



EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE 2005/2006

SECOND SEMESTER (March/April 2008) -PROPER

CH 206 SYMMETRY & SYMMETRY ELEMENTS, X-RAY CRYSTALLOGRAPHY AND PHASE RULE

(20)

Time allowed: **ONE Hour**

Answer all questions.

The use of non-programmable calculator is permitted.

1. (a) What are the symmetry elements present in the following molecule and show wherever possible the symmetry elements with the help of diagrams.



(20 Marks)

- (b) What are the Miller indices for the plane having the intercept of $4a$, $2b$, ∞c . Draw a schematic diagram for the above plane in a cube.

(20 Marks)

- (c) Titanium metal has a body centered cubic lattice and has the density 4.50 g cm^{-3} . Assuming that the length of the unit cell is 3.28 \AA , calculate the number of titanium atoms are found in the unit cell (Atomic weight of titanium is 47.88 g mol^{-1}).

(20 Marks)

- (d) A powder diffraction photograph of the element polonium gave lines for the following values of $100 \sin^2 \theta$ when 71.0 pm x-ray were used.

1.11 2.21 3.32 4.47 5.53 6.70 8.94 10.1 11.1

Identify the unit cell and dimension.

(40 Marks)

2. (a) State Gibb's phase rule and identify the terms in it. (08 marks)
- (b) Define the term 'degree of freedom' (05 marks)
- (c) What is the number of components, phases and degree of freedom in each of the following closed system?
- (i) Solid carbon in equilibrium with gaseous CO, CO₂ and O₂ at 100⁰ C.
- (ii) Decomposition of MgNO₃ (2x10 marks)
- (d) (i) Define 'miscible liquids' and give an example for it. (07 marks)
- (ii) The vapour pressure of pure liquid A at 293 K is 68.8 kPa and that of pure liquid B is 82.1 kPa. These two compounds form ideal liquid and gaseous mixtures. Consider the equilibrium composition of a mixture in which the mole fraction of A in the vapour is 0.621. Calculate the mole fraction of A and B in the liquid mixture and the total pressure of the vapour. (40 marks)
- (e) Give the labeled phase diagram of water system and discuss the various points and lines. (20 marks)

End.