EASTERN UNIVERSITY, SRI LANKA

THIRD YEAR SECOND SEMESTER EXAMINATION IN SCIENCE

2008/2009 (Sept./ Nov.2010)

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

Answer all questions — Time: 01 hour

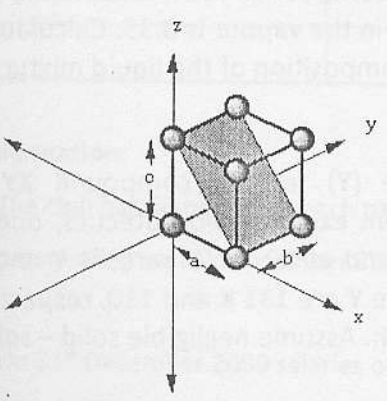
1. a). Explain the following terms with suitable example
   i. Symmetry operation
   ii. Symmetry elements

(20 Marks)

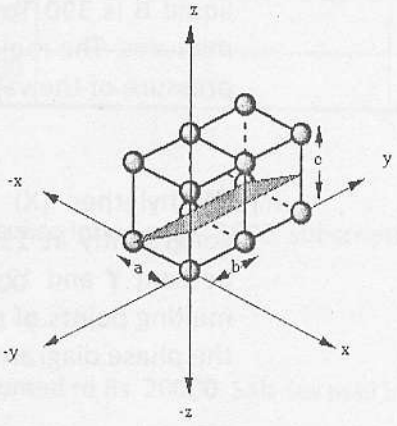
b) What are the symmetry elements present in PCl_5 molecule? Show the symmetry elements with suitable diagrams (wherever possible)

(20 Marks)

c). Determine the miller indices of the planes of the cubic system shown below.



(i)



(ii)

(20 Marks)

Turn over

d) A powder diffraction photograph of the element X showed various lines at following distances (in mm) from the central spot. Identify the unit cell and determine its dimension when 70 pm X-ray is used and radius of camera is 5.11 cm.

Distances: 12.1, 17.1, 21.0, 24.3, 27.2, 29.9, 34.7, 36.9, 38.9, 40.9 and 42.8 mm.

(40 marks)

2. (a) Ammonium carbonate get decomposes when it heated.

(i) How many components and phases are present when the salt is heated in an empty container?

(05 marks)

(ii) If the additional ammonia is present, how many components and phases are present?

(05 marks)

(iii) What is the number of degrees of freedom in each case (i) and (ii).

(10 marks)

(b) The vapour pressure of pure liquid **A** at 300 K is 575 Torr and that of pure liquid **B** is 390 Torr. These two compounds form ideal liquid and gaseous mixtures. The mole fraction of **A** in the vapour is 0.35. Calculate (i) the total pressure of the vapour and (ii) composition of the liquid mixture.

(40 marks)

(c) Methylether (**X**) and Diborane (**Y**) form a compound **XY** that melts congruently at 133 K. The system exhibits two eutectics, one at 25 mole percent **Y** and 123 K and a second at 90 mole percent **Y** and 104 K. The melting points of pure **X** and pure **Y** are 131 K and 110, respectively. Sketch the phase diagram for this system. Assume negligible solid – solid solubility.

(40 marks)

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