Optional Summer assignment (10 activities, one for each week… any that you do will be better than none! All answers are provided at the back of packet. Do your best, check your work, study the answers, print off a clean sheet and try it again…)

Week 1

Complete an online tutorial on significant figures and calculations

http://www.chem.sc.edu/faculty/morgan/resources/sigfigs/index.html

Try and put this into practice as you complete the rest of the problems below

Week 2

Atomic Structure

Fill in the blanks for the elements in this chart. For the purposes of this chart, round all atomic masses to the nearest whole number.

Element	Number of Protons	Number of Neutrons	Number of Electrons	Atomic Mass	Atomic Number
lithium					
carbon					
chlorine					
silver					
lead					
calcium					
tantalum					
radium					
samarium					
uranium					
americium					
lawrencium					

Week 3

Name these compounds. They may be either ionic or covalent.

1) $LiOH$ _____

2) PBr_3 _____

3) Na_2SO_4 _____

4) $(NH_4)_2S$ _____

5) $CaCO_3$ _____

6) CF_4 _____

7) $NaNO_3$ _____

8) P_2S_3 _____

9) $Al(NO_3)_3$ _____

10) $Mg(OH)_2$ _____

Write the formulas for the following compounds. Remember, they may be either ionic or covalent compounds, so make sure you use the right method!

11) potassium oxide _____

12) phosphorus tribromide _____

13) calcium hydroxide _____

14) dinitrogen sulfide _____

15) carbon monoxide _____

16) diboron tetrahydride _____

17) phosphorus pentabromide _____

18) sulfur dichloride _____

19) sodium carbonate _____

20) aluminum acetate _____

Week 4

Balance the equations and predict the products for the following reactions:

1) _____ Na + _____ $FeBr_3$ →

2) _____ $NaOH$ + _____ H_2SO_4 →

3) _____ $C_2H_4O_2$ + _____ O_2 →

4) _____ NH_3 + _____ H_2O →

5) _____ $PbSO_4$ + _____ $AgNO_3$ →

6) _____ PBr_3 →

7) _____ HBr + _____ Fe →

8) _____ $KMnO_4$ + _____ $ZnCl_2$ →

9) _____MnO_2 + _____ $Sn(OH)_4$ →

10) _____ O_2 + _____ $C_5H_{12}O_2$ →

11) _____ H_2O_2 →

12) _____ $PtCl_4$ + _____ Cl_2 →

Week 5

For each of the following problems, write complete chemical equations to describe the chemical process taking place. Important note: There are a few physical processes on this sheet – remember, you can't write an equation for a physical process!

1) When lithium hydroxide pellets are added to a solution of sulfuric acid, lithium sulfate and water are formed.

2) When dirty water is boiled for purification purposes, the temperature is brought up to 100^0 C for 15 minutes.

3) If a copper coil is placed into a solution of silver nitrate, silver crystals form on the surface of the copper. Additionally, highly soluble copper (I) nitrate is generated.

4) When crystalline $C_6H_{12}O_6$ is burned in oxygen, carbon dioxide and water vapor are formed.

5) When a chunk of palladium metal is ground into a very fine powder and heated to drive off any atmospheric moisture, the resulting powder is an excellent catalyst for chemical reactions.

Week 6

1) Define “mole”.

2) How many moles are present in 34 grams of $Cu(OH)_2$?

3) How many moles are present in 2.45×10^{23} molecules of CH_4?

4) How many grams are there in 3.4×10^{24} molecules of NH_3?

5) How much does 4.2 moles of $Ca(NO_3)_2$ weigh?

6) What is the molar mass of MgO?

7) How are the terms “molar mass” and “atomic mass” different from one another?

8) Which is a better unit for expressing molar mass, “amu” or “grams/mole”?

Week 7

Calculate the molarities of the following solutions:

1) 2.3 moles of sodium chloride in 0.45 dm^3 of solution.

2) 1.2 moles of calcium carbonate in 1.22 dm^3 of solution.

3) 0.09 moles of sodium sulfate in 12 cm^3 of solution.

4) 0.75 moles of lithium fluoride in 65 cm^3 of solution.

5) 0.8 moles of magnesium acetate in 5 dm^3 of solution.

6) 120 grams of calcium nitrite in 240 cm^3 of solution.

7) 98 grams of sodium hydroxide in 2.2 dm^3 of solution.

8) 1.2 grams of hydrochloric acid in 25 cm^3 of solution.

