Review Package #1

1) Write the chemical formulae resulting from the combination of the following ions.

a) Na^+ O^{2-} Na_2O c) Sr^{2+} Br^- $SrBr_2$

b) Au^{3+} S^{2-} Au_2S_3 d) Pb^{4+} $C2O4^{2-}$ $Pb(C_2O_4)_2$

2) Write the correct name for each of the following ionic compounds.

a) Li_2O Lithium dioxide c) Mg_3N_2 Magnesium Nitride

b) $CoCl_3$ Cobalt(III)Chloride d) $Cr_3(PO4)_2$ Chromium(II) Phosphate

3) Write the correct formula for each of the following ionic compounds.

a) Cesium iodide CsI d) Aluminum oxide Al_2O_3

b) Strontium cyanide $Sr(CN)_2$ e) Iron (III) hydroxide $Fe(OH)_3$

c) Copper (I) bicarbonate $CuHCO_3$ f) Potassium permanganate $KMnO_4$

4) Write the correct name for each of the following ionic hydrates.

a) $Cd(NO_3)_2$ Cadmium Nitrate

b) NaSCN Sodium Thiocyanate

Molecular Compounds:

1. Write the correct name for each of the following molecular compounds.

a. NF_3 Nitrogen Trifluoride d. N_2O_4 Dinitrogen Tetraoxide

b. CO_2 Carbon Dioxide e. SCl_6 Sulphur Hexachloride

c. P_2O_5 Diphosphorus Pentaoxide f. N_2O Dinitrogen Monoxide

2. Write the correct formula for each of the following molecular compounds

a. Silicon disulphide SiS_2 d. Triarsenic pentabromide As_3Br_5

b. Carbon tetrachloride CCl_4 e. Dicarbon hexahydride C_2H_6

c. Oxygen gas O_2 f. Iodine heptachloride ICl_7

Mixed Naming:

3.Write the correct formula for each of the following molecular compounds:

a) $CaBr_2$ Calcium Bromide

b) H_2SO_4 Dihydrogen Sulphate (Sulphuric Acid)

c) ICl Iodine Monochloride

d) $Cu(NO_3)_2$ Copper(II) Nitrate

The Mole:

Make the following conversions, clearly showing your steps. Include proper units in all of your work and in your answer.

a) 133.44 grams of PCl_5 = ? moles $MM\ PCl_5 = 208.5\ g/mol$

$$?\ moles\ PCl_5 = 133.44\ g\ PCl_5 \times \frac{1\ mol}{208.5\ g} = 0.6400\ mols$$

Answer 0.6400 mols

b) 0.00256 moles of $Li_2Cr_2O_7$ = ? grams $MM\ Li_2Cr_2O_7 = 229.88\ g/mol$

$$g\ ?\ Li_2Cr_2O_7 = 0.00256\ mols \times \frac{229.88\ g}{1\ mol} = 0.588\ g$$

Answer 0.588 g

c) 170.24 L of NO_2 at STP = ? moles $1\ mol = 22.4\ L$

$$?\ moles\ NO_2 = 170.24\ L \times \frac{1\ mol}{22.4\ L} = 7.60\ mol\ NO_2$$

Answer 7.60 mol NO_2

d) 570.625 g of PCl_3 gas = ? L (STP) $MM = 137.5\ g/mol$

$$?\ L = 570.625\ g\ PCl_3 \times \frac{1\ mol}{137.5\ g} \times \frac{22.4\ L}{1\ mol} = 92.96\ L = 93.0\ L$$

Answer 93.0 L

e) 1030.4 mL of C_2H_6 gas at STP = ? g $MM = 30.0\ g/mol$

$$?\ g\ C_2H_6 = 1030.4\ mL \times \frac{1\ L}{1000\ mL} \times \frac{1\ mol}{22.4\ L} \times \frac{30.0\ g}{1\ mol} = 1.38\ g$$

Answer 1.38 g

f) 5.00 kg of nitrogen gas = ? L (STP) $N_2 = 28.0\ g/mol$

$$?\ L\ N_2 = 5.00\ kg \times \frac{1000\ g}{1\ kg} \times \frac{1\ mol}{28.0\ g} \times \frac{22.4\ L}{1\ mol}$$

Answer 4.00×10^3 g

g) 0.5696 kg of $CH_{4(g)}$ = ? mL MM = 16.0 g/mol

$$? \text{ mL } CH_4 = 0.5696 \text{ kg} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mol}}{16.0 \text{ g}} \times \frac{22.4 \text{ L}}{1 \text{ mol}} \times \frac{1000 \text{ mL}}{1 \text{ L}} =$$

Answer 7.97×10^5 mL

2. The density of liquid ethanol (C_2H_5OH) is 0.790 g/mL. Calculate the number of molecules in a 35.0 mL sample of liquid ethanol. (NOTE: You CAN'T use 22.4 L/mol since this is NOT a gas at STP!)

