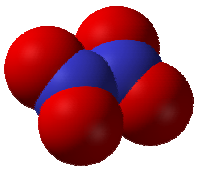
2. Write the name for each compound, using the Greek prefic method

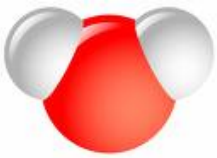
a) CS_2 _____
b) N_2O_3 _____
c) NO _____
d) CCl_4 _____
e) Si_2Br_6 _____
f) AsF_5 _____
g) N_2O _____
h) SO_2 _____
i) P_2O_5 _____
j) BH_3 _____

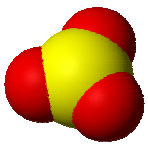
3. Write the chemical formula for each element or compound.

a) dinitrogen tetroxide _____
b) diphosphorus hexoxide _____
c) phosphorus tribromide _____
d) sulfur trioxide _____
e) oxygen gas _____
f) neon gas _____
g) oxygen difluoride _____
h) sulfur hexafluoride _____
i) nitrogen gas _____
j)carbon tetrabromide _____

4. Molecular compounds are depicted using a variety of interesting models. Examine each model below. Under each, write chemical formula of a possible molecular compound(s) it represents (Hint: Use the answers from questions 2 and 3)

a) 

b) 

c) 

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