Final Exam Review

This review is from chapter 9 to the present.

1. Write a balanced equation for each of the following reactions.
   - a. Lithium reacts with oxygen to produce lithium oxide. $4Li + O_2 \rightarrow 2Li_2O$
   - b. Silver(I) nitride is produced when silver reacts with atmospheric nitrogen. $6Ag + N_2 \rightarrow 2Ag_3N$

2. balance the following equations
   - a. $2NH_3 \rightarrow N_2 + 3H_2$
   - b. $3Ba(C_2H_3O_2)_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaC_2H_3O_2$
   - c. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
   - d. $2Hg + O_2 \rightarrow 2HgO$

3. Identify the type of reaction for each of the following
   - a. $Sb_2S_3 + 6HCl \rightarrow 2SbCl_3 + 3H_2S$ double replacement
   - b. $3Sn + 2P \rightarrow Sn_3P_2$ synthesis or direct combination
   - c. $2PbO_2 \rightarrow 2PbO + O_2$ decomposition
   - d. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ single replacement

4. Find the mass of each of the following
   - a. 3.2moles Li $3.2\text{ mol Li} \times \frac{6.9\text{ g Li}}{1\text{ mol Li}} =$ ~~[illegible]~~ $\boxed{22.1\text{ g Li}}$
   - b. 0.76 mole Ne $0.76\text{ mol Ne} \times \frac{20.2}{1\text{ mol}} = \boxed{15.4\text{ g}}$
   - c. 5.26 moles Au $5.26\text{ mol Au} \times \frac{197.0\text{ g}}{1\text{ mol}} = \boxed{1036\text{ g Au}}$
   - d. 3.78 moels Zn $3.78\text{ mol Zn} \times \frac{65.4\text{ g}}{1\text{ mol}} = \boxed{247.2\text{ g Zn}}$

5. Find the number of moles in each of the following
   - a. 2.67×10^{22} atoms Mg $2.67 \times 10^{22}\text{ atoms} \times \frac{1\text{ mol}}{6.02 \times 10^{23}\text{ atoms}} = \boxed{0.044\text{ mol Mg}}$
   - b. 3.25×10^{23} for. U. $FeSO_4$ $3.25 \times 10^{23}\text{ F.U.} \times \frac{1\text{ mol}}{6.02 \times 10^{23}\text{ FU}} = \boxed{0.54\text{ mol}}$
   - c. 9.25×10^{23} molecules O_2 $9.25 \times 10^{23}\text{ molecules} \times \frac{1\text{ mol}}{6.02 \times 10^{23}} = \boxed{1.5\text{ mol}}$
   - d. 8.17×10^{24} molecules of NH_3 $8.17 \times 10^{24}\text{ molecules} \times \frac{1\text{ mol}}{6.02 \times 10^{23}} = \boxed{13.6\text{ mols}}$

6. Find the volume of each (@STP)
   - a. 0.72 moles O_2 $0.72\text{ mol} \times \frac{22.4\text{ L}}{1\text{ mol}} = \boxed{16.1\text{ L}}$
   - b. 3.4 moles N_2 $3.4\text{ mol} \times \frac{22.4}{1\text{ mol}} = \boxed{76.2\text{ L}}$
   - c. 57g CO_2 $57\text{ g } CO_2 \times \frac{1\text{ mol}}{44.0\text{ g}} \times \frac{22.4\text{ L}}{1\text{ mol}} = \boxed{29.0\text{ L}}$
   - d. 320 g Rn $320\text{ g Rn} \times \frac{1\text{ mol}}{222\text{ g}} \times \frac{22.4\text{ L}}{1\text{ mol}} = \boxed{32.3\text{ L}}$

