Chemistry 30S Review

The following are ***some*** of the major skills and concepts from Chemistry 30S that you will need for Chemistry 40S. It is important that we identify any problems now, as you will be expected to know these concepts this semester.

Chemical Reactions:

1. Name the following compounds:

a) $Mg(NO_3)_2$ Magnesium Nitrate

b) $NaHCO_3$ Sodium bicarbonate

c) CCl_4 Carbon tetrachloride.

d) $KMnO_4$ Potassium Permanganate.

2. Give the molecular formula for the following compounds.

a) dinitrogen trioxide N_2O_3

b) copper II sulfate $CuSO_4$

c) ammonium phosphate $(NH_4)_3PO_4$

d) diphosphorus pentoxide P_2O_5

3. Predict the products of the reactions below. Then write the balanced equation and the reaction type.

a) magnesium bromide + Chlorine →

$$MgBr_2 + Cl_2 \rightarrow MgCl_2 + Br_2$$ S.R.

b) aluminum + iron(III) oxide →

$Fe^{3+}O^{2-}$ $Al^{3+}O^{2-}$

$$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$$ S.R.

c) nitrogen + hydrogen →

$$N_2 + 3H_2 \rightarrow 2NH_3$$ Synth.

d) methanol + oxygen →

$$2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$$ Comb.

e) Sodium metal + water →

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$ S.R.

$H(OH)$

4. Solve the following stoichiometry problems. Show all work.

a) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

How many moles of hydrogen are produced from the reaction of 12.8 g of zinc with excess hydrochloric acid?

$$12.8\,g\,Zn \times \frac{1\,mol}{65.4\,g} = 0.196\,mol\,Zn \times \frac{1\,mol\,H_2}{1\,mol\,Zn} = 0.196\,mol\,H_2$$

b) $2KClO_3 \rightarrow 2KCl + 3O_2$

How many grams of potassium chloride are produced if 25g of potassium chlorate decompose? How many litres of O_2 are produced?

$$25\,g \times \frac{1\,mol}{122.6\,g} = 0.204\,mol\,KClO_3 \times \frac{2\,mol\,KCl}{2\,mol\,KClO_3} = 0.204\,mol\,KCl \times \frac{74.6\,g}{1\,mol} = \boxed{15.22\,g\,KCl}$$

$$\times \frac{3\,mol\,O_2}{2\,mol\,KClO_3} = 0.306\,mol\,O_2 \times \frac{22.4\,L}{1\,mol} = \boxed{6.85\,L\,O_2}$$

c) $2AlCl_3 \rightarrow 2Al + 3Cl_2$

If 10.0 g of aluminum chloride are decomposed, how many molecules of Cl_2 are produced?

$$10.0\,g \times \frac{1\,mol}{133.5\,g} = 0.075\,mol\,AlCl_3 \times \frac{3\,mol\,Cl_2}{2\,mol\,AlCl_3} = 0.1125\,mol\,Cl_2 \times N_A$$

$$= \boxed{6.77 \times 10^{22}\ molecules.}$$

d) $3AgNO_3 + Na_3PO_4 \rightarrow Ag_3PO_4 + 3NaNO_3$

Silver nitrate and sodium phosphate are reacted in ***equal amounts*** of 175 g each (think limiting reagents!). How many grams of silver phosphate are produced?

$175g \times \frac{1mol}{169.9g} = 1.03 mol\ AgNO_3$ ∴ $AgNO_3$ is L.R.

$175g \times \frac{1mol}{164g} = 1.06 mol\ Na_3PO_4$

$1.03 mol\ AgNO_3 \times \frac{1mol\ Ag_3PO_4}{3mol\ AgNO_3} = 0.34 mol$

$0.34mol \times \frac{418.7g}{1mol} = 142.36g$

e) How many grams of the excess reactant remains?

$1.03 mol\ AgNO_3 \times \frac{1 mol\ Na_3PO_4}{3 mol\ AgNO_3} = 0.34 mol\ Na_3PO_4$ needed.

$1.06 - 0.34 = 0.72 mol$ left $\times \frac{164g}{1mol} = 118.g$

Solubility:

1. Answer the following theory questions as completely as possible.

a) Describe how one could increase the solubility of a ***solid in a liquid***.

Heat

b) A glass of cold water left sitting on a counter at room temperature usually develops many small gas bubbles on the inside of the glass. Describe what is likely happening.

dissolved gases are less soluble @ higher temps, they escape as the H_2O warms up.

c) Discuss how the solubility of a substance is dependent on the nature of the solute and solvent.

like dissolves like.

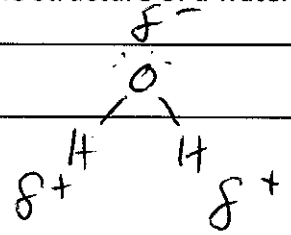
→ polar molecules are attracted to other polar molecules over non-polar.

d) Explain how the process of dissolving is different ionic versus covalent solids.

ionic → dissociate

covalent → don't diss.

e) Describe the structure of a water molecule in terms of its polarity.



2. Solve the problems below.

a) What is the molarity of 5.30 g of Na_2CO_3 dissolved in 400.0 mL solution?

$5.3\,g \times \frac{1\,mol}{106.9\,g} = \frac{0.05\,mol}{0.4\,L} = \boxed{0.125\,\frac{mol}{L}}$

b) How many grams of $Ca(OH)_2$ are needed to make 100.0 mL of 0.250 M solution?

$0.1\,L \times \frac{0.25\,mol}{1\,L} = 0.025\,mol \times \frac{74.12\,g}{1\,mol} = \boxed{1.85\,g}$

c) What volume of Li_2SO_3 is produced when 4.67 moles is dissolved to make a 1.89M solution?

$4.67\,mol \times \frac{1\,L}{1.89\,mol} = \boxed{2.47\,L.}$

d) An ammonia solution is made by ***diluting*** 150 mL of the concentrated (15 mol/L) commercial reagent until the final volume reaches 850 mL. What is the concentration of the new solution?

$$M_1V_1 = M_2V_2$$

$$\left(15\frac{mol}{L}\right)(0.15L) = M_2(850ml)$$

$$M_2 = \boxed{2.65\frac{mol}{L}}$$

e) Find the final concentration when 600mL of a 6.0mol/L solution has 200mL of water ***added to it***.

$$M_1V_1 = M_2V_2$$

$$\left(6.0\frac{mol}{L}\right)(0.6L) = M_2(0.8L)$$

$$M_2 = \boxed{\cancel{2.65}\ 4.5\ \frac{mol}{L}}$$

f) Calculate the final concentration if 2.00 L of 3.00 M NaCl and 4.00 L of 1.50 M NaCl are mixed.

$$M_1V_1 + M_2V_2 = M_fV_f.$$

$$\left(3.00\frac{mol}{L}\right)(2.0L) + \left(1.5\frac{mol}{L}\right)(4.0L) = M_f(6.0L)$$

$$M_f = \boxed{2.0\frac{mol}{L}}$$