9) 45 grams of ammonia in 0.75 dm^3 of solution.

Explain how you would make the following solutions. You should tell how many grams of the substance you need to make the solution, not how many moles.

10) 2 dm^3 of 6 mol dm^{-3} HCl

11) 1.5 dm^3 of 2 mol dm^{-3} NaOH

12) 0.75 dm^3 of 0.25 mol dm^{-3} Na_2SO_4

13) 45 cm^3 of 0.12 mol dm^{-3} sodium carbonate

14) 250 cm^3 of 0.75 mol dm^{-3} lithium nitrite

15) 56 cm^3 of 1.1 mol dm^{-3} iron (II) phosphate

Week 8

Le Châtlier's Principle

Explain how the following changes in reaction conditions will affect the position of the equilibrium below, and explain your reasoning.

$$A_{(g)} + B_{(aq)} \leftrightarrow C_{(s)} \quad \Delta H_{rxn} = -453 \text{ kJ/mol}$$

1) The pressure of A in the reaction chamber is increased.

2) The temperature of the reaction is increased by 20^0 C.

3) A catalyst is added to the system.

4) As the reaction progresses, more of compound B is steadily added to the reaction chamber.

5) An inhibitor is added to the reaction chamber.

6) Argon gas is added to the reaction chamber, doubling the pressure.

Week 9

For each of the following molecules, draw the Lewis structure (with any resonance structures, if applicable), indicate the molecular shapes and bond angles, indicate the molecular polarity (if any), and identify the major intermolecular force in each compound.

1) carbon tetrafluoride

2) BF_3

3) NF_3

4) H_2CS

5) carbonate ion

6) CH_2F_2

7) nitrate ion

8) O_2

9) PF_3

10) H_2S

Week 10

1) If I burn 0.315 moles of hexane (C_6H_{14}) in a bomb calorimeter containing 5.65 liters of water, what's the molar heat of combustion of hexane is the water temperature rises 55.4^0 C? The heat capacity of water is 4.184 J/g^0C.

2) If I burn 22.0 grams of propane (C_3H_8) in a bomb calorimeter containing 3.25 liters of water, what's the molar heat of combustion of propane if the water temperature rises 29.5^0 C?

Bonus: Look at other topics and get more help at the following site with quizzes and tutorials http://antoine.frostburg.edu/chem/senese/101/tutorials/

Week 2

Element	Number of Protons	Number of Neutrons	Number of Electrons	Atomic Mass	Atomic Number
lithium	3	4	3	7	3
carbon	6	6	6	12	6
chlorine	17	18	17	35	17
silver	47	61	47	108	47
lead	82	125	82	207	82
calcium	20	20	20	40	20
tantalum	73	108	73	181	73
radium	88	138	88	226	88
samarium	62	88	62	150	62
uranium	92	146	92	238	92
americium	95	148	95	243	95
lawrencium	103	159	103	262	103

Week 3

1) $LiOH$ **lithium hydroxide**

2) PBr_3 **phosphorus tribromide**

3) Na_2SO_4 **sodium sulfate**

4) $(NH_4)_2S$ **ammonium sulfide**

5) $CaCO_3$ **calcium carbonate**

6) CF_4 **carbon tetrafluoride**

7) $NaNO_3$ **sodium nitrate**

8) P_2S_3 **diphosphorus trisulfide**

9) $Al(NO_3)_3$ **aluminum nitrate**

10) $Mg(OH)_2$ **magnesium hydroxide**

Write the formulas for the following compounds. Remember, they may be either ionic or covalent compounds, so make sure you use the right method!

11) potassium oxide **K_2O**

12) phosphorus tribromide **PBr_3**

13) calcium hydroxide **$Ca(OH)_2$**

14) dinitrogen sulfide **N_2S**

15) carbon monoxide **CO**

16) diboron tetrahydride **B_2H_4**

17) phosphorus pentabromide **PBr_5**

18) sulfur dichloride **SCl_2**

19) sodium carbonate **Na_2CO_3**

20) aluminum acetate **$Al(C_2H_3O_2)_3$**

Week 4

1) **3** Na + **1** $FeBr_3$ → **3 NaBr + 1 Fe**

2) **2** $NaOH$ + **1** H_2SO_4 → **1 Na_2SO_4 + 2 H_2O**

3) **1** $C_2H_4O_2$ + **2** O_2 → **2 CO_2 + 2 H_2O**

4) **1** NH_3 + **1** H_2O → **1 NH_4OH**

5) **1** $PbSO_4$ + **2** $AgNO_3$ → **1 Ag_2SO_4 + 1 $Pb(NO_3)_2$**

6) **4** PBr_3 → **1 P_4 + 6 Br_2**

7) **2** HBr + **1** Fe → **1 H_2 + 1 $FeBr_2$** **OR** **6** HBr + **2** Fe → **3 H_2 + 2 $FeBr_3$**

