CHEM 1451 Lab Week 08 Colligative Properties Prelab and Data

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PRELAB

Show your all work and use the correct number of significant figures and units.

1. A calcium iodide solution is made by mixing 0.520 g of calcium iodide with 120.0 mL of water.

a. Determine the moles of calcium iodide used to make the solution. (9 pts)

molar of CaI_2 = 293.887 gm/mole that mean 1 mole of CaI_2 = 293.887gm then 0.520gm of CaI_2 is equal to how many mole of CaI_2?

ole of CaI_2 = 0.520 x 1/293.887 = 0.001769 mole

0.001769 mole used to make solution

b. Determine the mass of solvent used to make the solution. Assume that the density of water is 1.000 g/mL. (9 pts)

Density = mass/volume

mass = density x volume = 1 x 120 = 120g

c. Determine the molality of calcium iodide of the solution. (9 pts)

120gm = 0.12Kg

molality = number of mole of solute/mass of solvent in Kg

molality = 0.001769/0.12 = 0.01474m

molality of calcium iodide of solution = 0.014744m

d. Determine the molality of all solutes of the solution. (Hint: Calcium iodide completely ionizes when dissolved in water. All solutes means all cations and anions.) (9 pts)

$$m = \frac{0.520}{294} \times \frac{1000}{120} = 0.0147m$$

2. Calculate the mass of barium chloride you need to make a 0.200 *m* barium chloride solution with 100.0 g of water. (9 pts)

0.200m = 0.2 moles/1000g of water

0.02 moles of $BaCl_2$ = 0.02 x 208.23 = 4.16g

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3. Consider a 0.15 *m* calcium chloride aqueous solution.

a. Determine the molality of all solutes in the solution. Assume that calcium chloride completely ionizes when dissolved in water. All solutes means all cations and anions. The molality that you determine here is the value for m_{solute} of **(Eq. 3)** in the "Background and Procedure" file. **You must explain your answer. No credit will be given if you write only the molality.** (9 pts) molality of $CaCl_2$ Solution (m) = 0.15 mols/Kg Sol

As $CaCl_2$ dissolved in solution it is completely dissociate in to i

$CaCl_2 \xrightarrow{H_2O} Ca^{+2} + 2Cl^-$

1m 1m 2m $[CaCl_2] = 0$; $[Ca^{+2}] = [Cl^-] = 2 \times 0.15$

ity of all species is $CaCl_2$ Solution $= 0.15 + 0.30 =$ 0.45 mols/Kg Solvent $= 0.15m = 0.30$

b. Consult **Table 1** in the "Background and Procedure" file. Select the molal freezing point depression constant for the solution. Make sure to write the units! (Hint: What is the solvent?) (8 pts)

$K_f =$ 1.86°C Kg/mole

AS the solute $CaCl_2$ taken in water we would take H_2O Depre Constant

c. Determine the magnitude of the freezing point depression (ΔT) of the solution. Show your calculation. (9 pts)

$\Delta T_f = K_f \times m$

$T_0 - T = 1.86°C\ Kg/mole \times 0.45 moles/Kg\ solvent$

$= 0.837°C$

$\Delta T_f = 0.0837°C$

d. Determine the freezing point of the solution. The freezing point of water is 0.00°C. Show your calculation. (9 pts)

freezing point of water (T_0) = 0°C

freezing point of 0.15m $CaCl_2$ Solution (T_S) = ?

$\Delta T_f = 0.837°C$

$T_0 - T_S = 0.837°C$

$T_S = T_0 - 0.837$

$T_S = 0° - 0.837°C$

$T_S = -0.837°C$

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DATA

Make sure to use the correct number of significant figures and units when you record the measurements. The total points of DATA section is **20 points**. One point will be deducted for each missing units or incorrect number of significant figures or missing entry or incorrect measurement.

Part A: Preparing Solutions

Sodium Chloride Solutions

	Solution B	Solution C	Solution D
Mass of NaCl	11.87g	6.04g	3.21g
Volume of Water	116.50mL	112.42mL	109.09mL

Sucrose Solutions

	Solution E	Solution F
Mass of Sucrose	19.41g	17.51g
Volume of Water	143.51mL	123.06mL

Part B: Ice Bath Preparation

Note that you may not need to use all rows in the table below. Stop recording when the temperature of the ice bath does not change for two consecutive recordings. Unused rows are not considered as missing.

Time (min)	Temperature (°C)
0 (Initial)	-1°C
0.5min	-3°C
1.5min	-5°C
2min	-7°C
2.5min	-13°C

Ice bath temperature -13°C

Note that you may not need to use all rows in the tables below. Stop recording when water or solution freezes. Unused rows are not considered as missing.

Part C: Measuring the Freezing Point of Water

Time (min)	Temperature (°C)
0 (Initial)	20°C
0.5min	19°C
1.5min	9°C
2 min	2°C
2.5min	-1°C

Freezing Point of Water -1°C

Part D: Measuring the Freezing Point of NaCl Solutions and Sucrose Solutions

NaCl Solutions

Solution B	
Time (min)	Temperature (°C)
0 (initial)	19°C
0.5	10°C
1.5min	-3°C

Solution C	
Time (min)	Temperature (°C)
0 (initial)	21°C
0.5min	9°C
1.5min	0°C

Solution D	
Time (min)	Temperature (°C)
0 (initial)	20°C
0.5min	11°C
1.5min	0°C

Freezing point of Solution B -3°C

Freezing point of Solution C 9°C

Freezing point of Solution D 11°C

Note that you may not need to use all rows in the tables below. Stop recording when solution freezes. Unused rows are not considered as missing.

Sucrose Solutions

Solution E	
Time (min)	**Temperature (°C)**
0 (initial)	22°C
0.5min	13°C
1.5min	5°C
2min	0°C

Solution F	
Time (min)	**Temperature (°C)**
0 (initial)	19°C
0.5min	12°C
1.5min	6°C
2min	3°C
2.5min	0°C

Freezing point of Solution E 5°C

Freezing point of Solution F 3°C

PART E: Osmosis

Make sure to record the time (for example, 9:00 PM) when you measure the mass of celery.

Solution	Initial mass of celery at time: 6.56 p.m.	Mass of celery at time: 8.58 p.m.
A	6.28g	6.77g
B	7.75g	7.06g
C	5.29g	4.75g
D	7.53g	6.62g
E	9.11g	8.44g
F	8.43g	8.11g