

## HW02 - Colligative Properties

### Question 1

2 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?

- copper ions, nitrate ions, and water
- nitrogen gas, copper atoms, electrons, and water
- solid copper (II), nitrate, and water
- solid copper, nitrate ions, and water

### Question 2

2 pts

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

- glucose and sodium chloride
- sodium sulfate and potassium chloride
- perchloric acid and barium hydroxide
- sodium chloride and magnesium sulfate

### Question 3

2 pts

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

- $i = 0$
- $i = 3$
- $i = 1$
- $i = 2$

### Question 4

2 pts

How many moles of ions are contained in 1.27 L of a 1.75 M solution of  $\text{Mg}(\text{NO}_3)_2$ ?

- 6.67 mol
- 4.45 mol
- 2.22 mol
- 0.741 mol

### Question 5

2 pts

Theoretically, it should be harder to dissolve ( $\text{NaCl}$  /  $\text{Al}_2\text{S}_3$ ) in water because the (higher / lower) the charge density of a substance, the lower its solubility.

- $\text{Al}_2\text{S}_3$ , lower
- $\text{NaCl}$ , lower
- $\text{Al}_2\text{S}_3$ , higher
- $\text{NaCl}$ , higher

### Question 6

3 pts

The freezing point of seawater is about  $-1.85^\circ\text{C}$ . Assume that seawater is an aqueous solution of sodium chloride and then calculate the molality of  $\text{NaCl}$  in seawater. The  $K_f$  for water is  $1.86\text{ K/m}$ .

- $0.995\text{ m}$
- $-0.497\text{ m}$
- $0.497\text{ m}$
- $1.99\text{ m}$

### Question 7

3 pts

What will be the freezing point of a solution of 8 moles of sodium dichromate ( $\text{Na}_2\text{Cr}_2\text{O}_7$ ) dissolved in 16 kg of water? Use the following values:

$$K_b = 0.512\text{ K/m}$$

$$K_f = 1.86\text{ K/m}$$

- $272.2\text{ K}$
- $2.8^\circ\text{C}$
- $270.2\text{ K}$
- $275.8\text{ K}$

### Question 8

3 pts

Calculate the vapor pressure at  $20^\circ\text{C}$  of a solution containing 0.61g of naphthalene in 16g of chloroform ( $\text{CHCl}_3$ ). Naphthalene ( $\text{C}_{10}\text{H}_8$ ) has a low vapor pressure and may be assumed to be nonvolatile. The vapor pressure of chloroform at  $20^\circ\text{C}$  is 156 torr.

- 150.65 torr
- The vapor pressure would not change as naphthalene is considered non-volatile.
- 28.10 torr
- 20.90 torr

**Question 9**

2 pts

Rank the following aqueous solutions from lowest to highest boiling point: 0.5 m NaCl, 1 m KCl, 0.5 m BaCl<sub>2</sub>, and 1 m Ba(NO<sub>3</sub>)<sub>2</sub>. All salt are dissolved in water.

- 1 m KCl < 1 m Ba(NO<sub>3</sub>)<sub>2</sub> < 0.5 m NaCl < 0.5 m BaCl<sub>2</sub>
- 1 m Ba(NO<sub>3</sub>)<sub>2</sub> < 0.5 m NaCl < 0.5 m BaCl<sub>2</sub> < 1 m KCl
- 0.5 m BaCl<sub>2</sub> < 1 m KCl < 1 m Ba(NO<sub>3</sub>)<sub>2</sub> < 0.5 m NaCl
- 0.5 m NaCl < 0.5 m BaCl<sub>2</sub> < 1 m KCl < 1 m Ba(NO<sub>3</sub>)<sub>2</sub>

**Question 10**

2 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  $RT = 25 \text{ L}\cdot\text{atm}\cdot\text{mol}^{-1}$ )

- 0.01 M
- 0.03 mM
- 0.03 M
- 0.01 mM

**Question 11**

3 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?

- $2.81 \times 10^5 \text{ g/mol}$
- $1.69 \times 10^5 \text{ g/mol}$
- $1.81 \times 10^5 \text{ g/mol}$
- $1.49 \times 10^5 \text{ g/mol}$

**Question 12**

2 pts

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

Solution A = 0.34 M KCl

Solution B = 0.34 M MgCl<sub>2</sub>

Which of the following statements is TRUE?

- There is a net flow of H<sub>2</sub>O molecules from solution A to solution B.
- There is a net flow of H<sub>2</sub>O molecules from solution B to solution A.
- There is no net flow of H<sub>2</sub>O molecules from one solution to another.
- There is a net flow of Cl<sup>-</sup> ions from solution B to solution A.

**Question 13**

2 pts

Red blood cells contain Na<sup>+</sup> ions, K<sup>+</sup> ions, and water. If we place some red blood cells into a beaker full of pure water, what will happen to them?

- they will wiggle around rapidly
- nothing
- they will swell and burst
- they will shrivel and collapse