

**EASTERN UNIVERSITY, SRI LANKA**  
**SECOND EXAMINATION IN SCIENCE (2003/2004)**  
**EXTERNAL DEGREE**  
**SECOND SEMESTER (Oct./Nov. 2007)**  
**EXTCH 206 X-RAY CRYSTALLOGRAPHY, SYMMETRY,**  
**SYMMETRY ELEMENTS AND PHASE RULE**

**ANSWER ALL QUESTIONS**

**TIME – ONE HOUR**

1. a) What are the symmetry elements present in the following molecules?

i)  $C_6H_6$     ii)  $H_2O$     iii)  $C_2H_4$     iv)  $PtCl_4^{2-}$     (20 marks)

b) i) What are the Miller indices for the planes having the following intercepts in a simple cubic cell?

I) a, b, c    II)  $\infty$  a, b,  $\infty$  c    III) a/2, b, c/2    (20 marks)

ii) Draw a schematic diagram for each of the above planes.    (20 marks)

c) A powder diffraction photograph of the element Polonium gave lines at the following values of  $2\theta$  (in degrees) when 71.0 pm Mo X-rays used: 12.1, 17.1, 21.0, 24.3, 27.2 and 29.9. Identify the unit cell and determine its dimensions.    (40 marks)

2. a) State Gibb's phase rule and explain the terms in it.    (05 marks)

b) Explain the following terms

(i) Phase    ii) Degree of freedom    (10 marks)

c) Calculate the degree of freedom for the following

(i) A mixture of nitrogen gas and oxygen gas in a vessel    (10 marks)

(ii) Rhombic sulphur in equilibrium with monoclinic sulphur    (10 marks)

Turn over

