**Chapter 15 Review Problems**

**Day 1: Chapter 15.1 Water and its Properties**

1. What is unique about water in the solid state in comparison with most molecular compounds with similar molar masses when they freeze? Draw a diagram of the structure of solid water to support your answer.
2. Given the extensive hydrogen bonding of water, list three unique properties of water.

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1. What effect does a surfactant have on the surface tension of water?
2. Water (H2O) and methane (CH4) have similar molar masses. Methane changes from a liquid to a gas at - 161°C. Water becomes a gas at 100°C. Describe the factor(s) that account for this difference.

**Day 2: 15.2 Homogenous solutions**

1. Calculate the percent by mass of water in CuSO4·5H2O.
2. Why do hydrates easily lose water when heated and regain water when exposed to moisture?
3. Which of the following substances dissolve to a significant extent in water? Explain your answer in terms of the interactions between the solvent and solute:
   1. CH4
   2. KCl
   3. I2
   4. BaSO4
   5. Sucrose (C12H2sO11)
   6. NaHCO3

40) Describe the process of solvation

66) Explain which properties are responsible for each occurrence

a) Water in tiny cracks in rocks helps break up the rocks when it freezes.

b) Water beads up on a newly waxed car

c) A longer time is needed for a teaspoon of water to evaporate when compared to an equal volume of alcohol.

**Day 3: 15.3 Heterogeneous solutions**

1. List three distinguishing properties for suspensions, colloids and solutions. Which of these are observable?
2. List 3 examples of suspensions, of colloids and of solutions.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Suspension | Colloids | Solutions |
| Example 1 |  |  |  |
| Example 2 |  |  |  |
| Example 3 |  |  |  |

48) Write the formulas for these hydrates:

Sodium sulfate decahydrate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Calcium chloride dehydrate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Barium hydroxide octahydrate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

49) Name each hydrate

SnCl4 ·5H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

FeSO4·7H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

FePO4·4H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

70) Explain why ethanol (CH3CH2OH) will dissolve in both water and gasoline.

**Chapter 16 Review/Homework Problems**

**Day 4: 16.1 Properties of Solutions**

1. The solubility of a gas in water is 0.16 g/L at 104 kPa. What is the solubility when the pressure of the gas is increased to 288 kPa? Assume the temperature remains constant.
2. A gas has a solubility in water of 3.6 g/L at a pressure of 1.0 atm at 0 °C. What pressure is needed to produce an aqueous solution containing 9.5 g/L of the same gas at 0 °C?
3. What determines how fast a substance will dissolve?

6) Name a unit used to express solubility. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8) What would you do to change

(a) a saturated solid/liquid solution to an unsaturated solution?

(b) a saturated gas/liquid solution to an unsaturated solution?

**Day 5-6:16.2 Concentrations of Solutions**

*Complete two questions for this day, but ALSO determine the equation needed for EACH question.*

1. A solution has a volume of 2.0L and contains 36.0 g of glucose (C6H12O6). If the molar mass of glucose is 180 g/mol, what is the molarity of the solution?

Equation needed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A solution has a volume of 250 mL contains 0.70 mol NaCl. What is its molarity?

Equation needed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How many moles of solute are in 250 mL of 2.0M CaCl2? How many grams of CaCl2 is this?

Equation needed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If 10.0 mL of propanone (C3H6O or acetone) is diluted with water to a total solution volume of 200 mL, what is the percent by volume of propanone in the solution?

Equation needed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A bottle of the antiseptic hydrogen peroxide (H2O2) is labeled 3% (v/v). How many ml of H2O2 are in a 400.0 mL bottle of this?

Equation needed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate the grams of solute required to make 250 g of 0.10% MgSO4 (m/m).

Equation needed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How many milliliters of a solution of 4.00M KI are needed to prepare 250.0 mL of 0.760M KI?

Equation needed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Day 7-8: 16.3 Colligative Properties of Solutions and Calculations**

30) Why does a solution have a depressed boiling point and an elevated boiling point compared with the pure solvent?

34) How many grams of sodium fluoride are needed to prepare a 0.400m NaF solution that contains 750 g of water?

35) Calculate the molality of a solution prepared by dissolving 10.0 g NaCl in 600g of water.

**Day 9-10: Ch 16.4: Calculations involving Colligative Properties**

38) What is the freezing point depression of an aqueous solutions of 10.0 g of glucose (C6H12O6) in 50.0 grams of water? Given Kf = 1.86 °C/m

39) Calculate the freezing point depression of a benzene solution containing 400 g of benzene and 200 g of a molecular compound (C3H6O). Kf for benzene is 5.12 °C/m

40) What is the boiling point of a solution that contains 1.25 mol CaCl2 in 1400 g of water?

41) What mass of NaCl would have to be dissolved in 1.000 kg of water by raising the boiling point 2.00 °C?

61) Calculate the grams of solute required to make the following solutions?

a) 2500 g of saline solution (0.90% NaCl m/m)

b) 0.050 kg of a 4.0% (m/m) MgCl2

72) What is the freezing point of each solution?

a) 0.50 mol glucose(C6H12O6) in 1000g water

b) 1.50 mol NaCl in 1000g water