A Quick Review of the Rules

1. Compounds:
   - The definition:

   - Compound naming:
     - In general

     - Cation is not a transition metal:

     - Cation is a transition metal

Roman Numerals:

   - Exceptions:

Examples:

Ex:	Ex:	Ex:
Ex:	Ex:	Ex:

- Compound writing:
  - In general

  - Non-transition metal:

  - Transition metal:

Examples:

Ex: Ex: Ex:

Ex: Ex: Ex:

2. Molecules:

- The definition:

- Molecule naming

- Molecule writing:

Examples:

Ex: Ex: Ex:

Clem Brown Has No Friends In Ottawa

Pretty Sexy 48

3. Acids:

Definition:

- Naming:
  - ending in ~ide
  - ending in ~ate
  - ending in ~ite
- Writing:
- Careful!

4. Hydrates:

- Definition:

- Naming:

- Writing:

Examples:

Ex: Ex: Ex:

Compound, Molecule, Acid, or Hydrate?	Name	Formula
Ex: compound	Sodium chloride	NaCl
Ex: hydrate	Copper(II) sulfate pentahydrate	$CuSO_4 \cdot 5H_2O$
Ex: molecule	Dinitrogen pentoxide	N_2O_5
compound.	Lead (IV) hydroxide	$Pb(OH)_4$

compound.	sodium monohydrogen phosphate	Na_2HPO_4
molecule	phosphorus hexachloride	PCl_6
compound.	Calcium thiocyanate	$Ca(SCN)_2$
hydrate	manganese (IV) oxide monohydrate	$MnO_2 \cdot H_2O$
acid	nitric acid	HNO_3
acid	Hydroselenic acid	H_2Se
compound.	Tin (IV) dichromate	$Sn(Cr_2O_7)_2$
hydrate	Iron (III) hydroxide dihydrate	$Fe(OH)_3 \cdot 2H_2O$
compound	copper(I) acetate	$CuC_2H_3O_2$
compound.	chromium (II) phosphate	$Cr_3(PO_4)_2$
compound	Magnesium hydroxide	$Mg(OH)_2$
molecule	carbon monoxide	CO
acid	Dichromic acid	$H_2Cr_2O_7$
compound	sodium hydrogen ~~carbonate~~ sulphite	$NaHSO_3$
acid	Sulfurous acid	H_2SO_3
acid	Hydrosulfuric acid	H_2S
acid.	hydrocyanic acid.	HCN

acid	acetic acid. ethanoic acid.	CH_3COOH
hydrate	Zinc hydroxide hexahydrate	$Zn(OH)_2 \cdot 6H_2O$
hydrate	barium hydroxide octahydrate	$Ba(OH)_2 \cdot 8H_2O$
compound	potassium permanganate	$KMnO_4$
acid	Perchloric acid	$HClO_4$
compound	Potassium monohydrogen phosphate	K_2HPO_4
molecule	Dicarbon decahydride	C_2H_{10}
molecule	tetraphosphorus decoxide	P_4O_{10}
compound.	Lithium carbonate	Li_2CO_3
acid.	Chlorous acid	$HClO_2$
molecule	Dihydrogen monoxide	H_2O
compound	Ammonium chloride	NH_4Cl
compound	potassium chromate	K_2CrO_4
compound.	Aluminum permanganate	$Al(MnO_4)_3$
molecule	sulphur hexafluoride	SF_6
compound	Aluminum sulphate	$Al_2(SO_4)_3$
acid.	carbonic acid.	H_2CO_3

compound	silver chromate	Ag_2CrO_4
acid	hydroiodic acid	HI
acid	hydroxic acid	H_2O
acid	Nitrous acid	HNO_2
hydrate	manganese (IV) hydroxide heptahydrate	$Mn(OH)_4 \cdot 7H_2O$
molecule	xenon hexafluoride	XeF_6
molecule	Dinitrogen tetroxide	N_2O_4
molecule	dinitrogen monoxide	N_2O
compound	Lithium sulfide	Li_2S
compound	Rhodium (III) oxide	Rh_2O_3
compound	Molybdenum (VII) oxide	Mo_2O_7

A Quick Review of the Mole, Stoichiometry, and Dimensional Analysis (Factor Label)

1. Conversion Factors:
   - Mole and grams:
   - Mole and volume (at STP: 273K, 1atm)
   - Mole and particles (molecules, atoms, or compound units):
   - Molarity and moles (formula):
   - Dilutions (formula):

Examples:

1. How many grams would 34L of chlorine gas weigh at 0°C and 101.325kPa?

2. If I have 22 grams of NH_4NO_3, how many litres of solution would be required to make a molarity of 1.345M?

3. How much water must be added to 78mL of 0.305M NaOH to make the concentration 0.056M?

2. Stoichiometry:

Ex: $H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$

- What is the mole ratio for moles of H_2SO_4 to NaOH (show with factor label)

Steps to a Stoich problem:
1) balanced reaction
2) convert to moles
3) convert to answer substance
4) convert to answer units

- If I have 25mL of a 0.500M solution of NaOH, how many grams of H_2SO_4 will react with it?

