(1) Definition of terms *(5 points for each)*

(a) Phase rule
(b) Regular solution
(c) Raoult's law
(d) Gibbs-Duhem equation
(e) Clausius-Clapeyron equation
(f) Fugacity
(g) Trouton's rule
(h) Joule-Thomson coefficient
(i) Third-Law entropy
(j) Reference state

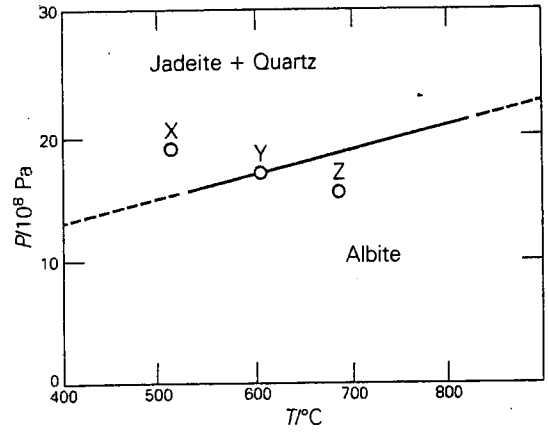
(2) Nernst equation: $E^0 = -\Delta G^0 / nF$. ($F = 96485$ C/mol). The standard potential of the Daniell cell is + 1.10 V, estimate the equilibrium constant for the cell reaction. *(12 points)*

(3) Calculate the difference in molar Gibbs energy between the top and bottom of a column of mercury in a barometer of height 760 mm. The density of mercury is 13.6 g/cm^3. *(12 points)*

(4) Calculate the change in molar entropy when hydrogen gas is heated from 20 ^{0}C to 30^{0}C at constant volume. ($C_{vm} = 22.44$ JK^{-1}mol^{-1}) *(13 points)*

(5) Please determine the slope of reaction boundary for the P-T diagram below. *(13 points)*

	S J K^{-1} mol^{-1}	V 10^{-6} m^3 mol^{-1}
jadeite ($NaAlSi_2O_6$)	133.5	60.4
quartz (SiO_2)	41.5	22.7
albite ($NaAlSi_3O_8$)	207.4	100.1



R = 8.314 51 J K^{-1} mol^{-1}
8.314 51 kPa L K^{-1} mol^{-1}
8.205 78 $\times 10^{-2}$ L atm K^{-1} mol^{-1}
62.364 L Torr K^{-1} mol^{-1}
1.987 22 cal K^{-1} mol^{-1}