Name: Key

Ksp and Keq Quiz

You must show all work to get credit for any part of this quiz.

1) $H_{2\,(g)} + I_{2\,(g)} \leftrightarrow 2\ HI_{(g)}$

The $[H_2] = 0.189$ M and $[I_2] = 0.189$ M and $[HI] = 0.965$
If the Keq = 3.5×10^{-8} at 427 C, is the reaction at equilibrium. Explain your answer. If it's not at equilibrium, state in which direction the reaction is running.

A) **Write the Equilibrium expression (Keq) (1pt)**

$$Keq = \frac{[HI]^2}{[H_2]\cdot[I_2]}$$

B) **Calculate Q (1pt)**

$$Q = \frac{(0.965)^2}{(0.189)(0.189)} \Rightarrow Q = 26.07$$

C) **Is the reaction @ equilibrium? If it isn't. Explain if it is favoring the forward or reverse reaction.(3pt)**

Rxn isn't at equilibrium b/c $Keq \neq Q$. Since $Keq < Q$ Rxn Runs in the Reverse direction

2.) What are the equilibrium concentrations of the dissolved ions in a saturated solution of $Fe(OH)_2$ at 25 °C. (K_{sp}= 8.05×10^{-16})

A) **Write the dissolution (dissolving reaction) (1pt)**

$$Fe(OH)_{2\,(s)} \leftrightarrow Fe^{+2}_{(aq)} + 2\,OH^-_{(aq)}$$

Let $x = [Fe^{+2}] = 5.86 \times 10^{-6}$ M

Let $2x = [OH^-] = 1.17 \times 10^{-5}$ M

B) **Write the Ksp expression (1pt)**

$$Ksp = [Fe^{+2}]\cdot[OH^-]^2$$

C) **Calculate the [ ]'s of the ions (2pts)**

$$8.05 \times 10^{-16} = (x)(2x)^2 \Rightarrow 8.05 \times 10^{-16} = 4x^3 \Rightarrow \sqrt[3]{\frac{8.05 \times 10^{-16}}{4}} = x$$

$x = 5.86 \times 10^{-6}$

3.) A solution is prepared by adding 50 mL of 4.2×10^{-2} M of $MgCl_2$ to 50 mL of 6.8×10^{-2} M of Na_2CO_3 at 25 °C. The excpected precipitate has a $K_{sp} = 3.5 \times 10^{-8}$

a. **Write the dissolution (dissolving) reaction for the expected precipitate. (1pt)**

$$MgCO_{3\,(s)} \leftrightarrow Mg^{+2}_{(aq)} + CO_3^{2-}{}_{(aq)}$$

b. **Write the Ksp expression for the expected precipitate. (1pt)**

$$Ksp = [Mg^{+2}]\cdot[CO_3^{2-}]$$

c. **Calculate the moles of Mg^{+2} in its initial solution (1pt)**

$$4.2 \times 10^{-2}\,M = \frac{x\ mol\ Mg^{+2}}{0.050\ L} \qquad mol\ Mg^{+2} = 2.1 \times 10^{-3}\ mol\ Mg^{+2}$$

d. **Calculate the moles of CO_3^{-2} in its initial solution (1pt)**

$$6.8 \times 10^{-2}\,M = \frac{x\ mol\ CO_3^{-2}}{0.050\ L} \qquad mol\ CO_3^{-2} = 3.4 \times 10^{-3}\ mol\ CO_3^{2-}$$

e. **Calculate the Molarity of of Mg^{+2} after the solutions are mixed (1pt)**

$$M = \frac{2.1 \times 10^{-3}\ mol}{0.10\ L} = 2.1 \times 10^{-2}\ M$$

f. **Calculate the Molarity of CO_3^{-2} after the solutions are mixed (1pt)**

$$M = \frac{3.4 \times 10^{-3}\ mol}{0.10\ L} = 3.4 \times 10^{-2}\ M$$

g. **Solve for Q (1pt)**

$$Q = (2.1 \times 10^{-2})(3.4 \times 10^{-2}) = 7.14 \times 10^{-4}$$

h. **Relate Q to Ksp and explain if a precipitate forms (1pt)**

Ksp vs Q

$3.5 \times 10^{-8} < 7.1 \times 10^{-4}$ ∴ Rxn Runs Left & precipitate forms

Name: Key **Ksp and Keq Quiz**

You must show all work to get credit for any part of this quiz.

