



EASTERN UNIVERSITY, SRI LANKA
SECOND EXAMINATION IN SCIENCE – 2003/2004
SECOND SEMESTER
(June/July-2005)
CH206 X-RAY CRYSTALLOGRAPHY, SYMMETRY & SYMMETRY
ELEMENTS AND PHASE RULE

Answer all questions

Time: 01 hour

- 1(a) What is the symmetry elements present in trans-dichloro ethylene? Show wherever possible the symmetry elements with help of diagrams.
- (b) Calculate the miller indices of planes whose intercept on (a),(b) and (c) axes are ,
(i). $\frac{1}{4} a, \alpha b, \frac{1}{4} c$ (ii). $2a, b, c$
Show the position of the above planes in the cubic unit cell in clearly drawn diagrams.
- (c) Draw the planes of (0, 0, 2) and (0, 0, 1) in a simple cubic lattice. Calculate the distance between these planes using Bragg's equation
- (d) An X-ray powder photography of an ionic solid M^+Cl^- was taken at room temperature using a camera of radius 10.0 cm and an X-ray of $\lambda=0.150\text{\AA}$. After developing and drying the photograph it was found that out of the first seven pairs of axes the intensities of the first fourth and seventh were very much weaker than the rest Calculation showed that the $\sin^2\theta$ values for the first seven pairs were 0.0560, 0.0746, 0.1492, 0.2052, 0.2239, 0.2984 and 0.3544 respectively . Assuming that MCl belong to a cubic system.

Calculate

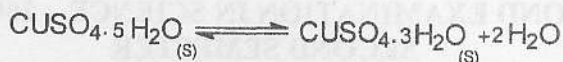
- (i) The cell dimension
(ii) Bravais lattice
(iii) The number of lattice point in the above unit cell
(iv) The distance between M^+ and Cl^- ions in the lattice

Cont..

2(a) State the phase rule and identify terms in it.

(b) What is the number of components, phases and degree of freedom in each of the following equilibria.

- (i) Solid carbon in equilibrium with gaseous CO, CO₂ and O₂ at 100^oC
 (ii)



(iii) an azeotrope point in binary component system

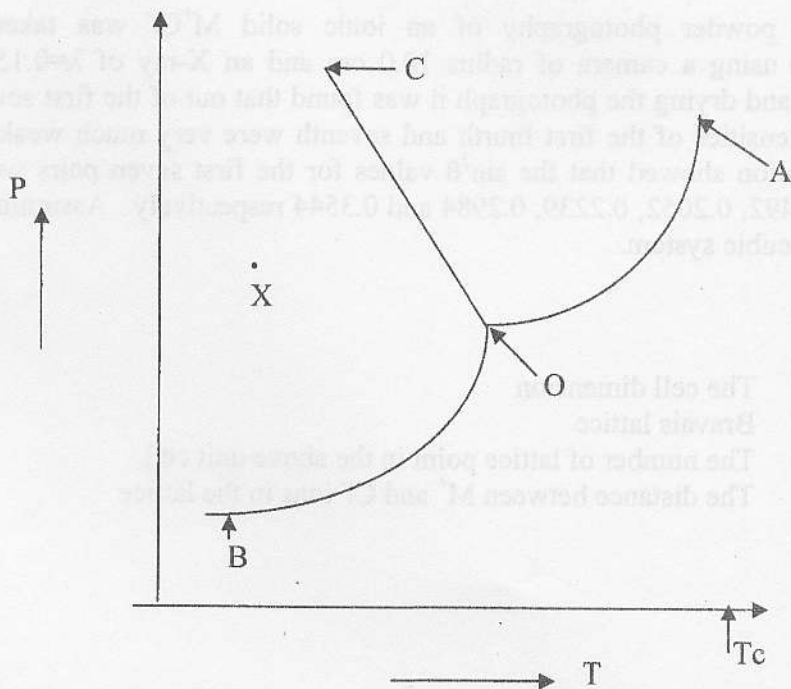
(c) Define the terms,

- (i) Triple point
 (ii) Eutectic point

(d) α -naphthol(A) and β -naphthol(B) form a compound AB that melts congruently at 133 K. The system exhibits two eutectics one at 25 mole percent B and 123 K and a second at 90 mole percent B and 104 K. The melting points of pure A and B are 131 K and 110 K respectively.

Draw the phase diagram for this system (assume: solid-solid solubility is negligible)

(e) The pressure Vs temperature diagram of a one-component system such as water is given below:



Label the diagram and calculate the number of degree of freedom corresponding to each of the points A, B, O, X.