7. Find the percent composition of $CaCO_3$

$Ca = 40.1\text{ g} + C = 12.0\text{ g} + (3 \times 16.0) = 100.1\text{ g}$

$Ca = \frac{40.1}{100.1} \times 100 = 40\%$

$C = \frac{12.0}{100.1} \times 100 = 12\%$

$O = \frac{48}{100.1} \times 100 = 48\%$

8. Find the empirical formula of a compound which contains 6.5 g K, 5.9 g Cl and 8.0g O

$K = 6.5\text{ g} \times \frac{1\text{ mol}}{39.1} = \frac{0.166}{0.166} = 1$

$Cl = 5.9\text{ g} \times \frac{1\text{ mol}}{35.5} = \frac{0.166}{0.166} = 1$

$O = 8.0\text{ g} \times \frac{1\text{ mol}}{16.00} = 0.5 / 0.166 = 3$

$\boxed{KClO_3}$

9. The explosive, TNT, is composed of 37.0% carbon, 2.20% H, 18.5% nitrogen and 42.3% oxygen
   - a. Determine the empirical formula
   - b. The molar mass of TNT is 227g/mol. What is the molecular formula?

10. How many moles of copper will be produced from 2 moles of Al?

a. $3CuSO_4 + \underline{\underline{2}}Al \rightarrow Al_2(SO_4)_3 + \underline{3}Cu$ 3 mol Cu

11. What mass of Barium chloride is needed to react completely with 46.8g of sodium phosphate according to the given equation? $3BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaCl$

$46.8g\ Na_3PO_4 \times \frac{1\ mol\ Na_3PO_4}{164\ g} \times \frac{3\ mol\ BaCl_2}{2\ mol\ Na_3PO_4} \times \frac{208.3\ g\ BaCl_2}{1\ mol\ BaCl_2} = \boxed{89.2g\ BaCl_2}$

12. How many grams of magnesium oxide are needed to produce 264g of magnesium hydroxide according to the equation. $MgO + H_2O \rightarrow Mg(OH)_2$

$264g\ Mg(OH)_2 \times \frac{1\ mol\ Mg(OH)_2}{58.3g\ Mg(OH)_2} \times \frac{1\ mol\ MgO}{1\ mol\ Mg(OH)_2} \times \frac{40.3\ g\ MgO}{1\ mol\ MgO} = \boxed{182.5g\ Mg(OH)_2}$

13. Which of the following is exothermic? Endothermic?

a. $C_2H_4 \rightarrow 2C + 2H_2 + 52.3KJ$ exo

b. $B_2H_6 + 6H_2O \rightarrow 2H_2BO_3 + 6H_2 + 493.4KJ$ exo

c. $2Fe + 3CO_2 + 26.8KJ \rightarrow Fe_2O_3 + 3CO$ endo

d. $Br_2 + Cl_2 + 29.4\ KJ \rightarrow 2BrCl$ endo

14. From the following enthalpy changes

flip → a. ~~$TiCl_4 + CO_2 \rightarrow TiO_2 + CCl_4$~~ $\Delta H = -155\ KJ$ $TiO_2 + CCl_4 \rightarrow TiCl_4 + CO_2$

b. $TiCl_4 + 2Mg \rightarrow Ti + 2MgCl_2$ $\Delta H = -478KJ$

Calculate delta H for the following rxn.

$TiO_2 + CCl_4 + 2Mg \rightarrow Ti + CO_2 + 2MgCl_2$ $\Delta H = -155 + (-478) = \boxed{-633\ KJ}$

15. From the following enthalpy changes

a. $CaO + CO_2 \rightarrow CaCO_3$ $\Delta H = -178\ KJ$

flip → b. ~~$CaO + H_2O \rightarrow Ca(OH)_2$~~ $\Delta H = -65KJ$ $Ca(OH)_2 \rightarrow CaO + H_2O$

Calculate the enthalpy change for the following reaction

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$ $\Delta H = -178 + 65 = \boxed{-113\ kJ}$

PV = nRT

① not possible

② $P = \frac{nRT}{V}$

$P = \frac{(0.0857)(0.0821)(373)}{5.25}$

16. complete the following chart using the ideal gas law

	①	②	③
Pressure	748mmHg	0.5 atm	1.21 atm
Volume		5.25L	465L
Temp	200 C	373K	274 K
Moles		0.0857	25.0
Mass	12.5g	Not possible	

