# Nomenclature

Label each compound "I" for ionic and "M" for molecular. Then name the following compounds:

1. $K_2CO_3$ I potassium carbonate
2. $MgCl_2$ I magnesium chloride
3. $N_2S_5$ M dinitrogen pentasulfide
4. $Mn(NO_3)_3$ I Manganese (III) nitrate
5. $FePO_4$ I iron (III) phosphate
6. $P_4O_{10}$ M tetraphosphorus decoxide
7. $SF_4$ M sulfur tetrafluoride
8. $Cu_2S$ I copper (I) sulfide

Label each compound "I" for ionic and "M" for molecular. Then write the formulas for the following compounds:

9. Xenon trioxide M $XeO_3$
10. Ammonium sulfate I $(NH_4)_2SO_4$
11. Copper (I) carbonate I $Cu_2CO_3$
12. Dintrogen monoxide M $N_2O$
13. Bromine pentoxide M $BrO_5$
14. Iron (III) oxide I $Fe_2O_3$
15. Zinc chloride I $ZnCl_2$

# Bonding

1. Write the formulas for the following molecules:
    a. Dichloromethane ($CH_2Cl_2$)
    b. Nitrogen trihydride
    c. Silicon dioxide

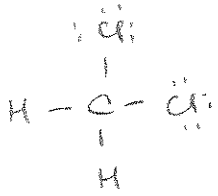
2. For the compounds above:
    a. Draw the dot structure
    b. Determine the shape of the molecule using VSEPR
    c. Is the molecule polar or nonpolar?
    d. What intermolecular forces (IMF) hold multiple molecules together?

3. Put three compounds in order from highest melting point to lowest melting point.

$NH_3$ highest  $CH_2Cl_2$  $SiO_2$ lowest

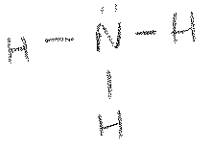
4. Thoroughly explain your order above.

① $CH_2Cl_2$

② 

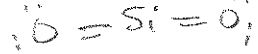
tetrahedral
polar
dipole

$NH_3$



pyramidal
polar
H-bonds

$SiO_2$



linear
non polar
dispersion

④ $NH_3$ - highest MP, strongest IMF holding different $NH_3$ molecules close to each other, H-bonds, most heat needed to overcome attractive forces

$CH_2Cl_2$ - next highest, dipole forces hold $CH_2Cl_2$ next to $CH_2Cl_2$

$SiO_2$ - lowest MP, dispersion forces are weakest, least heat needed to overcome attraction between different $SiO_2$ molecules

# Moles

1. An experiment required 8.40 moles of disulfur trioxide. What mass is this?
2. How many molecules are in 85 grams of sodium sulfate?
3. A balloon contains 0.35 L of carbon dioxide gas at STP. What is the mass of this gas?
4. Determine the percent composition of magnesium phosphate.

① $8.40\ mol\ S_2O_3 \left| \frac{112.14\ g}{1\ mol} \right. = 942\ g$

② $85\ g\ Na_2SO_4 \left| \frac{1\ mol}{142.05\ g} \right| \frac{6.022 \cdot 10^{23}\ molec}{1\ mol} = 3.6 \cdot 10^{23}\ molec$

③ $.35\ L\ CO_2 \left| \frac{1\ mol}{22.4\ L} \right| \frac{44.01\ g}{1\ mol} = .69\ g\ CO_2$

④ $Mg_3(PO_4)_2 = 262.87\ g/mol$

Mg: $\frac{72.93\ g}{262.87\ g} = 27.74\%\ Mg$

P: $\frac{61.94\ g}{262.87\ g} = 23.56\%\ P$

O: $\frac{128.00\ g}{262.87\ g} = 48.693\%\ O$

$99.99\%$

# Equations and Reactions

For the following reactions, determine what type of reaction is represented, predict the products, and balance the equation:

