Chemistry 12
Tutorial 6
Questions and Self-Test Only

1. The equilibrium equation for the formation of ***ammonia*** is:

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$$

In an **equilibrium mixture** at 200 °C, the concentrations were found to be as follows:

$[N_2] = 2.12M$, $[H_2] = 1.75M$ and $[NH_3] = 84.3M$

Notice the 3 SD's in all your data

Calculate the value of the Equilibrium Constant for this reaction at 200°C.

Answer: Keq = _____

Check your answer on page 1 of Tutorial 6 – Solutions

2. At 200°C, the Keq for the reaction: $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ is ***625***

If the $[H_2] = 0.430$ M, and the $[NH_3] = 0.10$ M, at equilibrium, calculate the equilibrium $[N_2]$.

Answer: Equilibrium $[N_2]$ = _____

Check your answer on pages 1 & 2 of Tutorial 6 – Solutions

3. Consider the following equilibrium system:

$$2NO_{(g)} + Cl_{2(g)} \rightleftharpoons 2NOCl_{(g)}$$

0.80 moles of NO and 0.60 moles of Cl_2 are placed into a 1.0 L container and allowed to establish equilibrium. At equilibrium [NOCl] = 0.56 M.

a) Calculate the equilibrium [NO]
b) Calculate the equilibrium [Cl_2]
c) Determine the value of Keq at this temperature

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NOTE: In a 1.0 Litre container, concentration is moles/ 1.0 litre, so concentration is the same as the moles. In other words, if 0.80 moles of NO are placed in a 1.0 L container, the ***initial concentration of NO*** = 0.80 M

(*Usually, you will have to construct your own "ICE" table but here's one you can use this time*)..

Write the balanced equation here

[I]			
[C]			
[E]			

a). The equilibrium [NO] = _____M

b). The equilibrium [Cl_2] = _____M

c). The value of Keq = _____

Check the answer on page 3 of Tutorial 6 – Solutions

4. Given the equilibrium equation:

$$A + 2B \rightleftharpoons C$$

When 2.0 moles of A and 4.0 moles of B are added to a 10.0 L container, an equilibrium established in which 1.4 moles of C are found.

Find the equilibrium concentrations of A, B and C.

(*Notice that you do NOT have a 1.0 L container! Also notice that the amount of C found at equilibrium is given in* **moles**, **not** *in concentration. Any moles you are given in the question* ***must be changed into concentration***. *And this time, you can make your* ***own*** *ICE table!*

The equilibrium [A] = _____

The equilibrium [B] = _____

The equilibrium [C] = _____

Check page 4 of Tutorial 6 - Solutions for the answer.

5. The equilibrium equation: $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ has a Keq = 0.50 at 25°C. If 0.60 moles of PCl_3 , 0.45 moles of Cl_2 and 0.26 moles of PCl_5 are all placed in a 1.0 L container, will the reaction move to the left, right or not at all in order to reach equilibrium?

Trial Keq = _____ Actual Keq = _____. Reaction will _____

As equilibrium is approached, what will happen to the $[PCl_5]$? _____

As equilibrium is approached, what will happen to the $[PCl_3]$? _____

As equilibrium is approached, what will happen to the $[Cl_2]$? _____

Check the answer on page 8 of Tutorial 6 – Solutions

6. Consider the reaction: $H_{2(g)} + CO_{2(g)} \rightleftharpoons H_2O_{(g)} + CO_{(g)}$

At a certain temperature the K_{eq} for this reaction = 1.50

If the initial concentration of *all four species* = 0.500 M, calculate the *equilibrium concentration* of CO_2 and CO.
Remember to determine which way the reaction has to shift in order to reach equilibrium using a Trial Keq (Sometimes this can be done in your head)
(Look at the example given before this to help you find this out.)

Answer [CO] = _____M

[CO_2] = _____M

Check page 4 of Tutorial 6 - Solutions for the answer.

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Self-Test on Tutorial 6

1. Given the equilibrium: $3A_{(g)} + B_{(g)} \rightleftarrows 2C_{(g)}$

   If 4.0 moles of A and 2.0 moles of B are added to a 2.0 L container, an equilibrium is established in which the [C] = 0.40 M.
   a) Calculate the equilibrium [A] and [B]

   Equilibrium [A] = _____

   Equilibrium [B] = _____

   b) Calculate the value of Keq at the temperature at which this was carried out.

   Keq = _____

2. Given the equilibrium equation: $A_{(g)} + B_{(g)} \rightleftarrows C_{(g)} + D_{(g)}$

   The value of Keq for this reaction at 25 °C is ***34.6***
   0.200 moles of A, B, C & D are all added to a 1.0 L container.
   Calculate the [B] at equilibrium.
   HINT: The reaction will have to shift to the _____ in order to reach equilibrium.

Equilibrium [B] = _____M

3. Consider the equation:

$$2X_{(g)} + 3Y_{(g)} \rightleftharpoons 2Z_{(g)}$$

An equilibrium mixture is analyzed and [X] is 0.030M, [Y] = 0.500M and [Z] = 0.600M

Calculate the value of Keq for this reaction.

Keq = _____

4. The Keq for the reaction: $A_{(g)} + B_{(g)} \rightleftharpoons 2C_{(g)}$ is ***1.20***

A mixture of A, B and C is analyzed and found to contain 3.0 M A, 0.40 M B and 2.50 M C.

This reaction will shift which way (left, right or not at all) in order to reach equilibrium?

Trial Keq = _____

The reaction will shift to the _____

As equilibrium is approached, the [A] will _____, [B] will _____

and the [C] will _____

Check the answers to the Self-Test starting on page 8 of Tutorial 6 - Solutions.

This is the end of Tutorial 6