MM = 46.0 g/mol

$$\text{molecules } C_2H_5OH = 35.0 \text{ mL} \times \frac{0.790 \text{ g}}{\text{mL}} \times \frac{1 \text{ mol}}{46.0 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} = 3.62 \times 10^{23} \text{ molec}$$

Answer 3.62×10^{23} molec

3. A 100.0 mL sample of liquid mercury contains 6.78 moles. Calculate the density of liquid mercury from this data. MM = 200.59 g/mol

$$\text{mols Hg} = 6.78 \text{ mols} \times \frac{200.59 \text{ g}}{1 \text{ mol}} = 1360.0 \text{ g}$$

$$D = g/L = \frac{1360.0 \text{ g}}{0.1000 \text{ L}} = 1.36 \times 10^4 \text{ g/L}$$

Answer 1.36×10^4 g/L

4. Calculate the density of $PCl_{3(g)}$ at STP.

MM = 137.5 g/mol

$$\text{Density} = \frac{137.5 \text{ g}}{\text{mol}} \times \frac{1 \text{ mol}}{22.4 \text{ L}} = 6.14 \text{ g/L}$$

Answer 6.14 g/L

5. a) The density of a gas at STP is 4.955 g/L. Calculate the molar mass of this gas.

$$MM = \frac{4.955 \text{ g}}{\text{L}} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = 111 \text{ g/L}$$

b) The gas is an oxide of selenium. Determine the molecular formula.

$$1 \text{ Se} + 2 \text{ O} \longrightarrow SeO_2$$
$$79.0 \quad 32.0 \rightarrow 111 \text{ g}$$

Answer SeO_2

6. Find the percent composition (% by mass of each element) in the following compound: $Sr_3(PO_4)_2$. Show your work.

MM = 452.8 g/mol

$\%\ Sr = \frac{262.8\ g/mol}{452.8\ g/mol} \times 100\% = 58.0\%$

$\%\ P = \frac{62.0\ g/mol}{452.8\ g/mol} = 13.7\%$

$\%\ O = \frac{128.0\ g/mol}{452.8\ g/mol} = 28.3\%$

Answer 58.0%Sr, 13.7%P, 28.3%O

7. A compound was analyzed and the following results were obtained:
Molar mass: 270.4 g/mol

Mass of sample: 162.24 g
Mass of potassium: 46.92 g
Mass of sulphur: 38.52 g
Mass of oxygen: the remainder of the sample is oxygen

KSO

a) Determine the mass of oxygen in the sample.

Answer 76.8 g

b) Determine the empirical formula for this compound.

$P_{mol}O = 76.8\ g \times \frac{1\ mol}{16.0\ g} = 4.8\ mol \div 4$

$P_{mol}K = 46.92 \times \frac{1\ mol}{39.1} = 1.2\ mol \div 1$

$P_{mol}S = 38.52\ g \times \frac{1\ mol}{32.1} = 1.27\ mol \div 1.$

Answer: Empirical Formula: KSO_4

MM = 135.2 g/mol

c) Determine the molecular formula for this compound.

$\frac{\text{molecular mass}}{\text{empirical mass}} = \frac{270.4\ g/mol}{135.2\ g/mol} = 2$

Answer: Molecular Formula: $K_2S_2O_8$

8. 123.11 g of zinc nitrate, $Zn(NO_3)_2$ are dissolved in enough water to form 650.0 mL of solution. Calculate the $[Zn(NO_3)_2]$) Include proper units in your work and in your answers.

$MM = 165.39\ g/mol$

$?\ mols\ Zn(NO_3)_2 = 123.11\ g \times \frac{1\ mol}{165.4\ g} = 0.7444\ mols$

$C = \frac{n}{V} = \frac{0.7444\ mols}{0.6500\ L} = 1.145\ M$

Answer 1.145 M

9. Calculate the mass of potassium sulphite (K_2SO_3) needed to make 800.0 mL of a 0.200 M solution of K_2SO_3. Include proper units in your work and in your answers.

$MM = 158.3\ g/mol$

$?\ g\ K_2SO_3 = 0.8000\ L \times \frac{0.200\ mol}{L} \times \frac{158.3\ g}{mol} = 25.3\ g$

Answer 25.3g

10. What volume of 2.50 M Li_2CO_3 would need to be evaporated in order to obtain 47.232 g of solid Li_2CO_3? Include proper units in your work and in your answers.

$MM = 73.8\ g/mol$

$?\ L\ Li_2CO_3 = 47.232\ g \times \frac{1\ mol}{73.8\ g} \times \frac{1\ L}{2.50\ mols} = 0.256\ L$

Answer 0.256 L

11. 150.0 mL of water are added to 400.0 mL of 0.45 M HNO_3 . Calculate the final $[HNO_3]$. Include proper units in your work and in your answers.

$C_1 = 0.45\ M$

$V_1 = 400.0\ mL$

$V_2 = 550.0\ mL$

$C_2 = ?$

$C_2 = C_1 \cdot \frac{V_1}{V_2}$

$= 0.45M \cdot \frac{400.0\ mL}{550.0\ mL} = 0.36M$

Answer 0.36M

12. What volume of water needs to be added to 150.0 mL of 4.00 M H_2SO_4 in order to bring the concentration down to 2.50 M? Include proper units in your work and in your answers.

$V_1 = 150.0\,mL$

$C_1 = 4.00\,M$

$C_2 = 2.50\,M$

$V_2 = ?$

$$V_2 = V_1 \cdot \frac{C_1}{C_2}$$

$$V_2 = 150.0\,mL \cdot \frac{4.00\,M}{2.50\,M} = 240\,mL$$

added 90 mL

Answer 90.0 mL

13. Give directions on how to make 5.00 L of 0.020 M $Ca(ClO)_2$ using solid $Ca(ClO)_2$ and water. Include proper units in your work and in your answers.

MM = 143.08 g/mol

$$?\,g\,Ca(ClO)_2 = 5.00\,L \times \frac{0.020\,mol}{1\,L} \times \frac{143.08\,g}{1\,mol} = 14.3\,g$$

$= 14\,g$

① weigh out 14 g

② add 14 g to a graduated cylinder

③ fill cylinder to 5.00 L