HW02 - Colligative Properties and Solubility Equilibria

Started: Jan 23 at 6:54am

Quiz Instructions

Homework 02

Colligative Properties and Solubility Equilibria

Question 1	1 pts

Some distilled water is added to an empty beaker. A gram of copper (II) nitrate is added to the beaker and while the water is being stirred. After a few minutes, what is in the beaker?

○ solid copper, nitrate ions, and water

○ nitrogen gas, copper atoms, electrons, and water

○ copper ions, nitrate ions, and water

○ solid copper (II), nitrate, and water

Question 2	1 pts

In which of the following pairs do both compounds have a van't Hoff factor (i) of 2?

○ glucose and sodium chloride

○ sodium chloride and magnesium sulfate

○ perchloric acid and barium hydroxide

○ sodium sulfate and potassium chloride

Question 3	1 pts

For solutions of a non-electrolyte, the van't Hoff factor is:

○ $i = 0$

○ $i = 3$

○ $i = 1$

○ $i = 2$

Question 4   **1 pts**

How many moles of ions are contained in 1.27 L of a 1.75 M solution of $Mg(NO_3)_2$?

○ 0.741 mol

○ 6.67 mol

○ 2.22 mol

○ 4.45 mol

Question 5   **1 pts**

Theoretically, it should be harder to dissolve (NaCl / Al_2S_3) in water because the (higher / lower) the charge density of a substance, the lower its solubility.

○ Al_2S_3, lower

○ NaCl, higher

○ NaCl, lower

○ Al_2S_3, higher

Question 6   **1 pts**

The freezing point of seawater is about -1.85°C. If seawater is an aqueous solution of sodium chloride, calculate the

molality of seawater. The k_f for water is 1.86 K/m.

○ 0.497 m

○ -0.497 m

○ 0.995 m

○ 1.99 m

Question 7

1 pts

What will be the freezing point of a solution of 8 moles of sodium dichromate ($Na_2Cr_2O_7$) dissolved in 16 kg of water?
Use the following values:

K_b = 0.512 K/m

K_f = 1.86 K/m

○ 272.2 K

○ 2.8°C

○ 275.8 K

○ 270.2 K

Question 8

1 pts

Calculate the vapor pressure at 20°C of a solution containing 0.61g of naphthalene in 16g of chloroform ($CHCl_3$).
Naphthalene ($C_{10}H_8$) has a low vapor pressure and may be assumed to be nonvolatile. The vapor pressure of
chloroform at 20°C is 156 torr.

○ 20.90 torr

○ 28.10 torr

○ The vapor pressure would not change as naphthalene is considered non-volatile.

○ 150.65 torr

Question 9   1 pts

Rank the following aqueous solutions from lowest to highest boiling point: 0.5 m NaCl, 1 m KCl, 0.5 m $BaCl_2$, and 1 m $Ba(NO_3)_2$. All salt are dissolved in water.

○ 1 m $Ba(NO_3)_2$ < 0.5 m NaCl < 0.5 m $BaCl_2$ < 1 m KCl

○ 1 m KCl < 1 m $Ba(NO_3)_2$ < 0.5 m NaCl < 0.5 m $BaCl_2$

○ 0.5 m $BaCl_2$ < 1 m KCl < 1 m $Ba(NO_3)_2$ < 0.5 m NaCl

○ 0.5 m NaCl < 0.5 m $BaCl_2$ < 1 m KCl < 1 m $Ba(NO_3)_2$

Question 10   1 pts

A semi-permeable membrane can withstand an osmotic pressure of 0.75 atm. What molarity of aqueous magnesium bromide solution would reach the limit for this membrane? (Assume RT = 25 $L \cdot atm \cdot mol^{-1}$)

○ 0.03 M

○ 0.01 mM

○ 0.03 mM

○ 0.01 M

Question 11   1 pts

Catalase (a liver enzyme) dissolves in water. A 14mL solution containing 0.166g of catalase exhibits an osmotic pressure of 1.2 Torr at 20°C. What is the molar mass of catalase?

○ 1.49×10^5 g/mol

○ 1.81×10^5 g/mol

○ 2.81×10^5 g/mol

○ 1.69×10^5 g/mol

Question 12   1 pts

Two aqueous solutions are separated by a semi-permeable membrane:

Solution A = 0.34 M KCl

Solution B = 0.34 M $MgCl_2$

Which of the following statements is TRUE?

- ○ There is a net flow of Cl^- ions from solution B to solution A.

- ○ There is no net flow of H_2O molecules from one solution to another.

- ○ There is a net flow of H_2O molecules from solution A to solution B.

- ○ There is a net flow of H_2O molecules from solution B to solution A.

Question 13   1 pts

Red blood cells contain Na^+ ions, K^+ ions, and water. If we place some red blood cells into a beaker full of pure water, what will happen to them?
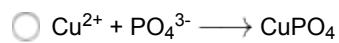
- ○ they will swell and burst

- ○ they will wiggle around rapidly

- ○ nothing

- ○ they will shrivel and collapse

Question 14   1 pts

What is the net ionic equation for the reaction between aqueous solutions of Na_3PO_4 and $CuSO_4$?

- ○ $2Na^+ + SO_4^{2-} \longrightarrow Na_2SO_4$

- ○ $3Cu^{2+} + 2PO_4^{3-} \longrightarrow Cu_3(PO_4)_2$

- ○ No reaction occurs since no precipitate is formed.

○ $Cu^{2+} + PO_4^{3-} \longrightarrow CuPO_4$

Question 15

1 pts

What ions are present in solution after aqueous solutions of $Cu(NO_3)_2$ and K_2S are mixed? Assume we mixed stoichiometric equivalent amounts of both reactants and 100% reaction.

○ No ions are present as both products form precipitates.

○ Cu^{2+}, NO_3^-, K^+, S^{2-}

○ K^+, NO_3^-

○ Cu^{2+}, S^{2-}

Question 16

1 pts

Molar solubility is...

○ the total molarity of the solution.

○ equal to the K_{sp}.

○ the number of moles that dissolve to give one liter of super-saturated solution.

○ the number of moles that dissolve to give one liter of saturated solution.

Question 17

1 pts

The K_{sp} eqution for sodium bicarbonate ($NaHCO_3$) should be written as:

○ $K_{sp} = [Na^+][HCO_3^-]$

○ $K_{sp} = [Na^+][H^+][C^{4+}][O^{2-}]^3$

○ $K_{sp} = [Na^+][H^+][CO_3^{2-}]$

○

$K_{sp} = [NaH^{2+}][CO_3^{2-}]$

Question 18

1 pts

Pure water is saturated with $PbCl_2$. In this saturated solution, which of the following is true?

○ $K_{sp} = [Pb^{2+}][Cl^-]$

○ $K_{sp} = [Pb^{2+}]^2[Cl^-]$

○ $[Pb^{2+}] = [Cl^-]$

○ $[Pb^{2+}] = 0.5[Cl^-]$

Question 19

1 pts

A hypothetical ionic substance T_3U_2 ionizes to form T^{2+} and U^{3-} ions. The solubility of T_3U_2 is 4.04×10^{-20} mol/L. What is the value of the solubility-product constant?

○ 9.79×10^{-39}

○ 1.08×10^{-97}

○ 1.63×10^{-39}

○ 1.16×10^{-95}

Question 20

1 pts

The value of K_{sp} for $SrSO_4$ is 2.8×10^{-7}. What is the solubility of $SrSO_4$ in moles per liter?

○ 5.3×10^{-4}

○ 2.8×10^{-7}

○ 1.4×10^{-7}

○

7.6 x 10^{-7}

Question 21

1 pts

Determine the molar solubility of some salt with the generic formula AB_2 if $K_{sp} = 2.56\times10^2$.

○ 10 M

○ 0.1 M

○ 4 M

○ 1 M

Question 22

1 pts

Rank the following salts from least to most molar solubility:

BiI $K_{sp} = 7.7\times10^{-19}$

$Cd_3(AsO_4)_2$ $K_{sp} = 2.2\times10^{-33}$

$AlPO_4$ $K_{sp} = 9.8\times10^{-21}$

$CaSO_4$ $K_{sp} = 4.9\times10^{-5}$

○ $AlPO_4 < BiI < Cd_3(AsO_4)_2 < CaSO_4$

○ $CaSO_4 < BiI < AlPO_4 < Cd_3(AsO_4)_2$

○ $Cd_3(AsO_4)_2 < AlPO_4 < BiI < CaSO_4$

○ $Cd_3(AsO_4)_2 < BiI < AlPO_4 < CaSO_4$

Question 23

1 pts

A hypothetical compound MX_3 has a molar solubility of 0.00562 M. What is the value of K_{sp} for MX_3?

○ 3.16 x 10^{-5}

○ 2.99 x 10^{-9}

○ 9.48 x 10^{-5}

○ 2.69 x 10^{-8}

Question 24   2 pts

Determine if a precipitate will form when 0.96g Na_2CO_3 is combined with 0.2g $BaBr_2$ in a 10L solution. (For $BaCO_3$, K_{sp} = 2.8x10^{-9}).

○ $BaCO_3$ precipitates

○ $BaCO_3$ does not precipitate

○ It is impossible to know if any $BaCO_3$ will precipitate with the information given.

○ $BaBr_2$ will remain in solid form as it is insoluble in water.

Question 25   1 pts

$CaSO_4$ has a K_{sp} = 3x10^{-5}. In which of the following would $CaSO_4$ be the most soluble?

○ 1.0 M $CaCl_2$(aq)

○ $CaSO_4$ would have the same solubility in all three of these solutions

○ 0.5 M K_2SO_4(aq)

○ pure water

Question 26   2 pts

A solution of AgI contains 1.9 M Ag^+. K_{sp} of AgI is 8.3 x 10^{-17}. What is the maximum I^- concentration that can exist in this solution?

○ 1.6x10^{-16} M

○ 1.9 M

○ 8.3x10^{-17} M

○ 4.4x10^{-17} M

Question 27   **2 pts**

What would be the molar solubility of Li_3PO_4 (K_{sp} = 2.37 x 10^{-4}) in a 1M LiCl solution?

○ 2.37 x 10^{-4}

○ 5.44 x 10^{-2}

○ 1.24 x 10^{-1}

○ 1.54 x 10^{-2}

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