Chemistry 2202 Review Questions

Science 1206 Review: In order to complete Stoichiometry type questions you must be able to write chemical formulas and predict products for balanced chemical equations.

WRITING CHEMICAL FORMULAS

Compound Type	How to Recognize	Rules to Write Formulas
Ionic	- start with **metal** (left of staircase) - watch for ammonium, NH_4^+ - ate & ite indicate complex ions - Roman numerals indicate charge on ion	- write ion symbols - determine the lowest whole number ratio to give overall charge of zero
Molecular	start with a non-metal (right of staircase)	
	Elements: (from table)	learn formulas which are diatomic & others F_2, Cl_2, Br_2, I_2, At_2, along with: H_2, O_2, N_2 P_4 & S_8

	Common Names	learn formulas: H_2O water
		                   NH_3 ammonia
		                   H_2O_2 hydrogen peroxide
		                   CH_4 methane
		                   $H_2S_{(g)}$ hydrogen sulfide
		                   O_3 ozone
		                   $C_{12}H_{22}O_{11}$ sucrose

	Others	prefixes tell the number of each type of atom
		     1 - mono 6 - hexa
		     2 - di 7 - hepta
		     3 - tri 8 - octa
		     4 - tetra 9 - nona
		     5 - penta 10 - deca

Acids	start with "H"
	    - watch for COO group, H is
	       placed at the end of this group.
		hydro_____ic acid comes from "ide"
		
		_____ic acid comes from "ate"
		
		_____ous acid comes from "ite"

Write formulas for the following:

Name	Ionic/ Molecular/Acid	workings	Formula
barium fluoride			
nitrogen dioxide			
hydrobromic acid			
tin (IV) nitrate			
fluorine			
potassium nitride			
trinitrogen hexahydride			
carbonic acid			
gold (I) chromate			
nitrogen			
sodium carbonate			
diphosphorus decaoxide			
phosphoric acid			
copper(II) phosphate			
sulfur			
calcium phosphate			
sulfur hexafluoride			
hydrocyanic acid			
antimony (III) hypochlorite			
barium hydroxide octahydrate			
ammonium nitrate			
phosphorus pentachloride			
nitrous acid			
lead (II) oxide			
cobalt (II) chloride hexahydrate			

WRITING BALANCED CHEMICAL EQUATIONS - PREDICTING PRODUCTS

Type	Recognition
Formation	Element + Element → Compound (usually ionic - look up ions to write formulas)
Decomposition	Compound → Element + Element (watch out for diatomic and other elements)
Combustion	hydrocarbon + oxygen → carbon dioxide + water vapour C_xH_y + $O_{2\,(g)}$ → $CO_{2\,(g)}$ + $H_2O_{\,(g)}$
Single Replacement	Element + Compound → Element$_2$ + Compound$_2$ metallic elements replace positive ions in the compound non-metallic elements replace negative ions in the compound
Double Replacement	Ionic Compound$_1$ + Ionic Compound$_2$ → Ionic Compound$_3$ + Ionic Compound$_4$ positive ions in the reactants will switch places

Write Balanced Chemical Equations for the following:

Type	Reaction
	magnesium reacts with nitrogen
	mercury (II) oxide breaks down on heating
	propane (C_3H_8) undergoes combustion when barbecuing.
	zinc reacts with gold (III) chloride
	fluorine reacts with sodium chloride
	sodium carbonate reacts with strontium nitrate

Type	Reaction
	aluminum reacts with sulfur
	phosphorus trichloride decomposes during a chemical reaction
	octane (C_8H_{18}) undergoes combustion in your car engine
	magnesium reacts with silver nitrate
	bromine reacts with potassium iodide
	calcium chloride reacts with silver chlorate
	lithium reacts with nitrogen
	copper (II) sulfate pentahydrate decomposes on heating
	candle wax ($C_{25}H_{52}$) burns when lit.
	tin reacts with hydrochloric acid
	barium chloride reacts with ammonium phosphate

Multiple Choice Type Questions

1a)   How many significant figures in 0.00120 g?
1b)   How many significant figures in 35000 L?

2a)   Convert 50.00 mL to L
2b)   Convert 2.5 kg to g.

3a)   Express 0.00120 g in scientific notation.
3b)   Express 35000 L in scientific notation.