③ $T = \frac{PV}{nR}$

$T = \frac{(1.21)(465)}{(25.0)(0.0821)}$

17. A balloon has a volume of 1.75L at a temperature of 25C. What ill be the volume if you leave it in a –15C temp?

$V_1T_2 = V_2T_1$

$(1.75)(-15+273) = (x)(25+273)$ $\boxed{x = 1.52\ L}$

PV=nRT

18. What is the volume in liters of a sample of 100.0g of O_2 at 298K and a pressure of 3.33 atm?

$n = 100.0g\ O_2 \times \frac{1\ mol}{32.0g} = 3.13\ mol$

$V = nRT/P$ $(3.13)(0.0821)(298)/3.33 = \boxed{23.0\ L}$

$P_T = P_A + P_B \ldots$ →

19. A gas mixture contains hydrogen, helium, neon and argon. ~~The total~~ pressure of the mixture is 93.6kPa. The partial pressure of He, Ne anr Ar are 15.4kPa, 25.7kPa and 35.6 kPa respectively. What is the pressure exerted by H?

$93.6 = 15.4 + 25.7 + 35.6 + x$

$\boxed{x = 16.9\ kPa}$

20. The mercury level on the container side of a monometer is 47mm lower than the level on the open side. The atmospheric pressure is 771 mmHg. What is the pressure in the container in atm? In kPa?

771 mmHg + 47 = $\boxed{818\ mmHg}$

V. What is the percentage of carbon in sodium carbonate, Na_2CO_3?

106 g

$$\frac{C = 12.0\,g}{106.0\,g} = \frac{x}{100}$$

$x = 11.3\%$

VI. Write a balanced equation for the double replacement reaction between silver nitrate and aluminum bromide.

$$3AgNO_3 + AlBr_3 \rightarrow 3AgBr + Al(NO_3)_3$$

VII. A compound was analyzed in the lab to determine its empirical formula. Analysis found the following elements and amounts: 9.00 g of carbon, 1.50 grams of hydrogen and 4.00 grams of oxygen.

a. What is the empirical formula for this compound?

$C_{.75}\,H_{1.5}\,O_{.25}$

$\frac{9.00\,g\ C}{x\ mol} = \frac{12.0\,g}{1\ mol}$ $x = 0.75$ mol (3)

$\frac{4.00\,g\ O}{x\ mol} = \frac{16.0\,g}{1\ mol}$ $x = 0.25$ mol (1)

$\frac{1.50\,g\ H}{x\ mol} = \frac{1.0\,g}{1\ mol}$ $x = 1.50$ mol (6)

C_3H_6O

b. The molecular mass of the compound is 116 g/mol. What is its molecular formula?

$C_3H_6O = 58\,g/mol$

$\frac{116}{58} = 2$ so... $C_6H_{12}O_2$

VIII $N_2 + 3H_2 \rightarrow 2NH_3$

14.0g 3.6g

(LR) $\frac{1\,mol}{x} = \frac{28.0\,g}{14.0\,g}$ $x = 0.5$ mol

$\frac{1\,mol}{x} = \frac{2.0\,g}{3.6\,g}$ $x = 1.8$ mol

$\frac{3\,mol\ H_2}{1.8\,mol} = \frac{2\,mol\ NH_3}{x}$ $x = 1.2$ mol NH_3

$\frac{1\,mol\ N_2}{0.5} = \frac{2\,mol\ NH_3}{x}$ $x = 1.0$ mol → 1 mol NH_3 = $\boxed{17.0\,g}$

% yield $\frac{14.5}{17} = 85\%$

IX $P = 0.96$ $R = 0.0821$

$V = 6.46$ $T = 21 + 273 = 294\,K$

$n = x$

$(0.96)(6.46) = (x)(0.0821)(294)$

$\boxed{x = 0.25\ mol}$

X $\frac{1\,kg}{13.5\,kg} = \frac{1000\,g}{13500\,g}$

$D = \frac{M}{V}$

$\frac{19.3\,g}{13500\,g} = \frac{1\,cm^3}{x\,cm^3}$ $x = 699.4\,cm^3$

$10.0 \times 30.0 \times 3.0 = 600\,cm^3$ NO!!