1. $Ca(OH)_2 + 2HF \rightarrow$ $CaF_2 + 2HOH$
   Double
2. $3Zn + 2H_3PO_4 \rightarrow$ $Zn_3(PO_4)_2 + 3H_2$
   Single
3. Sodium + oxygen → $4Na + O_2 \rightarrow 2Na_2O$
   combination
4. Hydrogen peroxide → $2H_2O_2 \rightarrow O_2 + 2H_2O$ or $H_2O_2 \rightarrow H_2 + O_2$
   decomp
5. Dicarbon hexahydride (burns) →
   Combustion $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

Limiting Reagents

# ~~Equations and Reactions~~

9.50 g of barium chloride reacts with 6.30 g of hydrogen phosphate

1. Write and balance the equation for the reaction above.
2. What mass of barium phosphate should be formed?
3. Identify the limiting reagent and the excess reagent.
   LR = $BaCl_2$ ER = $H_3PO_4$
4. What mass of excess reagent will be left over?
5. If a student performs the experiment and gets 5.49 g of barium phosphate, what is the student's percent yield?

① $3BaCl_2 + 2H_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6HCl$

② $9.50\,g\ BaCl_2 \left| \frac{1\ mol\ BaCl_2}{208.23\ g\ BaCl_2} \right| \frac{1\ mol\ Ba_3(PO_4)_2}{3\ mol\ BaCl_2} \left| \frac{601.93\ g\ Ba_3(PO_4)_2}{1\ mol\ Ba_3(PO_4)_2} \right.$

$= \boxed{9.15\ g\ Ba_3(PO_4)_2}$

$6.30\ g\ H_3PO_4 \left| \frac{1\ mol\ H_3PO_4}{98.00\ g\ H_3PO_4} \right| \frac{1\ mol\ Ba_3(PO_4)_2}{2\ mol\ H_3PO_4} \left| \frac{601.93\ g\ Ba_3(PO_4)_2}{1\ mol\ Ba_3(PO_4)_2} \right.$

$= 19.3\ g\ Ba_3(PO_4)_2$

④ $19.3\ g\ Ba_3(PO_4)_2 - 9.15\ g\ Ba_3(PO_4)_2 = 10.15 = 10.2\ g\ Ba_3(PO_4)_2$

$10.2\ g\ Ba_3(PO_4)_2 \left| \frac{1\ mol\ Ba_3(PO_4)_2}{601.93\ g\ Ba_3(PO_4)_2} \right| \frac{2\ mol\ H_3PO_4}{1\ mol\ Ba_3(PO_4)_2} \left| \frac{98.00\ g\ H_3PO_4}{1\ mol\ H_3PO_4} \right.$

$= \boxed{3.32\ g\ H_3PO_4}$

# Moles and Formulas

A student is creating a compound composed of copper and oxygen. The student reacts 17.50 g of solid copper with oxygen to create 19.70 g of the compound.

1. Calculate the percent composition of both copper and oxygen in the compound.
2. Calculate the empirical formula of this compound.
3. Determine the molecular formula of the compound if the molar mass is 143.10 g/mol.
4. Write an equation for the formation of the compound (use the molecular formula).

| Cu | + | $O_2$ | → | compound |
|---|---|---|---|---|
| 17.50 g | | ? | | 19.70 g |
| | | 2.20 g | | |

% comp

Cu: $\frac{17.50\text{ g Cu}}{19.70\text{ g cmpd}} =$ 88.83% Cu

O: $\frac{2.20\text{ g O}}{19.70\text{ g cmpd}} =$ 11.2% O

EF

use either % or mass from problem

$17.20\text{ g Cu} \mid \frac{1\text{ mol}}{63.55\text{ g}} = \frac{.2707\text{ mol Cu}}{.138} = 2$ $Cu_2O$

$2.20\text{ g O} \mid \frac{1\text{ mol}}{16.00\text{ g}} = \frac{.138\text{ mol O}}{.138} = 1$

MF

$\frac{MF}{EF} = \frac{143.10\text{ g/mol}}{143.10\text{ g/mol}} = 1$ $Cu_2O$

Eqn

$4Cu + O_2 \rightarrow 2Cu_2O$