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CH 16 CHEM EQUILIBRIUM: Study Guide

Terms to know and their symbols:

reaction quotient Q : ratio of conc. of products to reactants.

equilibrium constant K_{eq}

concentration $[]$

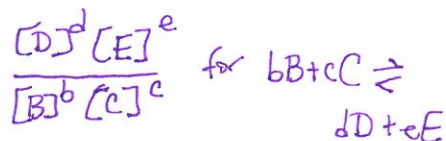
homogeneous equilibrium

equilibrium expression

reversible reaction

equilibrium position

heterogeneous equilibrium



1. What is happening when a system is in chemical equilibrium?

The rate at which reactants are consumed = rate at which products are consumed (make reactants)

2. Describe a reversible reaction.

Products can reform reactants.

3. Describe the relationship between rate and concentration for the forward reaction. The reverse reaction. Be able to interpret the graph.

As the concentration \downarrow , the rate \downarrow

4. What is the equilibrium expression for the following reaction, $eE + fF \leftrightarrow gG + hH$?

$$\frac{[G]^g [H]^h}{[E]^e [F]^f}$$

- 5.a. Write the equilibrium expression for $2CO_{(g)} \leftrightarrow C_{(s)} + CO_{2(g)}$

$$\frac{[CO_2]}{[CO]^2} \quad C \text{ is not included since it's a solid.}$$

- b. What is the reaction quotient if $[CO] = .200M$ and $CO_2 = 1.5M$?

$$Q = \frac{1.5}{(.200)^2} = 37.5 = 38$$

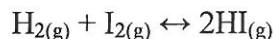
- c. If $K_{eq} = 45.9$, is the system at equilibrium? If not, will the reaction proceed to the right or to the left?

No $37.5 \neq 45.9$ \therefore not enough products \therefore will shift to the right.

- d. Does the K_{eq} for this reaction indicate whether reactants are favored or that products are favored? Know why!

Products are favored since $K_{eq} > 1$.

6. Find the concentration of I_2 in the following reaction at equilibrium given that $K_{eq} = .975$, $[H_2] = 2.0M$, and $[HI] = 1.5M$:



$$K_{eq} = \frac{[HI]^2}{[H_2][I_2]} \Rightarrow .975 = \frac{1.5^2}{2.0[I_2]} \Rightarrow \boxed{I_2 = 1.2M}$$

7. Why aren't solids or liquids included in the equilibrium expression?

Because density doesn't change much w/ temp changes.

8. If $K_{eq} \ll 1$, then what is favored, reactants or products? *reactants*

9. If $K_{eq} \gg 1$, then what is favored, reactants or products? *products*

10. If $Q < K_{eq}$, will the reaction proceed left or right? *right*

11. If $Q > K_{eq}$, will the reaction proceed left or right? *left*

12. Can K_{eq} or Q ever be zero? Less than zero? Equal to one?

Yes

No

Yes

13. What is the purpose of the reaction quotient?

To determine whether the system is in equilibrium & if not, which way it will proceed.

- 14.a. Which of the three factors can actually change an equilibrium constant? *Pressure, temperature or concentration?*

- b. How do the others affect the reaction?

They can change which direction the reax. will proceed (shift equilibrium position).

15. Describe LeChatelier's principle.

A system in equilibrium will react to changes by "undoing" the change.

16. According to LeChatelier's principle, how will a system in equilibrium react if the following conditions are imposed on it? Assume all substances in the system are gases and the reaction is endothermic.

- a. Increase reactants

*↓ reac. ∘ ∘
↑ products (right)*

- c. Increase pressure

↓ pressure lowest # gas molecules

- e. Decrease temp

↑ temp.

~~left~~

- b. Decrease products

↑ products by ↓ reactants

- d. Decrease volume

(↑ pressure) ∴ ↓ pressure # shift to side w/ least mole

- f. Remove reactants

*↑ reactants by ↓ products.
left*