Worksheet: Academic Chemistry

Name ____________________

Mod ____________________

I. Write correct formulas for the following compounds:

a. potassium sulfate

K_2SO_4

b. iron (III) oxide

Fe_2O_3

c. dinitrogen pentoxide

N_2O_5

d. ammonium carbonate

$(NH_4)_2CO_3$

e. aluminum iodide

AlI_3

f. tin (IV) phosphate

$Sn_3(PO_4)_4$

II. Write the correct name for each of these compounds:

a. $Ba(NO_3)_2$

barium nitrate

b. MnO

manganese (II) oxide

c. Na_2S

sodium sulfide

d. $Ca(OH)_2$

calcium hydroxide

e. $CoSO_4$

Cobalt (II) sulfate

f. CCl_4

carbon tetrachloride

III. Determine the molecular weight of the following compounds.

a. $Al_2(SO_4)_3$

$(2 \times 27) + (3 \times 32.1) + (12 \times 16)$

342.3 ~~g/mol~~ amu

b. $BaCl_2 \cdot 2H_2O$

$(1 \times 137.3) + (2 \times 35.5) + (4 \times 1) + (2 \times 16) =$

244.2 ~~g/mol~~ amu

IV. Make the following conversions:

a. convert 4.58 g. of NaCl to moles

$\frac{4.58\,g}{x\,mol} = \frac{58.5\,g}{1\,mol}$ x = 0.078 moles

b. convert 1.35 moles of $AgNO_3$ to grams

$\frac{1.35\,mol}{x\,g} = \frac{1\,mol}{169.9\,g}$ x = 229 g

~~c.~~ convert 3.88 moles of neon gas to liters @ STP

PV = nRT

STP T = 273 K

P = 101.3 kPa or 1atm

P = 101.3 kPa or 1atm

V = x

n = 3.88

R = 8.31 or 0.0821

T = 273

$V = \frac{(3.88)(0.0821)(273)}{1} = 86.96\,L$

$V = \frac{(3.88)(8.31)(273)}{101.3} = 86.9\,L$

Academic Chemistry Final Exam Review

These problems are an example of some of the types of problems that you may see on the academic chemistry final.

46g/mol

1. John used 4.64 g of ethanol, C_2H_5OH, in an experiment. How many moles did he use? 0.101 mol

2. What is the percentage of oxygen in calcium nitrate, $Ca(NO_3)_2$? 58.5%
164.1g/mol

3. Find the empirical formula of a compound containing 63.5 g Ag, 8.25 g N, and 28.26 g O. $AgNO_3$
0.589 mol 0.589 mol 1.77 mol

4. Hydrogen can be produced by this reaction: $Mg + 2\,HCl \rightarrow MgCl_2 + H_2$. How many grams of
36.5 g/mol 95.3 g/mol
$MgCl_2$ can be produced if 182 g of HCl are reacted?
$182 \times \frac{1}{36.5} \times \frac{1}{2} \times \frac{95.3}{1} =$ 237.6 g

5. ~~A mixture of 10.0 g of powdered iron and 10.0 g of powdered sulfur is heated and a reaction forms~~
$2Fe + 3S \rightarrow Fe_2S_3$
~~iron (III) sulfide. How many grams of iron (III) sulfide are formed?~~

6. What volume will 5.4L of gas at 40°C occupy if the temperature is lowered to 0°C? 4.7L
313 K $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ 273 K

7. The pressure exerted by 16.0 L of gas is 740.0 mmHg. If the volume is increased to 20.0 L, what will the new pressure of the gas be? $P_1V_1 = P_2V_2$ 592 mmHg

