

國立臺北教育大學 110 學年度碩士班「考試入學」招生考試

自然科學教育學系

化學 科試題

- (a) A Carnot engine contains 0.250 mol of a monatomic ideal gas as its working fluid. Assume C_v to be constant. If $T_h = 473$ K, $T_c = 373$ K, $V_1 = 0.600$ L, and if the compression ratio $V_3/V_1 = 6.00$, find the efficiency and calculate w , q , and entropy change for each of the steps in the cycle. (b) Calculate ΔU , ΔH and ΔS for the whole cycle. (20%)
- Assume that the mole fraction of carbon dioxide in the earth's atmosphere is 0.000306. (a) Estimate the mean free path between intermolecular collisions in the atmosphere at sea level if the temperature is 298 K. (b) Estimate the number of collisions with other carbon dioxide molecules per second undergone by a carbon dioxide molecule under the conditions in (a). (20%)
- A solution containing 4.48 ppm KMnO_4 exhibits 85.9 %T in a 1.00-cm cell at 520 nm. Calculate the molar absorptivity of KMnO_4 at this wavelength. (molar mass of $\text{KMnO}_4 = 158.03$ g/mol) (20%)
- (a) Derive an expression for the half-life of the reactant in a first-order process in terms of the rate constant k . (b) Find the natural lifetime for first-order reactions corresponding to half-life = 26.5 years. (20%)
- Write molecular equations for the halogenation of ethane. (20%)