Discussion Quiz 2 GRADE____ NAME (Print!!)_____

Do any Five(5) for the Following Nine(9) PROBLEMS

1) What is the molar mass of a nonelectrolyte if 1.50 g in 250.0 mL of solution has an osmotic pressure of 396 torr at 15 °C?

P=MRT
MW =gRT/PV
=1.5*0.0821*(273+15)/(0.521*0.25)
272.3 g/mol

2) What is the osmotic pressure of a solution of 1.455 g of $BeSO_4$ (molar mass=105.07) into exactly one half liter of aqueous solution at 21°C?

2*(g/MW)*RT/V
=2*(1.455/105.07)*0.0821*(273+21)/0.5
1.34

3) What is the van't Hoff factor of a 0.010 *M* solution of $CaCl_2$ if the osmotic pressure at 25°C is 0.70 atm?

i= P/(MRT)
=0.7/(0.01*0.0821*(273+25))
2.86
3.0=Theoretical since 3 ions

For calcium chloride, the predicted van't Hoff factor is 3. Ion pairing causes the true value to be less than the calculated one.)

4) Determine the pressure at 37°C generated when 8.5 grams/liter NaCl (0.145 M) is on one side and water on the other - this is pretty close to the situation of having blood on one side and water on the other. What would be the pressure in atm, torr, and cm of water (Density of Hg = 13.7 g/ml)

iMRT =2*0.145*310*0.0821
7.3718 atm 560.26 cm Hg
7602.69 cm H_2O

5) 10 grams of sodium chloride are added to 90 grams of water. What is the percent weight of salt? The density of solid salt is 1.25 g/cc and the final density of the above solution is found to be 1.0726. What is the volume of the solution before and after mixing the components? What is the molality and molarity of the solution?

10 grams of Salt(58.44)		1.25 g/cc	8.00	ml	**98.0 ml total before mixing**
100 grams of solution 90 grams of water			**93.23**	ml	
Molality =	0.171	moles/	0.09	kg/water=	**1.901**
Molarity=	0.171	moles/	0.093	L	**1.835**

6) The Maximum solubility of sodium chloride in water is 35.9 grams in 100 grams of water at zero Celsius (not easily attainable!) The K_f for water is 1.86. What would thus be the maximum freezing point depression in Fahrenheit?

26.20 % MAX weight percent Salt to water

35.9 g salt Kf =1.86
100 g water

0.614	moles	0.1	kg of water	6.14 m

ΔT=2*6.14*1.86	**22.85**	C
T_f	**-9.1**	F

BUT the maximum concentration on reach 23.3% due to the formation of a new phase NaCl*2H2O eutectic mixture resulting in a lowest temperature of -21.1C (-6.0F) but this process is very slow to reach and can take **many days** to come to equilibrium. Fahrenheit probably didn't wait that long!

7) What is the change in boiling point if 3.69 g of K_2SO_4 was added to 100.0 mL of water? Kb= 0.52 (°C/m)

$$\Delta T = iK_b m = 3 \times \frac{0.52\ °C}{m} \times 0.212\ m = 0.33\ °C$$

8) Calculate the SOLUBILITY of N_2 (~ 79%) and O_2 (~20%) in the blood at sea level and then at 130 ft given that Kf for oxygen and nitrogen gases have value of 1.30 x10^{-3} and 6.10 x10^{-3} respectively.

Depth (feet) sea/fresh water	Atm.	PSI	Density
33/34	2	29.4	2x
66/68	3	44.1	3x
99/102	4	58.8	4x
132/136	5	73.5	5x

	(Mole/L/)atm K_f	P=1 atm	P=5 atm
O_2	1.30E-03	2.60E-04 M	1.30E-03M
N_2	6.10E-03	4.76E-03M	2.38E-02M

9) How does the Raoult's Law explain both freezing point depression and boiling point elevation?

$$p = x_{solv} \times p^{o}_{solv}$$

(note that new lines are not exactly parallel!)