# CHEM 162w19 Worksheet Set #2

1. Find molality(*m*) or molarity (M), as stated:

a. 0.907 M lead II nitrate solution, density 1.252 g/cm3. Find molality of solution. #1a) 0.953 *m*

Pb(NO3)2 = 331.2 g/mol mass lead = moles\*form.wt. = (0.907 mol)\*(331.2 g/mol) = 300 g

mass solution = density\*volume = (1.252 g/ml)\*(1000 ml) = 1252 g

mass water = mass soln – mass solute (Pb(NO3)2) = 1252 g - 300 g = 952 g (0.952 Kg)

molality = 

b. find molar concentration of 0.273 m KCl solution, density 1.011\*103 g/L #1b) 0.271 *M*

states: 0.273 moles per 1 Kg of water KCl = 74.6 g/mol

mass KCl = mols KCl\*form wt. = (0.273 mols)\*( 74.6 g/mol) = 20.4 g

mass soln = mass solute + mass solvent = 20.4 g + 1000 g = 1020.4 g

vol soln = mass soln\*1/density = (1020.4 g)\*( 1 L/1.011\*103 g) = 1.009 L

Molarity= 

2. grams Zn(NO3)2 in 175 mL of 0.252 *M* solution. #2) 8.35 g



3. mL of 1.75 *M* BaBr2 needed react with 192 mL of 2.67 *M* K2SO4 solution #3) 293 mL

X g 192 mL

**BaBr2 + K2SO4 ---------🡪 BaSO4 + 2 KBr**



OR, simple “dilution” problem: M1V1 = M2V2

(1.75 M)V1 = (2.67 M)(192 mL) V1 = [(2.67 M)(192 mL)]/(1.75 M) = 293 mL

4. Find van’t Hoff factor from: 0.500 mass % CH3COOH with freezing point of –0.159oC. #4)

What does this factor indicate? *i* factor, explain:

1.02

molar mass CH3COOH = 60.0 g/mol **acetic acid weak**

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mCH3COOH = [0.500 g CH3COOH/0.0995 Kg H2O]/(60.0 g/mol) = 0.0838 m **dissociation of**

T = Tf – Ti = [0.00 – (-0.159)] = 0.159oC molecule to

**form ions**

**i = T/Kf\*m = (0.159oC)/[(1.86oC/m) \* 0.0838 m] = 1.02**

i = 1, so only 1 ion in solution, acetic acid is a weak acid so almost no dissociation of ions

5. freezing point benzene is 5.5oC What is freezing point of solution of 5.00 g C10H8 in 444 g of benzene. #5) FP: 5.1oC

Need look up Kf for benzene. Determine van’t Hoff factor to use. Show factor used & explain *why*.

*i* factor, explain:

Benzene Kf = \_**5.12oC/m**\_ van’t Hoff factor used: \_**1**\_ Explain: **C10H8 nonelectroylte; forms 1 ion** 1

mass benzene = 444 g = **0.444 Kg** formula wt. C10H8 = **128.0 g/mol** nonelectrolyte

moles C10H8 = [5.00 g/1]\*[1 mol/128.0 g] = **0.0391 mols** *m* = [0.0391 mols]/[0.444 Kg] = **0.0881 *m***

T = Kf\*m\**i*  = (5.12oC/mol)\*(0.0881 m)\*(1) = **0.45oC** Tf(solution) = Tf-benzene – T = 5.5 – 0.45 = **5.1oC**

6. solubility CO at 1 atm & 20oC is 2.70\*10-4 M. What is mole fraction, X, of CO in air? #6) 0.260

SCO = 2.70\*10-4 *M* KH = 1.04\*10-3 mol/L⋅atm

SCO = KH\*PCO ⇒ PCO = SCO/KH ⇒ PCO = (2.70\*10-4)/(1.04\*10-3) = **0.260 atm**

Keep in mind:

partial pressure of CO = mole fraction \* total pressure or X = (partial)/(total)

PCO = XPtot ⇒ X = PCO/Ptot  = (0.260 atm)/(1 atm) = 0.260

7. Ethylene glycol, (antifreeze, HOCH2CH2OH) dissolved in water. Find VP of 2.000 L solution mixing equal #7) dH2O=0.9584

volumes at 100oC. Obey Ideal (Raoult’s). Need to find density water 100oC. 0.747 atm

(568 torr)

**Need to determine solute (smallest amt) & solvent (largest amt).**

**Glycol nonvolatile, so VP of solution due only to solvent water; Psolv = PH2O = 1 atm**

you will use 1 atm & XH2O

antifreeze (solute) water @ 100oC (solvent) use dH2O=1.00g/ml

density 1.114 g/ml 0.9584 g/ml (1.00 g/ml) 0.755 atm

molecular wt. 62.0 g/mol 18.0 g/mol (574 mmHg)

mols antifreeze = (1000 mL)\*(1.114 g/ml)\*(mol/62.0 g) = **18.0 mol** (solute)

**If you use** dH2O of 0.9584 g/ml:

mols water = (1000 mL)\*(0.9584 g/ml)\*(mol/18.0 g) = **53.2 mol** (solvent)

mole fraction glycol, X = mol solute/tot mols soln = (53.2)/(53.2 + 18.0) = 53.2/71.2 = **0.747**

Psoln = XH2O\*PH2O = (0.747)\*(1 atm) = 0.747 atm

check ΔPsoln = XsolventPsolvent = [53.2/(18.0+53.2)](1 atm) = 0.253, then new Psoln = Psolvent – ΔP => (1 atm) – ( 0.253 atm) = 0.747 atm

**If you use** dH2O of 1.00 g/ml:

mols water = (1000 mL)\*(1.00 g/ml)\*(mol/18.0 g) = **55.6 mol** (solvent)

mole fraction glycol, X = mol solute/tot mols soln = (55.6)/(55.6 + 18.0) = 53.2/73.6 = **0.755**

Psoln = XH2O\*PH2O = (0.755)\*(1 atm) = 0.755 atm

check: ΔPsoln = XsolventPsolvent = [53.2/(18.0+55.6)](1 atm) = 0.245, then new Psoln = Psolvent – ΔP => (1 atm) – ( 0.245 atm) = 0.755 atm