Assignment 5

Indian Institute of Science Education and Research

CHM202: Energetics and dynamics of chemical reactions

Instructor: Dr. Arijit K. De

Ques. 1 The addition of 5.00 g of a compound to 250 g of naphthalene lowered the freezing point of the solvent by 0.780 K. Calculate the molar mass of the compound.

Ques. 2 Calculate the Gibbs energy, entropy, and enthalpy of mixing when 1 mol C_6H_{14} (hexane) is mixed with 1.00 mol C_7H_{16} (heptane) at 298 K. Treat the solution as ideal.

Ques. 3 What is the maximum number of phases that can be in equilibrium in a ternary system?

Ques. 4 The osmotic pressure of an aqueous solution at 300K is 120Pa. Calculate the freezing point of the solution.

Ques. 5 The following table gives the mole fraction of methylbenzene (A) in liquid and gaseous mixtures (x_A and y_A respectively) with butanone at equilibrium at 303.15K and total pressure *p*. Take the vapour to be perfect and calculate the partial pressures of the two components. Plot them against their respective mole fractions in the liquid mixture and find the Henry's law constant for the two components.

x_A	0	0.0898	0.2476	0.3577	0.5194	0.6036
y_A	0	0.0410	0.1154	0.1762	0.2772	0.3393
p/kPa	36.066	34.121	30.900	28.626	25.239	23.402

Ques. 6 The vapour pressure of the benzene is 53.3kPa at 60.6^0C, but fell to 51.5kPa when 19.0g of a non-volatile organic compound was dissolved in 500g of benzene. Determine the molar mass of the compound.

Ques. 7 The following temperature-composition data were obtained for a mixture of two liquids A and B at 1atm, where x is the mole fraction in the liquid and y is the mole fraction in vapour at equilibrium.

$\theta/^0$C	125	130	135	140	145	150
x_A	0.91	0.65	0.45	0.30	0.18	0.098
x_B	0.99	0.91	0.77	0.61	0.45	0.25

The boiling point are 124^0C for A and 155^0C for B. Plot the Temperature/Composition diagram for the mixture and calculate the composition of vapour in equilibrium with the liquid having composition (i) x_a=0.50 and (ii) x_b=0.33.