

八十四學年度 輻射生物研究所 組碩士班研究生入學考試

科目 物理化學 科號 3407 共 1 頁第 1 頁 *請在試卷【答案卷】內作答

- Write down equation for the following laws. (a) Boyle's Law; (b) The Phase Rule; (c) Nernst Equation; (d) Gibbs-Helmholtz Equation; (e) First Law of Thermodynamics. (20%)
- Initially at 300 K and 1 atm pressure, 1 mole of an ideal gas undergoes an irreversible isothermal expansion in which its volume is doubled, and the work it performs is 500 J/mol. What are the values of q , ΔU , ΔH , ΔG , and ΔS ? (10%)
- The equilibrium constant K_c for the reaction fructose-1,6-diphosphate \rightleftharpoons glyceraldehyde-3-phosphate + dihydroxyacetone phosphate is $8.9 \times 10^5 M$ at $25^\circ C$, and we can assume the behavior to be ideal. (a) Calculate ΔG° for the process (standard state: 1M) (b) Suppose that we have a mixture that is initially 0.01 M in fructose-1,6-diphosphate and $10^{-5} M$ in both glyceraldehyde-3-phosphate and dihydroxyacetone phosphate. What is ΔG ? In which direction will reaction occur? (10%)
- In a volume of 11.2 dm^3 at 273 K, 2 mole of oxygen gas, which can be regarded as ideal with $C_p = 29.4 \text{ J/K mol}$ (independent of temperature), are maintained. (a) What is the pressure of the gas? (b) What is PV ? (c) What is C_v ? (10%)
- Calculate the entropy of mixing per mole of air, taking the composition by volume to be 79% N_2 , 20% O_2 , and 1% Ar. (10%)
- The equilibrium constant for the reaction $A + 2B \rightleftharpoons Z$ is $0.25 \text{ dm}^5/\text{mol}^2$. In a volume of 5 dm^3 , what amount of A must be mixed with 4 mole of B to yield 1 mole of Z at equilibrium? (10%)
- The emf of a cell $Pt, H_2(1 \text{ atm})/HCl/AgCl, Ag$ was found to be 0.517 V at $25^\circ C$. Calculate the pH of the HCl solution. (10%)
- The isotope ^{90}Sr emits radiation by a first order process and has a half-life of 28.1 years. When ingested by mammals it becomes permanently incorporated in bone tissue. If 1 μg is absorbed at birth, how much of this isotope remains after (a) 25 years and (b) 50 years? (10%)
- Over a solution of benzene and cyclohexane the vapor pressure of benzene is observed to be 200 torr and that of cyclohexane is 40 torr. Assuming the solution to be ideal, calculate the mole fraction of each component of the solution. (10%)