8) **2** $KMnO_4$ + **1** $ZnCl_2$ → **2 KCl + 1 $Zn(MnO_4)_2$**

9) **1** MnO_2 + **1** $Sn(OH)_4$ → **1 $Mn(OH)_4$ + 1 SnO_2**

10) **7** O_2 + **1** $C_5H_{12}O_2$ → **5 CO_2 + 6 H_2O**

11) **1** H_2O_2 → **1** H_2 **+ 1** O_2 **OR** **2** H_2O_2 → **2** H_2O **+ 1** O_2

12) **1** $PtCl_4$ + **1** Cl_2 → **1** $PtCl_6$

Week 5

1) When lithium hydroxide pellets are added to a solution of sulfuric acid, lithium sulfate and water are formed.

$2\ LiOH_{(s)} + H_2SO_{4(aq)} \rightarrow Li_2SO_{4(aq)} + 2\ H_2O_{(l)}$

2) When dirty water is boiled for purification purposes, the temperature is brought up to 100^0 C for 15 minutes.

No equation is needed, as boiling is a physical process.

3) If a copper coil is placed into a solution of silver nitrate, silver crystals form on the surface of the copper. Additionally, highly soluble copper (I) nitrate is generated.

$Cu_{(s)} + AgNO_{3(aq)} \rightarrow Ag_{(s)} + CuNO_{3(aq)}$

4) When crystalline $C_6H_{12}O_6$ is burned in oxygen, carbon dioxide and water vapor are formed.

$C_6H_{12}O_{6(s)} + 6\ O_{2(g)} \rightarrow 6\ CO_{2(g)} + 6\ H_2O_{(g)}$

5) When a chunk of palladium metal is ground into a very fine powder and heated to drive off any atmospheric moisture, the resulting powder is an excellent catalyst for chemical reactions.

Both grinding and heating are physical processes. Even if the atmospheric moisture is mentioned, boiling is still a physical process. No equation is needed.

Week 6

1) Define "mole".
6.02×10^{23} of anything, usually atoms or molecules.

2) How many moles are present in 34 grams of $Cu(OH)_2$?
0.35 moles

3) How many moles are present in 2.45×10^{23} molecules of CH_4?
0.41 moles

4) How many grams are there in 3.4×10^{24} molecules of NH_3?
96 grams

5) How much does 4.2 moles of $Ca(NO_3)_2$ weigh?
689 grams

6) What is the molar mass of MgO?
40.3 grams/mole

7) How are the terms "molar mass" and "atomic mass" different from one another?

"Molar mass" is used to describe the mass of one mole of a chemical compound, while "atomic mass" is used to describe the mass of one mole of an element or the mass of one atom of an element.

8) Which is a better unit for expressing molar mass, "amu" or "grams/mole"?
"Grams/mole" is better, because any macroscopic amount of a substance is better expressed in grams than amu.

Week 7

Calculate the molarities of the following solutions:

1) **5.11 mol dm^{-3}**

2) **0.98 mol dm^{-3}**

3) **7.5 mol dm^{-3}**

4) **11.5 mol dm^{-3}**

5) **0.16 mol dm^{-3}**

6) **3.79 mol dm^{-3}**

7) **1.11 mol dm^{-3}**

8) **1.35 mol dm^{-3}**

9) **3.53 mol dm^{-3}**

Explain how you would make the following solutions.

10) **Dissolve 426 g HCl, dilute to 2 dm^3**

11) **Dissolve 120 g NaOH, dilute to 1.5 dm^3**

12) **Dissolve 26.64 g Na_2SO_4, dilute to 0.75 dm^3**

13) **Dissolve 0.57 g Na_2CO_3, dilute to 45 cm^3**

14) **Dissolve 9.92 g $LiNO_2$, dilute to 250 cm^3**

15) **Dissolve 22.02 g $Fe_3(PO_4)_2$, dilute to 56 cm^3**

Week 8

1) The pressure of A in the reaction chamber is increased.
The reaction is pushed toward products.

2) The temperature of the reaction is increased by 20^0 C.

