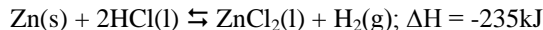


Chapter 18

Study Guide

- Write the expression for the equilibrium constant for each of the following reactions.
 - $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2\text{HCl}(\text{g})$
 - $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons 2 \text{NH}_3(\text{g})$
 - $\text{HCN}(\text{g}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{CN}^-(\text{aq})$
 - $\text{H}_2\text{SO}_4(\text{g}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{HSO}_4^-(\text{aq})$
 - $\text{PbF}_2(\text{s}) \rightleftharpoons \text{Pb}^{2+}(\text{aq}) + 2\text{F}^-(\text{aq})$
- From the data provided below, calculate the value of the equilibrium constant for the reaction.
 - $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2\text{HCl}(\text{g})$
 $[\text{H}_2] = [\text{Cl}_2] = 1.0 \times 10^{-2}$; $[\text{HCl}] = 1.0 \times 10^{-4}$
 - $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons 2 \text{NH}_3(\text{g})$
 $[\text{N}_2] = 4.4 \times 10^{-2}$; $[\text{H}_2] = 1.2 \times 10^{-1}$; $[\text{NH}_3] = 3.4 \times 10^{-3}$
- For the reaction $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$, $K_{\text{eq}} = 0.2$. At a particular time, the following concentrations are measured; $[\text{N}_2\text{O}_4] = 2.0 \text{ M}$, $[\text{NO}_2] = 0.2 \text{ M}$. Is this reaction at equilibrium? If not, in which direction will the reaction proceed?
- For the reaction $2\text{ICl}(\text{g}) \rightleftharpoons \text{I}_2(\text{g}) + \text{Cl}_2(\text{g})$, $K_{\text{eq}} = 0.11$. At a particular time, the following concentration are measured; $[\text{ICl}] = 2.5 \text{ M}$, $[\text{I}_2] = 2.0 \text{ M}$, $[\text{Cl}_2] = 1.2 \text{ M}$. Is this reaction at equilibrium? If not, in which direction will the reaction proceed?
- Name the 3 stresses that may be applied to a chemical equilibrium to cause it to shift.
- Describe LeChatelier's Principle.
- For the reaction below, mark whether the stress listed will cause the reaction to move forward or in reverse.



- | | | |
|----------------------------|-------------------------------|----------------------------|
| a. Increase Heat | e. Increase $[\text{ZnCl}_2]$ | i. Decrease $[\text{H}_2]$ |
| b. Increase Pressure | f. Increase $[\text{HCl}]$ | j. Decrease Pressure |
| c. Increase $[\text{H}_2]$ | g. Decrease $[\text{HCl}]$ | k. Decrease Heat |
| d. Increase $[\text{Zn}]$ | h. Decrease $[\text{ZnCl}_2]$ | |
- In a system at equilibrium, the _____ are equal.
 - In a system at equilibrium, the _____ are constant.
 - K_{sp} depends on the _____ of the solution.
 - How many ions are produced by the dissolution of a unit of CaCl_2 ?
 - When referred to in terms of K_{sp} , Q is called the _____. If $Q > K_{\text{sp}}$, the solution is _____. If $Q < K_{\text{sp}}$, the solution is _____. If $Q = K_{\text{sp}}$, the solution is _____.
 - What is the common-ion effect?
 - Write the expression for the solubility product constant for SrSO_4 .
 - Write the expression for the solubility product constant for $\text{Al}_2(\text{SO}_4)_3$.
 - Write the expression for the solubility product constant for AgI .
 - A sample of $\text{SrCO}_3(\text{s})$ is added to pure water and allowed to come to equilibrium at 25°C . The concentration of Sr^{2+} is $4.0 \times 10^{-5} \text{ M}$ at equilibrium. What is the value of K_{sp} for SrCO_3 ?

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18. A sample of $\text{BaSO}_4(\text{s})$ is added to pure water and allowed to come to equilibrium at 25°C . The concentration of Ba^{2+} is $1.05 \times 10^{-5} \text{M}$ at equilibrium. What is the value of K_{sp} for BaSO_4 ?
19. What will be the equilibrium concentration of dissolved ions in a saturated solution of $\text{Pb}(\text{OH})_2$ at 25°C ? K_{sp} for the reaction is 1.2×10^{-15} .
20. What will be the equilibrium concentration of dissolved ions in a saturated solution of SrSO_4 at 25°C ? K_{sp} for the reaction is 3.44×10^{-7} .