QUIZ 1 & 2
NAME (Print) Key Sign
Name of Grader Grade

1) The Lattice Energy ΔH_1 for a salt is found to be **35kJ/mol**; the enthalpy for solvent-solvent interaction ΔH_2 is **17.1 kJ/mol**. The heat of solvation of the salt (ΔH_3) into this solvent is found to be **-38.3 kJ/mol**. Discuss the influence of added heat (temperature) on the solubility of this salt. Is this always true for this salt?

$\Delta H_{solution} = \Delta H_1 + \Delta H_2 + \Delta H_3 = +13.7 \text{ kJ/mol}$

Since Positive → Heat of Dissociation / Dissolution is Endothermic

All Endothermic Rx are pushed to PRODUCT side

Thus

Increasing Temp/Heat will increase solubility.

2) *True/False and Reason*: **All endothermic reaction are independent of temperature effects**

FALSE – Endothermic Reactions are always pushed to the Right (PRODUCT) by increasing temperature.

3) A 0.1M NaOH aqueous solution has a density of 1.18g/ml. What is the molality and mole fraction of the solution with respect to NaOH? *Extra: How would one make this solution starting with solid sodium hydroxide and pure water?*

Assume 1 L = 1000 ml of solution

1000 ml × 1.18 g/ml = 1180 g of solution

0.1 M NaOH = − 4 g of NaOH

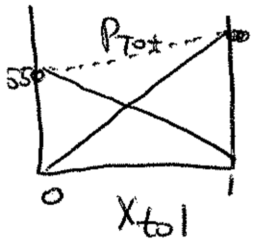
1176 g of solvent

$$\text{molality} = \frac{0.1 \text{ moles of NaOH}}{1.176 \text{ kg of } H_2O} = 0.085 \text{ m}$$

$$\frac{0.1}{0.1 + \left(\frac{1176}{18.0}\right)} = \frac{0.1}{65.43} = 0.0015 = \chi_{NaOH}$$

4) The vapor pressure of Toluene and Benzene are 75 torr and 55 torr respectively at 20C. Derive an equation that would define the total pressure as a function of the mole fraction of Toluene. Use this equation to draw a rough graph showing the individual and total vapor pressure at 20C. *Extra: Which solvent has a lower BP and why?* Toluene since higher VP related to lower intermolecular forces.

$$P_{Toluene} = X_{Tol} \cdot P^{o}_{Tol} \;;\quad P_{Benzene} = X_{Ben} P^{o}_{Ben}$$



$$P_{total} = X_{Tol} P^{o}_{Tol} + X_{Ben} P^{o}_{Ben} = X_{Tol} P_{Tol} + (1-X_{Tol}) \times P_{Benz}$$

$$= 75 X_{TOL} + (1 - X_{TOL}) \cdot 55$$

5) The Henry constant for hydrogen cyanide is 1.35×10^{-2} mol/(V*atm). At what pressure would the blood pressure of this gas equal a fatal level of 1 micro-molar? (Assume blood is solely water)

$$S_g = 10^{-6}$$

$$S_g = kP_g \Rightarrow 1 \times 10^{-6} = (1.35 \times 10^{-2}) P_g$$

$$P_g = \underline{\underline{7.4 \times 10^{-5}}}$$

very low partial pressure will cause death

6) Four beakers of equal volume are placed into a large sealed vessel. One container contained a 0.15M Calcium Nitrate Solution; the second contained a 0.2M Sodium Chloride Solution; the third contained 0.12M Aluminum Fluoride solution; while the last was pure water. After a week to reach equilibrium; what would be the order in the quantities of liquid in each of the containers and why?

Although Raoult's law requires "x", mole fraction is roughly prop. to M

$Ca(NO_3)_2$	$3 \times .15 = .45$	2	
NaCl	$2 \times .2 = .40$	3	
AlF_3	$4 \times .12 = .48$	1	Most water
Water	$0 = 0$	4	Least water