

Biophysical Chemistry for Life Scientists

Biotechnology Research Center, National Taiwan University

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Instructor: Sunney I. Chan

Vice President & Distinguished Research Fellow

Institute of Chemistry, Academia Sinica

Telephone: 2-2789-9402

E-mail: chans@chem.sinica.edu.tw

Problem Set 5

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- (1) From the following data, determine the total volume change for dissolving glycine in 1 kg water to 1 m concentration (1 kg H₂O = 55.51 mol).

Glycine Concentration	Glycine	Water
<u>m</u>	$V_2, \text{cm}^3\text{mol}^{-1}$	$V_1, \text{cm}^3\text{mol}^{-1}$
0	43.20	18.07
1	44.88	18.05
pure glycine	46.71	--

- (2) Dissolution of sucrose in water at 20 °C to a mole fraction of 0.0671 reduces the vapor pressure from 17.54 to 15.98 mm Hg. Calculate the activity of water in the solution, and x_{water} . Assume $\gamma_f = 1$ for water vapor. Is the $a_{\text{water}} = x_{\text{water}}$?
- (3) The activity coefficient of the drug actinomycin at $C_T = 10^{-3}$ M concentration in water at 5 °C is 0.379. Assume the deviation from $\gamma = 1$ is due solely to dimerization, and calculate the dimerization equilibrium constant.
- (4) Estimate the osmotic pressure of a 1 % solution (10 mg ml⁻¹) of a protein with molecular weight 10^4 at 25°C.