8. Write the correct formulas for the following compounds:
   - a. Potassium sulfate K_2SO_4
   - b. Iron (III) oxide Fe_2O_3
   - c. Dinitrogen pentoxide N_2O_5
   - d. ammonium carbonate $(NH_4)_2CO_3$
   - e. aluminum iodide AlI_3
   - f. tin (IV) phosphate $Sn_3(PO_4)_4$

9. Write the correct name for each of these compounds:
   - a. $Ba(NO_3)_2$ barium nitrate
   - b. MnO manganese (II) oxide
   - c. Na_2S sodium sulfide
   - d. $Ca(OH)_2$ calcium hydroxide
   - e. ~~Co~~ Mg SO_4 ~~cobalt (II)~~ magnesium sulfate
   - f. CCl_4 carbon tetrachloride

10. Determine the molar mass of $Al_2(SO_4)_3$. 342.3 g/mol

11. Make the following conversions:
    - a. 4.58 g of NaCl to moles 0.078mol
      58.5 g/mol
    - b. 1.35 moles of $AgNO_3$ to grams 229.4g
      169.9 g/mol

12. What element is this electron configuration showing … $1s^22s^22p^63s^23p^3$?
P

$3.6 \times \frac{1}{1} \times \frac{2}{3} \times \frac{17}{1} = \cancel{40.8g}$ $14 \times \frac{1}{28} \times \frac{2}{1} \times \frac{17}{1} \Rightarrow 17.0g$

13. Tom performs a reaction between 3.6 g of hydrogen and 14.0 g of nitrogen to produce ammonia (NH_3) by this reaction…$3 H_2 + N_2 \rightarrow 2 NH_3$.

  a. Which of these two will run out first?...this is not a guess do the math N_2

  b. How many grams of NH_3 would this reaction produce theoretically? 17.0g

  c. If 14.5 g were actually produced, what would the percent yield be? 85.3%

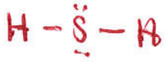
14. How many moles of He gas are contained in a 6.46 L balloon if the temperature is 21°C and the pressure is 0.96 atm? $PV = nRT$ $n = \frac{PV}{RT}$ 0.258 mol

293 K

15. Of the elements P, S Ar and Ca, which is the largest in size? Which is the smallest?

Ca   Ar

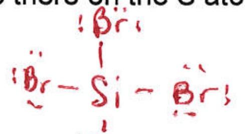
16. Draw the Lewis dot structure for H_2S.



  a. What shape will this be? bent

  b. How many pairs of ~~unpaired~~ shared electrons are there on the S atom? 2

17. Draw the Lewis dot structure for $SiBr_4$.



  a. What shape is this molecule?
  tetrahedral

  b. How many pairs of shared electrons are there on the ~~C~~ Si atom? 4

18. Balance the following equations and identify the type of reaction for each:

  a. $2NaCl + Cu(OH)_2 \rightarrow 2NaOH + CuCl_2$ DR

  b. $K_2CO_3 \rightarrow K_2O + CO_2$ Decomposition

  c. $2N_2 + 5O_2 \rightarrow 2N_2O_5$ Direct Combination

  d. $ZnCl_2 + Li \rightarrow LiCl_2 + Zn$ SR

19. $C(s) + O_2(g) \rightleftharpoons CO_2(g)$ $\Delta H^\circ = -393.5$ kJ/mol

  a. Is this reaction endothermic or [✓ exothermic]?

  b. If 393.5 kJ were written in the equation would it be on the right or the left? right

  c. Sketch the graph of this reaction.

  d. Will the container feel [✓ warm] or cold?

10.3 L

20. What will the volume of a gas be at 15°C and 1.4 atm if it starts at 3.7 L at 45°C and 4.3 atm? $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

288 K   318 K

21. How much will the boiling point change if ~~275~~ 575 g of sugar ($C_6H_{12}O_6$) are added to 1500 g of water?

$K_b = 1.86$ °C/m   180.0 g/mol   1.5 kg

3.96 °C