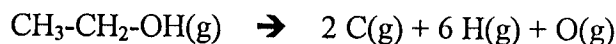


(1) The average bond energy of C-H, C-C, O-H, O-O, H-H at 25 °C are 413, 348, 463, 495, and 436 kJ/mol, respectively. The standard molar heat of formation of $C_2H_5OH(g)$ is -235 kJ/mol, and the heat of sublimation of carbon(s) at 25 °C is 717 kJ/mol.

(a) Estimate ΔH°_{298} for the reaction



(b) Estimate the C-O bond energy. (10%)

(2) Draw the Lewis structures and predict the molecular shapes for (a) SeO_4^{2-}

(b) $XeOF_4$. (8%)

(3) If the radius of the packed sphere is R , calculate the volume of the unit cell in the cubic closet packing arrangement. (5%)

(4) The energy level for hydrogen-like atom is $E_n = -hRZ^2/n^2$, where $R = 3.29 \times 10^{15}$ Hz, $h = 6.626 \times 10^{-34}$ Js, and Z is the nuclear charge. Calculate the wavelength of light emitted when the transition $n=4 \rightarrow n=2$ occurs in the Li^{+2} ion. (6%)

(5) It took 143 seconds for 50.0 % of a particular substance to decompose. If the initial concentration is 0.060 M and the decomposition reaction follows the second-order kinetics, calculate the value of rate constant. (5%)

(6) Use the following data

	ΔG_f° (kJ/mol)	ΔH_f° (kJ/mol)
$C_2F_2(g)$	191.2	241.3
$C_6F_6(g)$	78.2	132.8

to calculate the ΔS° and equilibrium constant at 298 K for the reaction



(7) Consider an ideal solution of benzene and toluene at 25 °C. If the mole fractions of benzene and toluene in the vapor phase are equal, calculate the mole fraction of benzene in the solution. At 25 °C, the vapor pressures of benzene and toluene are 95 and 28 torr, respectively. (6%)