1. Discuss the physical meaning between Henry's law and Raoult's law. Using the Henry's law constant calculate the solubility of carbon dioxide in water at 25°C at a partial pressure of CO_2 over the solution of 760 mm. Assume that a liter of solution contains practically 1000 grams of water and Henry's-law constant for CO_2 is 1.25×10^6. 10 %

2. Give examples and discuss physical meanings between the ideal and nonideal solution.
At 90°C benzene and toluene have the vapor pressure of 1022 and 406 mm, respectively. Culculate the composition of the Benzene - toluene solution which will boil at 1 atm pressure at 90°C. Also calculate the vapor composition. Assuming that
(1) the solution is ideal.
(2) the solution is nonideal. 10 %

3. The following temperature-composition diagram shows the phase equilibrium between zinc and magnesium. Please find out
(1) Compound(s) formation,
(2) Fraction of each compound, and 20 %
(3) Draw a graph that shows its microstructure under microscopic examination
for the specified point as indicated in the diagram.
(I, II)

4. One mole of an ideal gas at temperature T_o expands isothermally from a presusre of $10P_o$ to P_o. What are the work (w), heat (q), internal energy change ($\triangle U$), enthalpy change ($\triangle H$), Gibbs energy change ($\triangle G$), and entropy change ($\triangle S$) in the following cases?
(1) The expansion is reversible. 6 %
(2) The expansion is free 6 %
(3) The gas and its surroundings form an isolated system, and the expansion is reversible. 6 %
(4) The gas and its surroundings form an isolated system, and the expansion is free. 6 %

5. Freezing of a mole of supercooled water at -10°C is a spontaneous (irreversible) process. How do you prove it? Write the data you need. 10 %

6.The stndard Gibbss energy change for the reaction

$2Ni_{(s)} + O_{2(g)} = 2NiO_{(s)}$

is $\triangle G^\circ = -489{,}100 + 197T$ (J) in the temperature range 298 to 1,725 K.

Calculate:

(1) The equilibrium constant at 1,000 K. 4 %

(2) The equilibrium partial pressure of oxygen at 1,000 K, $P_{O_2(eq.,\ 1,000K)}$. 4 %

(3) $\triangle H^\circ$ and $\triangle S^\circ$ at 1,000 K. 4 %

(4) If the partial pressure of oxygen at 1,000 K is larger than $P_{O_2(eq.,\ 1,000K)}$, which form of nickel is more stable, Ni or NiO? 4 %

(Standard state: P° = 1 bar)

7.discuss the following terms: 10 %

(1) Incongruent melting

(2) Solid solution

(3) Osmotic pressure

(4) Phase rule

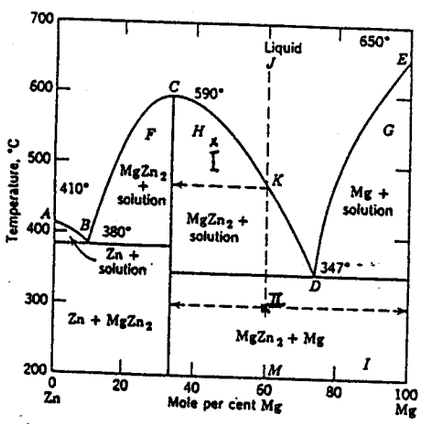

Fig. 5.17 Temperature-composition diagram, showing a maximum for the system zinc-magnesium.