HOMEWORK 13 SUPPLEMENTAL

1) "THIS ASSUMPTION IS WRONG;" OR "IN THOSE CASES IN"

2) $\Delta T_F = -iK_f C_m$ → UNITS ON PPT WERE INCORRECT, SHOULD BE $\frac{\text{MOL SOLUTE}}{\text{Kg SOLVENT}} = C_m$

FOR $CaCl_2$, 3 IONS FORM SO $i = 3$

$K_F = 1.86 \frac{^\circ C}{\left(\frac{\text{mol } CaCl_2}{\text{Kg } H_2O}\right)}$ FOR H_2O

FIND C_m IN $\frac{\text{mol SOLUTE}}{\text{Kg SOLVENT}}$

$\frac{0.2 \text{ mol } CaCl_2}{1 \text{ L sol}} \left| \frac{1 \text{ L } CaCl_2}{19.37 \text{ mol } CaCl_2} \right. = 0.010325245 \frac{\text{L } CaCl_2}{\text{L sol}}$

$\rho_{CaCl_2} = \frac{2.15 \text{ g}}{\text{mL}} \left| \frac{\text{mol}}{110.98 \text{ g}} \right| \frac{1000 \text{ mL}}{1 \text{ L}} = 19.37 \frac{\text{mol } CaCl_2}{\text{L } CaCl_2}$ → ASSUMING ANHYDROUS $CaCl_2$ DENSITY & $V_{CaCl_2} + V_{H_2O} = V_{TOTAL}$

ASSUME 1L SOL

$1 \text{ L sol} - 0.01 \text{ L } CaCl_2 = 0.9897 \text{ L } H_2O$

$\frac{0.2 \text{ mol } CaCl_2}{0.9897 \text{ L } H_2O} \left| \frac{1 \text{ L } H_2O}{1 \text{ Kg } H_2O} \right. = 0.202087 \frac{\text{mol } CaCl_2}{\text{Kg } H_2O}$

W/ ROUNDING

$\Delta T_F \approx -(3)(1.86 \left(\frac{^\circ C}{\left(\frac{\text{mol } CaCl_2}{\text{Kg } H_2O}\right)}\right)(0.202087 \frac{\text{mol}}{\text{Kg } H_2O})$

$\Delta T_F \approx -1.1276^\circ C$, $\boxed{T_F + \Delta T \approx -1.1276^\circ C}$

3) a) $M_n = \frac{5(5 \text{ lbs}) + 3(50 \text{ lbs}) + 1(1500 \text{ lbs})}{9} = 186.11 \text{ lbs}$

$\frac{186.11 \text{ lbs}}{1 \text{ lbs}} \left| \frac{\$1.00}{1 \text{ lbs}} \right. = \boxed{\$186.11 \text{ PAID BY INSURANCE}}$

b) M_w: 1,675 TOTAL lbs

$1500 \text{ lbs} \frac{1500}{1675} = 1343.28 \text{ lbs}$

$150 \text{ lbs} \frac{150}{1675} = 13.43 \text{ lbs}$

$25 \text{ lbs} \frac{25}{1675} = 0.37 \text{ lbs}$

1357.08 lbs

OR

$M_w = \frac{1(1500)^2 + 3(50)^2 + 5(5)^2}{1675} = 1347.84 \text{ lbs}$

$\frac{1357.08 \text{ Kg}}{1 \text{ lb}} \left| \frac{\$0.50}{1 \text{ lb}} \right. = \boxed{\$678.54 \text{ PAID TO LAWYER}}$

c) $\$186.11 - \$678.54 = -\$492.43$

$\boxed{\$492.43 \text{ PAID BY BUBBA}}$

$\boxed{-\$492.43 \text{ EARNED BY BUBBA}}$

+12

4) OVERALL PDI $= \frac{M_w}{M_n}$

DP 20: $MW = \frac{20 \text{ mol MONOMER}}{1 \text{ mol POLYMER}} \left| \frac{100 \text{ g}}{1 \text{ mol MONOMER}} \right. = \boxed{2000 \frac{g}{mol}}$

