淡江大學八十九學年度碩士班招生考試試題 84

系別：化學工程學系　　科目：物理化學

本試題共 1 頁

1. (a) Explain the phenomenum of osmotic pressure and deduce the mathematical relationship between π and the activity of solvent $a_{solvent}$ in a certain solution. (b) How do you approximate the previous relation into π = MRT, where M is the molarity of solute in the solution. 20%

2. (a) Explain the two correction terms in van der Waals' equation with respect to the ideal gas equation. (b) Calculate, to a precision of 1 %, the molar volume of carbon dioxide CO_2, given the constants of van der Waals' equation as a = 3.66 bar liter^2 mol^{-2} and b = 0.0428 liter mol^{-1}. 20%

3. Deduce the following relation

(a) $\left(\frac{\partial U}{\partial V}\right)_T = T\left(\frac{\partial P}{\partial T}\right)_V - P$,

(b) $C_P - C_V = T\left(\frac{\partial P}{\partial T}\right)_V\left(\frac{\partial V}{\partial T}\right)_P$.　　20%

4. Suggest a mechanism and verify it for enzyme-catalyzed reactions as following

$E + S \leftrightarrow E + products$

with rate-equation as $R = \frac{k[E_{total}][S]}{K_M + [S]}$.

20%

5. Oxygen is expanded reversibly and adiabatically from a volume of 1 liter at 100 bar and 100°C, until the volume is 20 liter. The C_p of oxygen can be taken to be 29.38 J K^{-1} mol^{-1}. (a) Calculate the final pressure and temperaturre assuming ideal gas behavior. (b) Calculate ΔU_{therm}, ΔU_{mech} for the thermal and mechanical surrounding, and ΔU, ΔH for the oxygen gas. 20%