- How many grams of $MgBr_2$ will be necessary to react with 32.45g $FeCl_3$?

$$3\,MgBr_2 + 2FeCl_3 \rightarrow 3MgCl_2 + 2\,FeCl_3$$

$$32.45\text{ g } FeCl_3 \times \frac{1\text{ mol } FeCl_3}{162.3\text{ g } FeCl_3} \times \frac{3\text{ mol } MgBr_2}{2\text{ mol } FeCl_3} \times \frac{184.1\text{ g } MgBr_2}{1\text{ mol } MgBr_2}$$

$$= 55.21\text{ g } MgBr_2$$

Try some:

1. For the reaction $4NH_{3(g)} + 5O_{2(g)} \rightarrow 6H_2O_{(g)} + 4NO_{(g)}$
   a) what is the mass of NO produced when 2.00 mol of NH_3 is reacted with excess O_2?

$$2.00\text{ mol } NH_3 \times \frac{4\text{ mol } NO}{4\text{ mol } NH_3} \times \frac{30\text{ g } NO}{1\text{ mol } NO}$$

$$= 60.0\text{ g } NO.$$

b) What mass of H_2O will be produced when 4.00L of O_2 is reacted with excess NH_3?

$$4.00\text{L } O_2 \times \frac{1 \text{ mol } O_2}{22.4 \text{ L } O_2} \times \frac{6 \text{ mol } H_2O}{5 \text{ mol } O_2} \times \frac{18 \text{ g } H_2O}{1 \text{ mol } H_2O}$$

$$= 3.86 \text{ g } H_2O$$

c) What mass of NH_3 is required to react with 2.03×10^{24} molecules of O_2?

$$2.03 \times 10^{24} \text{ particles } O_2 \times \frac{1 \text{ mol } O_2}{6.02 \times 10^{23} \text{ part } O_2} \times \frac{4 \text{ mol } NH_3}{5 \text{ mol } O_2} \times \frac{17 \text{ g } NH_3}{1 \text{ mol } NH_3}$$

$$= 45.86$$

2. For the reaction $NH_4NO_3 + NaOH \rightarrow NH_3 + H_2O + NaNO_3$

a) how many grams of NH_3 would be produced from the reaction of 35mL of 0.560M NaOH?

$$\text{mol} = M \times V_L$$

$$= (0.560\text{M})(0.035\text{L})$$

$$= 0.0196 \text{ mol NaOH} \times \frac{1 \text{ mol } NH_3}{1 \text{ mol NaOH}} \times \frac{17 \text{ g } NH_3}{1 \text{ mol } NH_3}$$

$$= 0.332 \text{ g } NH_3$$

b) If 100mL of 0.334M NaOH is mixed with 45mL of 0.500M NH_4NO_3, what are the new molarities of each solution BEFORE ANY REACTION?

[NaOH]

$M_c = 0.334M$

$V_c = 100mL$

$M_d = ?$

$V_d = 145mL$

$$M_d = \frac{(0.334M)(100mL)}{145mL}$$

$= 0.230M$

$[NH_4NO_3]$

$M_c = 0.500M$

$V_c = 45mL$

$M_d = ?$

$V_d = 145mL$

$$M_d = \frac{(0.500M)(45mL)}{145mL}$$

$= 0.155M$

A Quick Review of Significant Figures

The Rules:

1. Non-zero digits are:

Ex:

2. Front zeros are:

Ex:

3. Sandwiched zeros are:

Ex:

4. Trailing zeros are:

Ex:

Ex:

5. For numbers in scientific notation:

Ex:

For each of the numbers below, state how many significant figures are present:

Number	Number of Sig Figs
3570	3
17.505	5
41.400	5
0.51	2
0.00572	3
41.50×10^{-4}	4
100000	1
100000.	6
1.23400×10^{7}	6

Calculating with Sig Figs:

1. The rule for adding and subtracting:

Examples:

Ex: Ex: Ex:

2. The rule for multiplying and dividing:

Examples:

Ex: Ex: Ex:

3. Mixed Operations:

Example: Calculate the density (density = mass/volume) given the data below

Mass of graduated cylinder	32.564g
Mass of liquid and graduated cylinder	32.613g
Volume of liquid	25.6mL

Perform the following calculations and express the answer in the correct number of sig figs:

a) $15.1 + 75.352$ $= 90.452 \longrightarrow$ 90.5

b) $178.305 - 125.8055642 = 52.4994\ldots. \longrightarrow$ 52.499

c) $375.265 \times 375.59 = 140945.7814 \longrightarrow$ 140950

d) $45.25 \div 10 = 4.525 \longrightarrow$ 5

e) $(32.036 - 13.2) \times 65 = 1222 \longrightarrow$ 1200

f) $\frac{3.306 - 1.0256}{4.562 + 85} = \frac{2.280}{90.} =$ 0.025

Ex: A student has to calculate the density (=mass/volume) of a liquid. In the lab he/she takes the following measurements:

Mass of graduated cylinder = 32.106g

Volume of liquid = 25.3mL

Mass of graduated cylinder and liquid = 34.567g

Calculate the density of the solution.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$= \frac{34.567\text{ g} - 32.106\text{ g}}{25.3\text{ mL}}$$

$$= \frac{2.461\text{ g}}{25.3\text{ mL}}$$

$$= 0.0973\text{ g/mL}$$