CHM 152 Quiz 3 25 Pts Spring 2015 Name: Key

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1. (5 Pts) 5.00 mol of ammonia are introduced into a 5.00 L reactor vessel in which it partially dissociates at high temperatures.

$$2NH_3(g) \leftrightharpoons 3H_2(g) + N_2(g)$$

At equilibrium at a particular temperature, 1.00 mole of ammonia remains. Calculate K_c for the reaction.

$2NH_3 \rightleftharpoons 3H_2 + N_2$

I. 5.00mol 0 0

C. $-2x$ $+3x$ x

E. $5.00-2x=1.00$ $3x$ x

$x = 2$ moles

E $\frac{1}{5}$ $\frac{6}{5}$ $\frac{2}{5}$

$$K_c = \frac{[H_2]^3[N_2]}{[NH_3]^2} = \frac{\left(\frac{6}{5}\right)^3\left(\frac{2}{5}\right)}{\left(\frac{1}{5}\right)^2}$$

$K_c = 17.3$

2. (3 Pts) Given the following data for the reaction: A(g) + 2B(s) $\leftrightharpoons$ AB_2(g) + heat

Temperature (K)	K_c
300	1.5×10^4
600	55
900	3.4×10^{-3}

Is the reaction *endothermic* or *exothermic*? Explain your reasoning:

Exothermic

As temperature increased, the value of K_c decreased, meaning less products were formed.

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3. (4 Pts) Consider the reaction, $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$. $K_c = 8.1 \times 10^{-3}$ at 900 K. What is the value of K_c for $NH_3(g) \leftrightharpoons \frac{1}{2}N_2(g) + 3/2H_2(g)$

$$K_{c_1} = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$K_{c_2} = \frac{[N_2]^{1/2}[H_2]^{3/2}}{[NH_3]} = \sqrt{\frac{1}{K_{c_1}}} = \sqrt{\frac{1}{8.1\times10^{-3}}} = 11$$

4. (2 Pts) Consider the reaction $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$. If nitrogen is removed from the system at equilibrium, what will happen to the hydrogen (H_2) concentration?

$[H_2]$ will increase.

More Questions on Back

5. (2 Pts) The data below refer to the following reaction:

$$2NO(g) + Br_2(g) \leftrightharpoons 2NOBr(g)$$

Concentration (M)	[NO]	[Br_2]	[NOBr]
Initial	2.5	5.0	1.0
Equilibrium	2.0	____	____

Find the concentration of Br_2 when the system reaches equilibrium.

	$2NO$	$+ \ Br_2$	$\rightleftharpoons 2NOBr$
I	2.5	5.0	1.0
C	$-2x$	$-x$	$+2x$
E	2.0	$5.0-x$	$1.0+2x$

So $2x = 0.5$ and $x = 0.25$ So For Br_2 $5.0 - 0.25 = 4.75M$

6. (2 Pts) Consider the reaction $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$. If we use a catalyst, which way will the reaction shift?

A catalyst does not affect equilibrium value. It only moves to system to equilibrium faster.

7. (5 Pts) The data below refer to the following reaction: **Refer to question 5.**

$$2NO(g) + Br_2(g) \leftrightharpoons 2NOBr(g)$$

Concentration (M)	[NO]	[Br_2]	[NOBr]
Initial	2.5	5.0	1.0
Equilibrium	2.0	4.75	$1+2x = 1.5$

Calculate K_c.

$$K_c = \frac{[NOBr]^2}{[NO]^2[Br_2]} = \frac{[1.5]^2}{[2.0]^2[4.75]} = 0.12$$

8. (2 Pts) Consider the reaction $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$. $+$ heat The production of ammonia is an exothermic reaction. Will heating the equilibrium system *increase* or *decrease* the amount of ammonia produced?

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decrease since heat is a product