1) $H_{2\,(g)} + I_{2\,(g)} \leftrightarrow 2\,HI_{(g)}$

The $[H_2] = 0.528$ M and $[I_2] = 0.528$ M and $[HI] = 4.823$
If the Keq = 54.0 at 427 C, is the reaction at equilibrium. Explain your answer. If it's not at equilibrium, state in which direction the reaction is running.

A) **Write the Equilibrium expression (Keq) (1pt)**

$$Keq = \frac{[HI]^2}{[H_2]\cdot[I_2]}$$

B) **Calculate Q (1pt)**

$$Q = \frac{(4.823)^2}{(0.528)(0.528)} \Rightarrow Q = 83.44$$

C) **Is the reaction @ equilibrium? If it isn't. Explain if it is favoring the forward or reverse reaction.(3pt)**

Rxn isn't at equilibrium b/c $Keq \neq Q$. Since $Keq < Q$ (54.0 < 83.44) Rxn Runs Reverse

2.) What are the equilibrium concentrations of the dissolved ions in a saturated solution of $Mg(OH)_2$ at 25 ^{0}C. (K_{sp} 3.5 x 10^{-8})

A) **Write the dissolution (dissolving reaction) (1pt)**

$$Mg(OH)_{2(s)} \leftrightarrow Mg^{+2}_{(aq)} + 2\,OH^-_{(aq)}$$

Let $x = [Mg^{+2}] = 2.06\times10^{-3}$ M

Let $2x = [OH^-] = 4.12\times10^{-3}$ M

B) **Write the Ksp expression (1pt)**

$$Ksp = [Mg^{+2}]\cdot[OH^-]^2$$

C) **Calculate the [ ]'s of the ions (2pts)**

$3.5\times10^{-8} = (x)(2x)^2$

$3.5\times10^{-8} = 4x^3$

$\sqrt[3]{\frac{3.5\times10^{-8}}{4}} = x$

$x = 2.06\times10^{-3}$ M

$2x = 4.12\times10^{-3}$ M

3.) A solution is prepared by adding 50 mL of 7.5 x 10^{-2} M of $CaCl_2$ to 50 mL of 5.0 x 10^{-2} M of Na_2CO_3 at 25 ^{0}C. The excpected precipitate has a K_{sp} = 2.8x 10^{-9}

a. **Write the dissolution (dissolving) reaction for the expected precipitate. (1pt)**

$$CaCO_{3(s)} \leftrightarrow Ca^{+2}_{(aq)} + CO_3^{2-}{}_{(aq)}$$

b. **Write the Ksp expression for the expected precipitate. (1pt)**

$$Ksp = [Ca^{+2}]\cdot[CO_3^{2-}]$$

c. **Calculate the moles of Ca^{+2} in its initial solution (1pt)**

$7.5\times10^{-2}\,M = \frac{x \text{ mol } Ca^{+2}}{0.050\,L}$ mol Ca^{+2} = 3.75×10^{-3} mol Ca^{+2}

d. **Calculate the moles of CO_3^{-2} in its initial solution (1pt)**

$5.0\times10^{-2}\,M = \frac{x \text{ mol } CO_3^{2-}}{0.050\,L}$ mol CO_3^{2-} = 2.5×10^{-3} mol CO_3^{2-}

e. **Calculate the Molarity of of Ca^{+2} after the solutions are mixed (1pt)**

$M = \frac{3.75\times10^{-3}\text{ mol}}{0.10\,L} = 3.75\times10^{-2}\,M = [Ca^{+2}]$

f. **Calculate the Molarity of CO_3^{-2} after the solutions are mixed (1pt)**

$M = \frac{2.5\times10^{-3}\text{ mol}}{0.10\,L} = 2.5\times10^{-2}\,M = [CO_3^{2-}]$

g. **Solve for Q (1pt)**

$Q = (3.75\times10^{-2})(2.5\times10^{-2})$ $Q = 9.375\times10^{-4}$

h. **Relate Q to Ksp and explain if a precipitate forms (1pt)**

Ksp vs Q

$2.8\times10^{-9} < 9.4\times10^{-4}$ ∴ Rxn Runs Left & precipitate forms