

Chemistry 30

Unit 3: Chemical Equilibrium

Assignment 3: 3-1 to 3-5

Le Châtelier's Principle

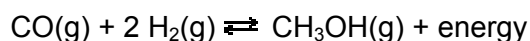
1. State Le Chatelier's Principle.

2. What are three stresses that can affect the position of an equilibrium?

Identify the one stress that will cause the value of K_{eq} to change.

3. State the effect of a catalyst on equilibrium.

4. Methanol (methyl alcohol; CH_3OH) can be manufactured using the following equilibrium reaction:



Predict the effect of the following changes on the equilibrium concentration of $\text{CH}_3\text{OH(g)}$. Will its concentration increase, decrease, or remain the same?

- a) The temperature of the system is decreased.

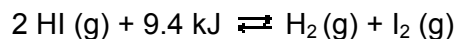
- b) The pressure of the system is increased.

- c) More $\text{H}_2\text{(g)}$ is added.

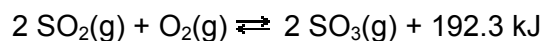
- d) A catalyst is added to the system.

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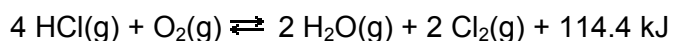
5. Use Le Chatelier's Principle to predict how the changes listed will affect the following equilibrium reaction:



- Will the concentration of HI increase, decrease, or remain the same if more H₂ is added?
 - What is the effect on the concentration of HI if the pressure of the system is increased?
 - What is the effect on the concentration of HI if the temperature of the system is increased?
 - What is the effect on the concentration of HI if a catalyst is added to the system?
 - Write the equilibrium constant expression for this reaction.
 - At 435°C the equilibrium constant for this reaction is 1.88×10^{-2} . Does equilibrium favor the reactants or products?
6. Suggest four ways to increase the concentration of SO₃ in the following equilibrium reaction:



7. In the equilibrium reaction:



Predict the direction of equilibrium shift (forward, reverse, no change) if the following changes occur:

a) the pressure is increased

b) heat is added

c) oxygen is added

d) HCl is removed

e) a catalyst is added

8. Nitric oxide, NO, releases 57.3 kJ/mol when it reacts with oxygen to give nitrogen dioxide.

a) Write a balanced equation for this reaction.

b) Write the equilibrium constant expression for this reaction.

c) Predict the effect that increasing the temperature will have on:

1) the equilibrium concentration of all reaction participants (NO, O₂, and NO₂)

2) the numerical value of the equilibrium constant, K_{eq}