Because heat can be thought of as being a product, the reaction will be pushed toward reactants.

3) A catalyst is added to the system.
No change. A catalyst doesn't change the equilibrium position, it only changes how quickly equilibrium is reached.

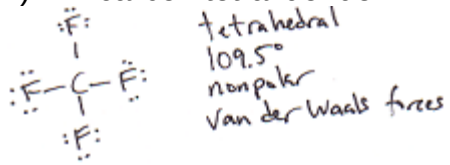
4) As the reaction progresses, more of compound B is steadily added to the reaction chamber.
The reaction is pushed toward products.

5) An inhibitor is added to the reaction chamber.
No change, though the reaction will move more slowly.

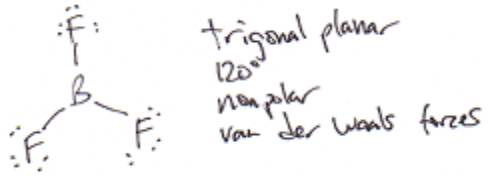
6) Argon gas is added to the reaction chamber, doubling the pressure.
No change. If the partial pressure of gaseous compounds is changed, the equilibrium will shift position. However, adding argon gas doesn't change the partial pressures of A, so the equilibrium position is unaffected.

Week 9

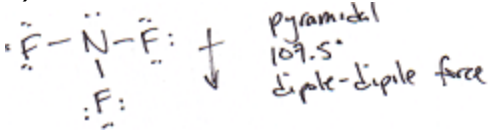
1) carbon tetrafluoride



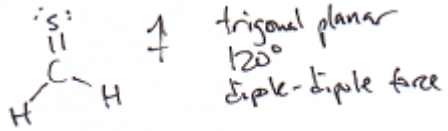
2) BF_3



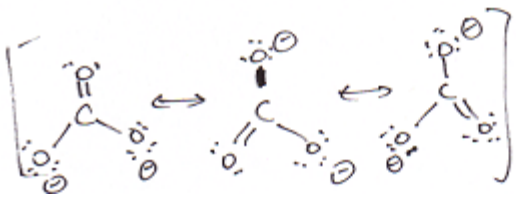
3) NF_3



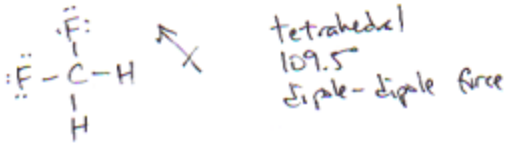
4) H_2CS



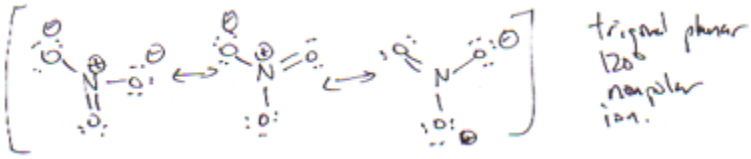
5) carbonate ion



6) CH_2F_2

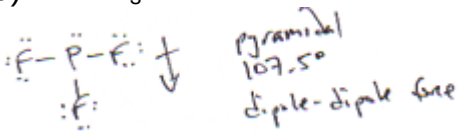


7) nitrate ion

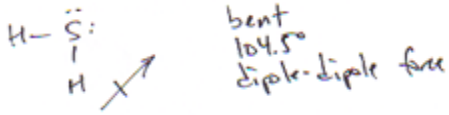


8) O_2

9) PF_3



10) H_2S



Week 10

1)

$$\Delta H = mC_p\Delta T$$

$$\Delta H = (5{,}650 \text{ grams } H_2O)(4.184 \text{ J/g}^0\text{C})(55.4^0 \text{ C})$$

$$\Delta H = 1310 \text{ kJ}$$

Now, remember, this is the amount of energy generated when 0.315 moles of hexane is burned. To find the molar heat of combustion, we need to multiply this by (1 mole/0.315 moles) = 3.17. As a result, the molar heat of combustion of hexane is *4150 kJ/mol*.

2) $\Delta H = mC_p\Delta T$

$\Delta H = (3250 \text{ grams } H_2O)(4.184 \text{ J/g}^0\text{C})(88.5^0 \text{ C})$

$\Delta H = 1.20 \times 10^3 \text{ kJ}$

Because 22.0 grams of propane corresponds to 0.500 moles, the molar heat of combustion of propane is twice the number we computed above, or *2.40 x 10^3 kJ/mol*.