This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

Msci 18 0907
001 10.0 points

What is the concentration of SO_4^{2-} in 2.0 M H_2SO_4? K_{a1} is strong and $K_{a2} = 1.2 \times 10^{-2}$.

1. 4.0×10^{-1} M

2. 4.0×10^{-2} M

3. 1.0×10^{-7} M

4. 2.0×10^{-1} M

5. 1.2×10^{-2} M **correct**

Explanation:

Msci 20 0604
002 10.0 points

AgCl would be least soluble in

1. 0.1 M HNO_3.

2. 0.1 M NH_3.

3. pure water.

4. 0.1 M $CaCl_2$. **correct**

5. 0.1 M HCl.

Explanation:

Msci 20 0402b
003 10.0 points

Consider the following K_{sp} values for metal carbonates:
$CdCO_3 = 2.5 \times 10^{-14}$ $CoCO_3 = 8.0 \times 10^{-13}$
$CuCO_3 = 2.5 \times 10^{-10}$ $PbCO_3 = 1.5 \times 10^{-13}$

Which pair would best be separated by fractional precipitation?

1. Cd^{2+} and Cu^{2+} **correct**

2. Co^{2+} and Cu^{2+}

3. Cu^{2+} and Pb^{2+}

4. Cd^{2+} and Co^{2+}

5. Co^{2+} and Pb^{2+}

6. Cd^{2+} and Pb^{2+}

Explanation:

All the salts are 1:1 ratios so the K_{sp}'s can be directly compared for solubility. The pair that will be the easiest to separate will be the pair that have their K_{sp} values the farthest apart (Cd and Cu).

DAL Hydron Concen
004 10.0 points

Which of the following solutions of weak acids has a hydronium ion concentration that is most accurately calculated by

$$[H_3O^+] = (K_a C_a)^{1/2}$$

1. CH_3COOH, $K_a = 1.8 \times 10^{-5}$, $C_a = 0.001$ M

2. HCOOH, $K_a = 1.8 \times 10^{-4}$, $C_a = 0.01$ M

3. HCOOH, $K_a = 1.8 \times 10^{-4}$, $C_a = 0.001$ M

4. CH_3COOH, $K_a = 1.8 \times 10^{-5}$, $C_a = 0.01$ M **correct**

Explanation:

Msci 18 0357
005 10.0 points

What is the pH of a solution labeled 1.6×10^{-6} M KOH?

1. 8.2 **correct**

2. 8.8

3. 6.6

4. 7.4

5. 5.2

Explanation:
$[\text{KOH}] = 1.6 \times 10^{-6}$ M

$$\text{KOH} \rightleftharpoons \text{K}^+ + \text{OH}^-$$

$$[\text{OH}^-] = [\text{KOH}] = 1.6 \times 10^{-6}\ \text{M}$$

$$\begin{aligned}\text{pOH} &= -\log[\text{OH}^-] = -\log(1.6 \times 10^{-6}) \\ &= 5.79588\end{aligned}$$

$$\text{pH} = 14 - \text{pOH} = 14 - 5.79588 = 8.20412$$

DAL Mass Charge Balance
006 10.0 points

Which of the following is a correct mass balance expression for the addition of H_2CO_3 to water?

1. $C_{\text{H}_2\text{CO}_3} = [\text{H}_2\text{CO}_3] + [\text{HCO}_3^-] + [\text{CO}_3^{2-}]$ **correct**

2. $[\text{H}^+] = [\text{HCO}_3^-] + [\text{CO}_3^{2-}] + [\text{OH}^-]$

3. $C_{\text{H}_2\text{CO}_3} = [\text{HCO}_3^-] + [\text{CO}_3^{2-}]$

4. $K_\text{w} = [\text{H}^+] + [\text{OH}^-]$

Explanation:

Sys Treat Equil 01
007 10.0 points

NaF, NaCl, and HBr are dissolved in water. How many equations are needed to describe this system?

1. 6

2. 8

3. 5

4. 7 **correct**

5. 4

Explanation:
The species Na^+, HF, F^-, Cl^-, Br^-, H^+, and OH^- will be present in the water.

Msci 20 0603
008 10.0 points

Solid $Mg(OH)_2$, which has a solubility product constant of 1.5×10^{-11}, dissolves in water when NH_4Cl is added to the solution because

1. OH^- ion reacts with Cl^- ion to form the weak acid HClO.

2. $MgCl_2$ is a salt and completely ionized in water solution.

3. one of the ions from $Mg(OH)_2$ is oxidized to form a different species.

4. Mg^{+2} forms a very stable complex ion with ammonia.

5. OH^- ion is converted to NH_4OH by reaction with NH_4^+. **correct**

Explanation: