

WORKSHEET: SOLUTIONS AND COLLIGATIVE PROPERTIES

SET A:

1. Find the molarity of all ions in a solution that contains 0.165 moles of aluminum chloride in 820. ml solution.

Answer: $[Al^{3+}] = 0.201\text{ M}$, $[Cl^-] = 0.603\text{ M}$.

2. Find the molarity of each ion present after mixing 27 ml of 0.25 M HNO_3 with 36 ml of 0.42 M $Ca(NO_3)_2$ (Note: There is no reaction taking place.)

Answer: $[H^+] = 0.11\text{ M}$, $[NO_3^-] = 0.59\text{ M}$, $[Ca^{2+}] = 0.24\text{ M}$.

3. Find the molarity of each ion present after mixing 35 ml of 0.42 M K_2SO_4 with 27 ml of 0.17M K_3PO_4 .

Answer: $[K^+] = 0.71\text{ M}$, $[SO_4^{2-}] = 0.24\text{ M}$, $[PO_4^{3-}] = 0.074\text{ M}$.

4. Calculate the concentration of each ion and the mass of any precipitate when a 0.300 mole of aluminum hydroxide is added to 50.0 ml of 2.5 M nitric acid solution (Assume that there is no volume change upon the addition of the aluminum hydroxide to the solution).

Hint: Write a balanced equation for the reaction taking place.

Answer: 20 g $Al(OH)_3$ left over, $[Al^{3+}] = 0.83\text{ M}$, $[NO_3^-] = 2.5\text{ M}$

5. A solution consists of 3.88 g benzene, C_6H_6 , and 2.45 g toluene, $C_6H_5CH_3$. The vapor pressure of pure benzene at 20. °C is 75 mm Hg and that of toluene at 20.0 °C is 22 mm Hg. Assume that Raoult's law holds for each component of the solution, calculate the mole fraction of benzene in the vapor. (molar mass of benzene = 78.0 g/mole and toluene = 92.0 g/mole.)

Answer = 0.87

6. The freezing point of a glucose solution ($C_6H_{12}O_6$, molar mass = 180.0 g/mole) is - 10.3 °C . The density of the solution is 1.50 g/ml. What is the molarity of the glucose solution? (K_f for water is 1.86 °C.kg/mole)

Answer: 4.16 mole/L

7. What is the normal boiling point of a 2.70 M solution of KBr that has a density of 1.80 g/ml? (K_b for H_2O is 0.512 °C .kg/mole)

Answer =: 101.9 °C

8. 28.00 ml of 0.670 M potassium carbonate solution is mixed with 15.00 ml of 0.940 M cobalt(III) chloride

a. Write a balanced equation for the reaction.

b. Write the total-ionic and net-ionic equations for the above reaction.

Total ionic:

Net-ionic:

c. Give the name and mass of any precipitate(s) that may have formed.

Answer: 1.87 g of $Co_2(CO_3)_3$ precipitate.

Calculate the molar concentration of each ion remaining in solution after the reaction is complete.

Answer: concentration of potassium ions = 0.874 M

concentration of cobalt (III) ions = 0.0372 M

concentration of carbonate ions = 0 M

concentration of chloride ions = 0.986 M

SET B:

1. A solution that contains 12.6 g of a nonvolatile nondissociating solute in 400. g of benzene freezes at 3.6 °C . The normal freezing point of benzene is 5.5 °C. What is the molar mass of the solute? (K_f for benzene = 4.96 °C .kg/mole)

Answer: 82 g/mole

2. Chloroform and methanol form an ideal solution. The solution boils at 22 °C and 0.255 atm . At 22 °C , the vapor pressure of pure methanol is 0.192 atm and the vapor pressure of pure chloroform is 0.311 atm. What is the mole fraction of chloroform in the solution?

Answer: 0.529

Colligative Properties Of Solutions Worksheet Answers

Ying-Ying Zheng



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