$25 \text{ g} \left| \frac{\text{mol}}{2000 \text{ g}} \right. = 0.0125 \text{ mol POLYMER}$

DP 15: $MW = \boxed{1500 \frac{g}{mol}}$

$25 \text{ g} \left| \frac{1 \text{ mol}}{1500 \text{ g}} \right. = 0.0167 \text{ mol POLYMER}$

DP 10: $MW = \boxed{1000 \frac{g}{mol}}$

$50 \text{ g} \left| \frac{\text{mol}}{1000 \text{ g}} \right. = 0.0500 \text{ mol POLYMER}$

FIND M_n: TOTAL MOL POLYMER $= \boxed{0.0792 \text{ mol}}$

$M_n = \frac{100 \text{ g}}{0.0792 \text{ mol}} = \boxed{1262.63 \frac{g}{mol}} = \frac{(0.0125 \text{ mol})(2000 \frac{g}{mol}) + (0.0167)(1500) + (0.05)(1000)}{0.0125 + 0.0167 + 0.05}$ (mol)

FIND M_w:

$M_w = \frac{(0.0125 \text{ mol})(2000 \frac{g}{mol})^2 + (0.016666 \text{ mol})(1500 \frac{g}{mol})^2 + (0.05)(1000 \frac{g}{mol})^2}{100 \text{ g}} = \boxed{1375 \frac{g}{mol}}$

ALSO CAN CALC BY

DP 20: $\left(\frac{25 \text{ g}}{100 \text{ g}}\right)\left(2000 \frac{g}{mol}\right) = 500 \text{ g/mol}$

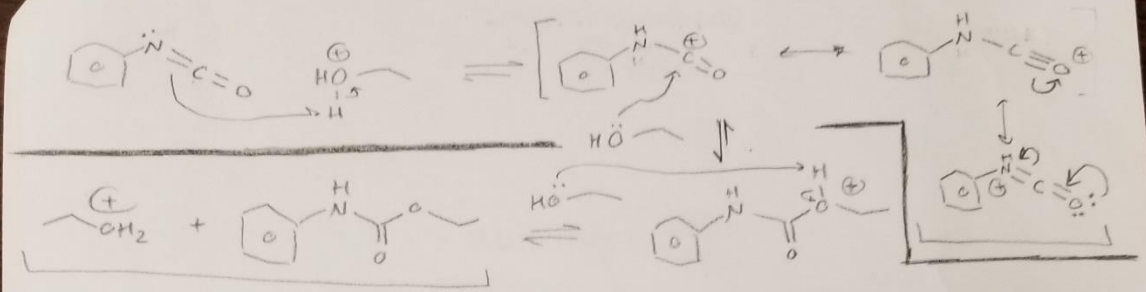
DP 15: $\left(\frac{25 \text{ g}}{100 \text{ g}}\right)\left(1500 \frac{g}{mol}\right) = 375 \text{ g/mol}$

DP 10: $\left(\frac{50 \text{ g}}{100 \text{ g}}\right)\left(1000 \frac{g}{mol}\right) = 500 \text{ g/mol}$

$M_w \boxed{1375 \text{ g/mol}}$

PDI $= Đ = \frac{M_w}{M_n} = \frac{1375}{1262.63} = \boxed{1.089}$

CRET 1) ASSUME ACD OR BASIC SOL.



SECRET 2

POLYMER MADE UP OF MONOMER UNITS, SO DIVIDING AVERAGE MASS BY MONOMER MOLECULAR WEIGHT SHOWS HOW MANY MONOMERS ARE NEEDED TO PRODUCE A POLYMER WITH "n" REPEAT UNITS

$$n = \frac{25578\ g}{104\ g/mol} = 246$$

IF NEUTRAL (HOW WILLSON DID IT)