4.   What does the number 35 in chlorine- 35 represent?

5.   What does the number 23 represent in ^{23}Na?

6.   How many electrons, protons and neutrons does chlorine-35 have?

7.   How many electrons, protons and neutrons does ^{23}Na have?

8.   How many electrons, protons and neutrons does ^{25}Mg^{2+} have?

9.   How many electrons, protons and neutrons does oxide - 18 have?

10.   How many atoms of copper are found in 3.24 mol of copper?

11.   How many molecules of carbon dioxide are found in 8.55 mol of carbon dioxide?

12.   How many formula units of calcium fluoride are found in 0.254 mol of calcium fluoride?

13.   How many moles of copper are in 3.93 x 10^{25} particles of Cu?
        What type of particles make up Cu?

14.   How many moles of methane are in 2.45 x 10^{24} particles of CH$_4$?
        What type of particles make up CH$_4$?

15.   How many moles of iron (III) sulfate are in 2.29 x 10^{21} particles of Fe$_2$(SO$_4$)$_3$?
        What type of particles make up Fe$_2$(SO$_4$)$_3$?

16a)   Calculate the molar mass of Sn(ClO$_2$)$_4$.
16b)   Calculate the molar mass of Fe(NO$_3$)$_3$ • 9 H$_2$O.

17.   How many moles does 5.30 g of oxygen represent?

18.   What mass does 0.585 mol of sodium nitride have?

19a)   What type of solution holds the maximum amount of solute at a given temperature?
19b)   What type of solute forms non-conducting solutions?
19c)   What type of solution has a large amount of solute dissolved in a given volume?
19d)   What name is given to a solid in solid solution?

Extended Response

1.   The element silicon has three stable isotopes. Calculate its average atomic mass.

Isotope	Atomic Mass (μ)	Percent Abundance (%)
^{28}Si	27.98 μ	92.18 %
^{29}Si	28.98 μ	4.71 %
^{30}Si	29.97 μ	3.12 %

For extra examples: See MHR Text Page 45 Practice Problems # 1 - 4

2a. 2.89×10^{23} molecules of carbon tetrafluoride has what mass?
2b.   How many atoms are in this sample of carbon tetrafluoride?

3.   5.85 g of tin contains how many atoms?

For extra examples like #2 & 3:   See Worksheet 9 # Sections E, F, G, H

4.   A compound was found to be 49.3% carbon, 6.91% hydrogen and 43.8 % oxygen. If its molar mass has been determined as 146.16 g/mol, what is its molecular formula?

**For extra examples like #4:   See Worksheet 10 # 6 - 10**

5.   8.00 g of an oxide of tin decomposes on heating to produce 6.30 g of tin metal. What is the empirical formula of the oxide?

For extra examples like #5:   See Worksheet 10 # 16 - 18 (first)

6.   Find the formula for the hydrate of barium hydroxide, if 6.78 g of the hydrate produced 5.60 g of the anhydrous salt on heating.

For extra examples like #6:   See Worksheet 10 # 11 - 15

7.   A white fluffy solid is produced when phosphoric acid reacts with barium hydroxide according to the following reaction:

$$2 \; H_3PO_{4(aq)} \; + \; 3 \; Ba(OH)_{2(aq)} \; \rightarrow \; Ba_3(PO_4)_{2(s)} \; + \; 6 \; HOH_{(l)}$$
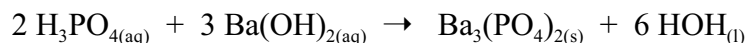
a)   What is the theoretical yield of the solid, if 25.0 g of barium hydroxide in solution reacts with the phosphoric acid?

b)   If Lindsay collects 27.2 g of the solid when she does the experiment, what is her percent yield?

For extra examples like #7:   See Worksheet 11 # Section E

8a.   75.0 g of propane (C_3H_8) reacts with 195 g of oxygen, what is the theoretical yield of carbon dioxide?

8b.   What mass of the limiting reagent would be needed to react with all of the excess reactant?

9.   22.8 g of lithium reacts with 39.2 g of nitrogen to produce a black solid.
   a)   What is the theoretical yield (in grams) of the black solid?
   b)   Which reactant is in excess?
   c)   How much of the excess reagent reacted?
   d)   How much of the excess reagent remained after the reaction was complete?

For extra examples like #8 & 9:   See Worksheet 11 # Section F