



EASETRN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE – REPEAT

SECOND SEMESTER 2004/2005 (OCTOBER 2006)

CH 206 X RAY CRSTALLOGRAPHY, SYMMETRY AND SYMMETRY ELEMENTS AND PHASE RULE

Time allowed: **ONE Hour**

Candidate must NOT start writing their answers until told to do so

You may find the following data useful

Avogadro constant (N_A): $6.023 \times 10^{23} \text{ mol}^{-1}$

Electron charge (e): $1.602 \times 10^{-19} \text{ C}$

Faraday constant (F): $9.648 \times 10^4 \text{ Cmol}^{-1}$

Gas constant (R): $8.314 \text{ JK}^{-1}\text{mol}^{-1}$

Planck's constant (h): $6.626 \times 10^{-34} \text{ Js}$

Rest mass of electron (m_e): $9.1 \times 10^{-31} \text{ kg}$

Velocity of light (c): $3 \times 10^8 \text{ ms}^{-1}$

The molar mass of Barium is 137.3 gmol^{-1}

The use of a non-programmable calculator is permitted

1. a. What are the symmetry elements present in SO_3 . Show wherever possible the symmetry elements with the help of diagrams.

(20 marks)

b. What is the Miller indices for the plane having the intercept of $a/2$, $b/2$, αc . Draw a schematic diagram for the above plane in a cube.

(20 marks)

c. The distance between the (211) planes in Barium is 204.9 pm. Given that the Barium forms a body centered cubic lattice, calculate the density of Barium.

(20 marks)

d. A powder diffraction photograph of powdered lead gave Bragg's diffraction at the following angles when 154.43 pm X rays were used in a camera of radius 5.73 cm.

15.66° , 18.17° , 26.13° , 31.11° and 32.71°

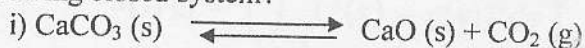
Identify the unit cell and its dimension.

(40 marks)

2. a. State Gibb's phase rule and identify the terms in it.

(10 marks)

b. What is the number of components, phases and degrees of freedom in each of the following closed system?



(20 marks)

c. What is "Condensed system"? Write the reduced phase rule equation.

(10 marks)

d. I) Explain the following

i) Congruent melting point

ii) Eutectics

(20 marks)

II) Components A and B form two solid compounds A_2B and AB_2 . The compound A_2B melts at 800°C to give a liquid having the same composition as that of A_2B . The compound AB_2 melts and decomposes at 700°C to give solid B and a liquid containing 60% of B. The melting points of A and B are 500°C and 1000°C respectively. Sketch a phase diagram of temperature versus amount of fraction of the system and completely label it.

(40 marks)