**MOLECULAR SUBSTANCES:** → non-metals

- are solids, liquids or gases at SATP
- if soluble, dissolve in water to form **colorless** aqueous solutions that **do not conduct** electricity ie. they are ***non-electrolytes***
- they contain only **nonmetal atoms**

***Molecule***
a particle of a molecular substance that contains a fixed number of covalently-bonded nonmetal atoms

***Covalent Bond:***
formed from the sharing of valence electrons between nonmetal atoms, which results in an electron structure that is the same as a noble gas, for each atom in the molecule

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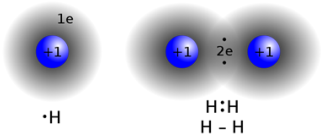
**Example:**
**$H_2$** A molecule of hydrogen gas has 2 atoms of Hydrogen, each with one electron. When they bond they share a pair of electrons (one pair one covalent bond). Since each atom now has 2 electrons, they both have same electron structure as He (noble gas).




**NOTE:** **molecules DO NOT form ions.**

http://www.youtube.com/watch?v=1wpDicW_MQQ&feature=related

http://www.youtube.com/watch?v=LRVW0tgSLRI&feature=endscreen&NR=1&safety_mode=true&persist_safety_mode=1&safe=active

http://www.youtube.com/user/greatpacificmedia#p/u/55/UR4eG60jjQQ

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**Molecular Substances Include Molecular Elements and Molecular Compounds**
Molecular elements: contain only **one kind of nonmetal atom**

| Type | Molecular Elements |
|---|---|
| Monatomic one atom | Noble gases : He(g) Ne(g) Ar(g) Kr(g) Xe(g) Rn(g) |
| Diatomic two atoms/molecule | Hydrogen, Oxygen, Nitrogen and the Halogens<br>The "HONorable Halogens"<br>$H_2(g)$, $O_2(g)$, $N_2(g)$, $F_2(g)$, $Cl_2(g)$, $Br_2(g)$, $I_2(s)$, $At_2(s)$ |
| Polyatomic more than 2 atoms/molecule | Ozone = $O_3(g)$<br>Phosphorus = $P_4(s)$<br>Sulfur (Sulphur) = $S_8(s)$ |

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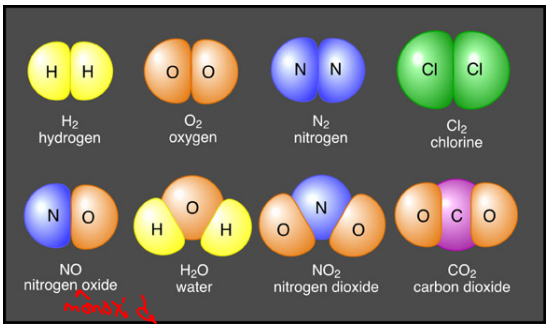
Molecular elements and Molecular compounds

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Molecular Compounds

a) Common (**to memorize**):

$H_2O_{(l)}$ = water $CH_{4(g)}$ = methane $CH_3OH_{(l)}$ = methanol

$C_3H_{8(g)}$ = propane $C_2H_5OH_{(l)}$ = ethanol $H_2O_{2(l)}$ = hydrogen peroxide

$NH_{3(g)}$ = ammonia $C_6H_{12}O_{6(s)}$ = glucose $C_{12}H_{22}O_{11(s)}$ = sucrose

b) Binary Molecular Compounds

- composed of 2 different kinds of nonmetals eg. CO $CO_2$ $CCl_4$ $SO_3$ $N_2O$

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**Writing Molecular Formulas**

***General Rules***

1. Write each atom symbol.
2. Each prefix indicates the subscript for the nonmetal atom that precedes it (# of atoms present).
3. If no prefix is present, then there is only one atom of that nonmetal present. Monoxide = one oxygen atom present.

***Examples:*** Fill-in the table by writing the molecular formulas

| Name | Formula | Name | Formula |
|---|---|---|---|
| Carbon monoxide | | Trisulfur hexaoxide | |
| Carbon tetrachloride | | Dinitrogen pentaoxide | |
| phosphorus pentachloride | | disulfur tetraoxide | |
| tetraphosphorus decaoxide | | tetraphosphorus octaoxide | |

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**Note:**

Formulas for common molecular substances **must be memorized**, as well as those for the "HONorable Halogens": $\mathbf{H_{2(g)}}$ $\mathbf{O_{2(g)}}$ $\mathbf{N_{2(g)}}$ $\mathbf{F_{2(g)}}$ $\mathbf{Cl_{2(g)}}$ $\mathbf{Br_{2(l)}}$ $\mathbf{I_{2(s)}}$ $\mathbf{At_{2(s)}}$

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**Naming Molecular Substances**

***General Rules***

1. First element is named in full.
2. Second element name is shortened and given an **-ide** ending.
3. Use prefixes (same as for hydrates) to indicate the number of each kind of atom.
4. The prefix mono is usually only used for the second element.
   Ex CO = carbon monoxide.
5. Certain Hydrogen compounds (those with H first in the formula) do not use prefixes.
   Ex. $H_2S_{(g)}$ = hydrogen sulfide, **not** dihydrogen sulfide

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| Formula | Name | Formula | Name |
|---|---|---|---|
| $N_2O(g)$ | | $H_2O$ | |
| $SO_3(g)$ | | $H_2S$ | |
| $P_4O_6(s)$ | | $NH_3$ | |
| $N_3O_7$ | | $H_2O_2$ | |

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