CHM152 quiz 3 25 Pts Fall 07 Name: Key

*******SHOW ALL WORK TO RECEIVE CREDIT*******

1. (3 Pts) Write the expressions for both K_c and K_p for the reaction

$PH_3BCl_3(s) \rightleftharpoons PH_3(g) + BCl_3(g)$

$K_c = [PH_3][BCl_3]$ $\quad K_p = P_{PH_3} P_{BCl_3}$

2. (6 Pts) At a high temperature, the following reaction has an equilibrium constant of 1.0×10^2.

$H_2(g) + F_2(g) \rightleftharpoons 2HF(g)$

If 1.00 mol of each of H_2 and F_2 are allowed to come to equilibrium in a 10.0 L vessel, calculate the equilibrium concentration of H_2 and HF and then determine how many moles of each element or compound are present at equilibrium.

$K_c = \dfrac{[HF]^2}{[H_2][F_2]}$

	$H_2(g)$	+ $F_2(g)$	$\rightleftharpoons$ $2HF(g)$
I.	0.100	0.100	0
C.	$-x$	$-x$	$+2x$
E	$0.100-x$	$0.100-x$	$2x$

$1.0\times10^2 = \dfrac{(2x)^2}{(0.100-x)(0.100-x)}$

$\sqrt{}$ gives: $10 = \dfrac{2x}{0.100-x}$

$x = 0.0833$

$[H_2] = 0.100 - 0.0833 = 0.0167 = [F_2]$ $\quad [HF] = 0.167$

for moles use 10.0 L volume

moles H_2 = mole F_2 = 0.167

mol HF = 1.67

3. (6 Pts) When 0.152 mol of solid PH_3BCl_3 is introduced into a 3.0 L container at a certain temperature, 8.44×10^{-3} mol of PH_3 is present at equilibrium:

$PH_3BCl_3(s) \rightleftharpoons PH_3(g) + BCl_3(g)$

Construct a reaction table (I.C.E.) for the process, and use it to calculate K_c at this temperature.

	$PH_3BCl_3(s)$	$\rightleftharpoons$ $PH_3(g)$	+ $BCl_3(g)$
I.	NA	0	0
C.		$+x$	$+x$
E.		x	x

$x = \dfrac{8.44\times10^{-3}\ \text{mol}}{3.0\ \text{L}}$

$K_c = [PH_3][BCl_3]$

$K_c = \left(\dfrac{8.44\times10^{-3}}{3.0}\right)^2$

$K_c = 7.91\times10^{-6}$

************THERE ARE MORE QUESTIONS ON THE BACK ************

Key

4. (6 Pts) Consider the following gas-phase equilibrium reaction:

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$; $K_c = 4.10 \times 10^{-4}$ at 2000°C

If 1.0 mol of NO is introduced into a 1.0 L container at 2000°C, what is the concentration of NO when equilibrium is reached?

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

	N_2	O_2	NO
I.	0	0	1.0 M
C.	+x	+x	−2x
E.	x	x	1.0 − 2x

$$K_c = \frac{[NO]^2}{[N_2][O_2]}$$

$$4.10\times10^{-4} = \frac{(1.0-2x)^2}{x^2}$$

$$\sqrt{4.10\times10^{-4}} = \frac{1.0-2x}{x^2}$$

$$0.02024\,x = 1.0 - 2x$$

$$2.02025\,x = 1.0$$

$$x = 0.4950$$

$$1.0 - 2(0.4950) = \underline{0.010\ M}$$

5. (4 Pts) Consider the equilibrium: $A(s) \rightleftharpoons B(s) + C(g)$; $\Delta H^\circ_{rxn} > 0$ $\Delta H = (+)$

A + heat ⇌ B(s) + C(g)

Predict and explain how or whether the following actions would affect this equilibrium.

a. adding more solid A No effect (solids do not effect Eq)

b. lowering the temperature More A (since RXN is endothermic, heat is a reactant)

c. increasing the pressure on the system by reducing its volume

More A (since conc. of C(g) is increased

d. adding helium gas to increase the total pressure

no effect (the partial pressure of C(g) does not change.