Stoichiometry: Completion vs. Equilibrium Review (2ndary emphasis) Name______________________

1. Iron (III) oxide reacts with aluminum in the following reaction:
   a. If I have 55 grams of Fe_2O_3 and 55 grams of Al, determine the limiting reactant. Show your work.

$Fe_2O_{3(s)}$ +	$2Al_{(s)}$ →	$2Fe_{(s)}$ +	$Al_2O_{3(s)}$
0.34	2.1	0	0
−0.34	−0.68	+0.68	+0.34
0	1.4	0.68	0.34

Fe_2O_3
Fe $2 \times 55.8 = 111.6$
O $3 \times 16 = 48.0$ } 159.6

Al − 27.0g/mol

$55g \mid \frac{1}{27} = 2.1$ mol Al

$55g \mid \frac{1}{159.6} = 0.34$

$\boxed{\text{Limiting Reactant is } Fe_2O_3}$

   b. Determine the excess reactant in grams.

$1.4 \text{ mol Al} \mid \frac{27g}{1 mol} = 37.8g$ Al

   c. Determine the amount of Fe atoms produced.

$0.68 \text{ mol Fe} \mid \frac{6.022E23}{1 mol} = \boxed{4.1E23 \text{ atoms Fe}}$

2. Two beakers are mixed together: one with 100.0 mL of 0.0100M Pb(NO3)2 reacts with 200. mL of 0.0500M KI.

	$Pb(NO_3)_{2(aq)}$ +	$2KI_{(aq)}$ →	$PbI2_{(s)}$ +	$2KNO_{3(aq)}$
I	0.001	0.01		
S	−0.001	−0.002	+0.001	+0.002
E	0	0.008	0.001	0.002

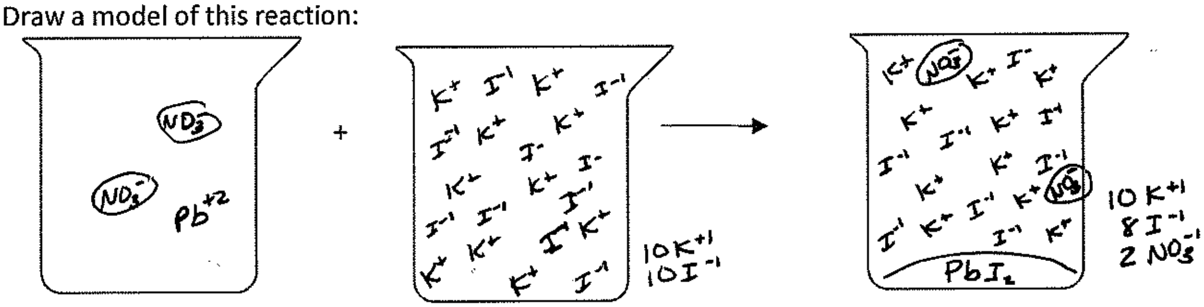
   a. Determine the following Molarity of each before mixed:
      i. potassium ions: $0.05M\ K^{+1}$
      ii. iodine ions: $0.05M\ I^{-1}$
      iii. lead(II) ions: $0.01\ Pb^{+2}$
      iv. nitrate ions: $0.02\ NO_3^{-1}$

   b. What is the mass of solid produced?

Pb 207.2
I $2 \cdot 126.9 = 253.8$ } → 461g/mol

$0.001 \text{ mol } PbI_2 \mid \frac{461g}{1 mol} = 0.461g\ PbI_2$

   c. Draw a model of this reaction:



3. Write the equilibrium constant for concentration (Kc) and pressure (Kp) for each reaction shown:

	Equilibrium Equation	Kc	Kp
a.	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2\ HI_{(g)}$	$K_c = \frac{[HI]^2}{[H_2][I]}$	$K_p = \frac{(P_{HI})^2}{(P_{H_2})(P_{I_2})}$
b.	$C_{(s)} + CO_{2(g)} \rightleftharpoons 2CO_{(g)}$	$K_c = \frac{[CO]^2}{[CO_2]}$	$K_p = \frac{(P_{CO})^2}{P_{CO}}$

4. Hydrogen and Iodine react and come to an equilibrium using the following reaction: → At 490°C, equilibrium amounts of $[H_2]$= 0.316, [I_2]= 1.1316 and [HI]=4.368. Calculate the equilibrium constant.

	$H_{2(g)}$ +	$I_{2(g)} \rightleftharpoons$	$2\ HI_{(g)}$
I			
S			
E	0.316	1.1316	4.368

$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{(4.368)^2}{(0.316)(1.1316)} = 53.4$$

5. At a different temperature, both hydrogen and iodine gases are placed in a reaction vessel, and this time, partial pressures of all the gasses are tracked. The initial pressure of P_{H2}= 2 atm and P_{I2}= 3 atm. At equilibrium, the final P_{H2} = 1.5 atm.

a. Determine the following partial pressures at equilibrium:

i. P_{I2}= 2.5 atm

ii. P_{HI}= 1.0 atm

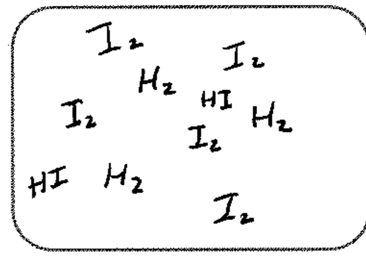
	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2\ HI_{(g)}$		
I	2	3	
C	-0.5	-0.5	+1.0
E	1.5	2.5	1.0

-double these no. to draw

b. Determine Kp at this temperature.

$$K_p = \frac{(1)^2}{(1.5)(2.5)} = 0.27$$

c. Draw a model of the reaction vessel at equilibrium: →



3H_2
5I_2
2HI
Reactant favored.

6. Create a Concept Map of all the main concepts from this unit!

Stoichiometry