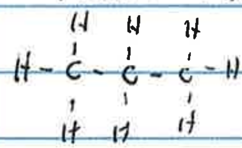
Today Jan 23: finish ch 12
Friday Jan 25: Start ch 13 (day 1 of 4)
lab next Tuesday: quiz over syllabus and lab orientation presentation and pre-lab for expt 2

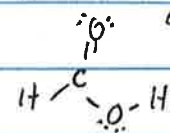
- Rank these in order of increasing solubility in water.



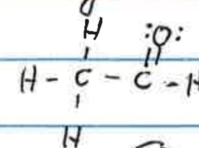
(1)

NH_4Cl

(4)



(3)



(2)

- What is the vapor pressure of a solution that has $X_{K_2SO_4} = 0.22$ at 20°C ($P^{20°}_{H_2O} = 17.3\ mmHg$)

$$P_{soln} = \frac{n_{H_2O}}{n_{H_2O} + n_{K_2SO_4} \times i} \times P^{20°}_{H_2O}$$

$$P_{soln} = \frac{0.78}{0.78 + (0.22)(3)} \times 17.3\ mmHg$$

$$P_{soln} = 9.37\ mmHg$$

- What is the vapor pressure of a solution containing $X_{CH_3OH} = 0.35$ ($P^{22°C} = 91 mmHg$) in water ($P^{22°C}_{H_2O} = 19.5 mmHg$)

$T^{CH_3OH}_{BP} = 65°C$ $\quad T^{H_2O}_{BP} = 100°C$

$$P_{soln} = X_{H_2O} \times P_{H_2O} + X_{CH_3OH} \times P_{CH_3OH}$$

$$P_{soln} = (0.65 \times 19.5\ mmHg) + (0.35 \times 91\ mmHg)$$

$$\boxed{P_{soln} = 44.5\ mmHg}$$

- Benzene has a normal mp/fp of 5.53°C. Suppose 6.12g unknown are dissolved in 75.0g benzene. If the solution freezes at 3.90°C, what is MM_{unk}?

Given K_f = 5.07 deg/molal

$\Delta T_f = m \cdot K_f \cdot i$

$5.53°C - 3.90°C = m \cdot 5.07 \text{deg/molal} \cdot (1)$

$m = 0.32 \text{ molal}$

$0.32 = \frac{n_{unk}}{m_{benzene}(kg)}$

$0.32\,(0.075) = n_{unk}$

$0.024 \text{ mol} = n_{unk}$

$MM_{unk} = \frac{m_{unk}}{n_{unk}} = \frac{6.12g}{0.024mol} = \boxed{255 g/mol}$

<u>Osmotic pressure</u>

$\Pi = M \cdot R \cdot T \cdot i$

- If 11.5 mg insulin is dissolved in 5.00mL H_2O, Π = 7.14 mmHg at 25°C. What is $MM_{insulin}$?

$\underset{9.40 \times 10^{-3} atm}{\cancel{7.14 mmHg}} = M \cdot \left(0.0821 \frac{L \cdot atm}{mol \cdot K}\right)(298K)(1)$

$\frac{7.14 mmHg}{} \Big| \frac{1 atm}{760 mmHg} = 9.40 \times 10^{-3} atm$

$M = 3.84 \times 10^{-4} mol/L$

$n = (3.84 \times 10^{-4} mol/L)(5 \times 10^{-3} L)$

$n = 1.92 \times 10^{-6} mol$

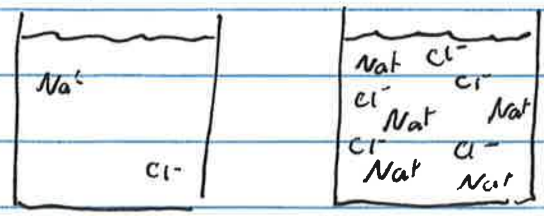
$MM = \frac{1.15 \times 10^{-2} g}{1.92 \times 10^{-6} mol} = \boxed{6000 g/mol}$

$i = 1$ for non-electrolytes

$i = 2$ for 1:1 ionics (like $NaCl$ or KBr or $MgSO_4$)

$i = 3$ for 1:2 or 2:1 ionics (like K_2SO_4)

very dilute solutions | more conc solutions



ions interact more so i is less than 2

$i = 2$ | "tight ion pairing" $i < 2$

· weak acids only dissociate a little bit so it is not $i = 1$ (completely associated) or $i = 2$ (completely dissociated)

· Suppose a 1.00 molal solution of HA has a fp/mp = −2.4°C. What is i?

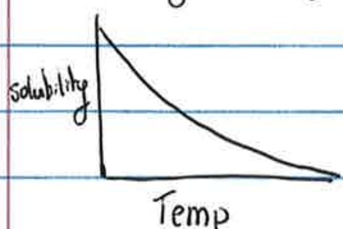
$\Delta T_f = K_f \times m \cdot i$

2.4 deg = (1.86 deg/molal)(1.00 molal)(i)

1.29 = i 29% dissociated

Henry's law

Solubility of gases in solvents:



- At any specific temperature

Solubility = $k \times P_{gas}$

H_2S has a solubility of 0.195 mol/L at STP. What is its solubility at 25.5 mmHg

solubility = K × ~~conc~~ P

solubility = 0.195 m/L = K · 1.00 atm

K = 0.195 m/L·atm

solubility = (0.195 mol/L·atm) $\left(\frac{25.5\text{ mmHg} \mid 1\text{ atm}}{\mid 760\text{ mmHg}} \right)$

solubility = 0.0065