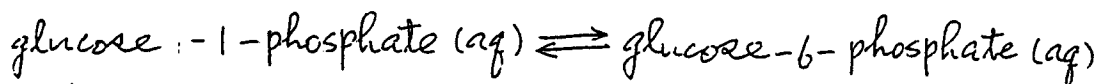


- 1). Obtain an expression for the Joule-Thomson coefficient, $\mu_{J.T.}$, for a gas obeying the equation of state, $P(\bar{V}-b) = RT$. (17%)
- 2). (a) Why do positive and negative deviations from Raoult's law occur?
(b) Explain why Trouton's rule, according to which the entropy of vaporization is $88 \text{ JK}^{-1}\text{mol}^{-1}$, holds fairly closely for normal liquids. (16%)
- 3). Calculate the osmotic pressure of a 1 mol L^{-1} sucrose solution in water from the fact that at 30°C the vapor pressure of the solution is 4.1606 kPa . The vapor pressure of water at 30°C is 4.2429 kPa . The density of pure water at this temperature ($0.99564 \text{ g cm}^{-3}$) may be used to estimate V_1 for a dilute solution. (16%)
- 4). Show that the fugacity of a gas can be calculated at some pressure P if compressibility factor Z is known as a function of pressure up to that particular pressure from the following equation

$$\frac{f}{P} = \exp\left[\int_0^P \frac{Z-1}{P} dP\right]$$
 (17%)

5). When the reaction

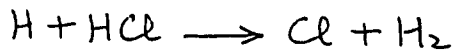


is at equilibrium at 25°C , the amount of glucose-6-phosphate present is 95% of the total.

(a) Calculate $\Delta_r G^\circ$ at 25°C .

(b) Calculate $\Delta_r G$ for reaction in the presence of 10^{-2} M glucose-1-phosphate and 10^{-4} M glucose-6-phosphate. In which direction does reaction occur under these conditions? (17%)

6). What is the rate constant for the following reaction at 500 K ?



The rate constant for the backward reaction at 500 K is $3.1 \times 10^8 \text{ L mol}^{-1} \text{ s}^{-1}$

The Gibbs energies of formation for H , HCl , and Cl at 500 K are 192.955 , -97.169 , and $94.191 \text{ kJ mol}^{-1}$, respectively. (17%)