Chapter 14 Worksheet 4 (osmotic pressure, melting and boiling points)

Name: UGA ID:

Instructions:

- Please enter your first and last name as it appears on the eLC roster (do not use a nickname).
- Your UGA myID is a combination of letters and numbers (example: mine is sre13137). **Do not use your 81x number.**
- If you do not have a printer, type your answers in the then upload the worksheet template to Gradescope by Monday, October 5 at 11:59 p.m. Write your work on separate sheets of paper, convert to a PDF and upload to eLC.
- If you have a printer download the worksheet, convert it to a PDF and upload to Gradescope by Monday, October 5 at 11:59 p.m. You do not need to upload anything to eLC.

1. Rank the following solutions from *lowest* boiling point to *highest* boiling point.

A. 0.35 *m* Ethylene Glycol ($C_2H_6O_2$)
B. 0.20 *m* KBr
C. 0.50 *m* Glucose ($C_6H_{12}O_6$)
D. 0.20 *m* Na_2SO_4

2 A. A 0.100 *M* acetic acid solution has an osmotic pressure of 2.47 atm at 25 °C. Calculate the van't Hoff factor.

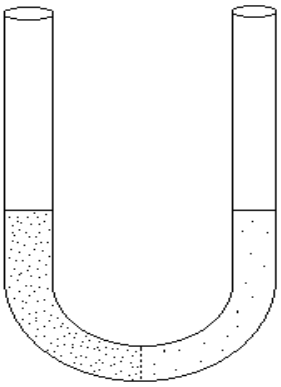
B. What is the percent ionization of acetic acid in the solution?

3. An isotonic solution will produce an osmotic pressure of 7.84 atm measured against pure water at human body temperature (37.0 °C). How many *grams* of sodium chloride must be dissolved in a liter of water to produce an isotonic solution?

4. The smell of ripe raspberries is due to 4-(*p*-hydroxyphenyl)-2-butanone, which has the emperical formula C_5H_6O. To find its molecular formula, you dissolve 0.135 g in 25.0 g of chloroform, $CHCl_3$. The boiling point of the solution is 61.82 °C. What is the molecular formula of the solute?
$CHCl_3$: BP = 61.70 °C; K_{bp} = +3.63 °C/*m*

5. Consider the U-tube at right. Solutions A and B are separated by a semipermeable membrane. On which side will the fluid level rise in each case?

	Solution A	Solution B
Solution 1	1 m Glucose	2 m Glucose
Solution 2	0.5 m Glucose	0.5 m Galactose
Solution 3	1% w/w Glucose	3% w/w Glucose
Solution 4	3% Ethylene Glycol	3% Galactose



Glucose, $C_6H_{12}O_6$, MW=180
Galactose, $C_6H_{12}O_6$, MW=180
Ethylene Glycol, $C_2H_6O_2$, MW=62

A. Side A
B. Side B
C. No change in fluid levels
D. Cannot be determined from the data provided

	☐	☐	☐	☐
Solution	1	2	3	4

6. A 2.0 molal aqueous solution of glucose ($C_6O_6H_{12}$) is found to boil at 101 °C. What would the boiling point of a 2.0 molal solution of sucrose be?

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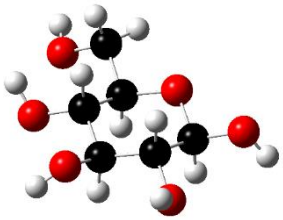
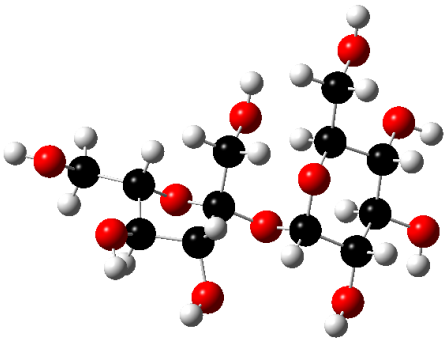
A. 102 °C
B. 100.5 °C
C. 101 °C
D. Slightly higher than 100.5 °C
E. Cannot determine without K_b



glucose ($C_6O_6H_{12}$)



sucrose ($C_{12}O_{11}H_{22}$)

7. Last year the lowest temperature in Athens was 12 °F (-11 °C). What is the minimum concentration for the radiator fluid in your car so that the solution doesn't freeze? Radiator fluid is ethylene glycol (MW 62.07 g/mol) dissolved in water. The K_{fp} for water is -1.86 °C/*m*.

☐

8. The freezing point of a solution is lower than that of the pure solvent because

[ ]

A. The addition of solute to the liquid increases the rate of escape of molecules from the solid phase to the liquid phase. At lower temperature these rates can again become equal.

B. The addition of solute to the liquid decreases the rate at which solvent molecules enter the solid phase. By lowering the temperature, the rate of escape of molecules from the solid to liquid phase is also lowered and become equal.

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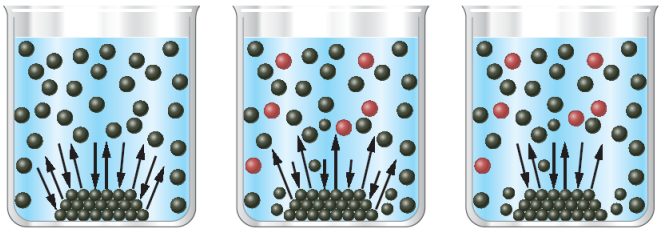

Equilibrium at freezing point of solvent | Equilibrium disrupted by solute added to solvent | Equilibrium restored at a lower temperature

For questions 10-14, *match the following.*

A. solution with Δ_{Tb} = 0.026 °C

B. solution of ionic compound with highest freezing point

C. highest boiling point

D. largest van't Hoff factor

E. solution that is most strongly dependent upon pressure

10. 0.050 *m* NaCl

[ ]

11. 0.050 *m* $C_6H_{12}O_6$ (aqueous)

[ ]

12. 0.0050 *m* CO_2

[ ]

13. 0.020 m NH_4Cl

14. 0.010 *m* $Al(NO_3)_3$