ESO 205T

Nature and Properties of Materials

Interaction session: 11-12 Monday
Tutorial: 11-12 Thursday

Assignment 3

Due by 24 September 2020 11 am

Question 1

Identify the crystal system, Bravais lattice and point group for the space groups provided below. Also show the stereographic projection of the point group with all the symmetry operators marked on it. Show the x, y and z axes on the stereographic projection properly. Please refer to the IUCR table of 32 point groups shared in the class for the stereographic projections of the point groups. [5 * 5 = 25]

    a) P321

    b) Amm2
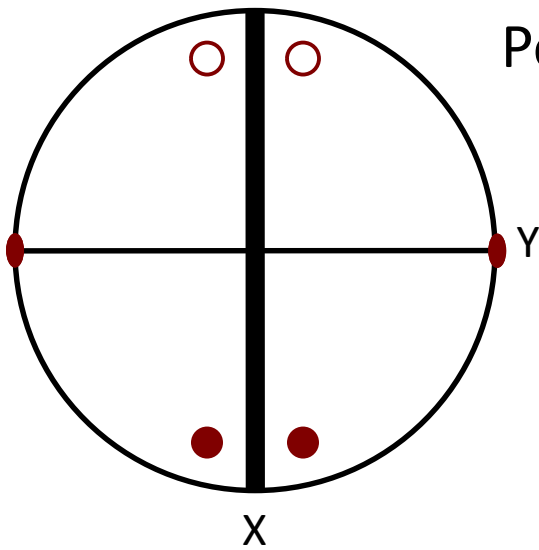
    c) $Fd\bar{3}m$

    d) P4mm

    e) $I4_1/a$

Model answer

P2$_1$/m
Monoclinic crystal system
Simple monoclinic Bravais lattice
Point group 2/m

Question 2

Hexagonal close packed crystal is obtained by stacking of the 2D rhombic unit cell in a stacking sequence of ABAB. Determine the ideal c/a ratio for materials with HCP crystal structure. Find the c/a ratio for Ti, Mg and Zn and comment on the reasons for the deviation if any from the ideal c/a ratio. [10]

Question 3

We had determined the plane group for graphene and boron nitride in the last assignment. Given below is an arrangement of three layers of graphene which is repeating along the vertical direction. Determine the space group of this crystal. [10]
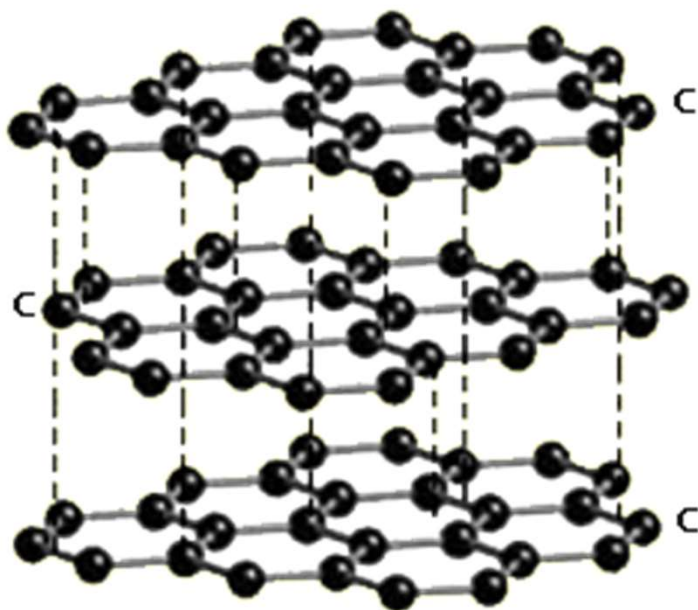
Question 4

Show that 3/m is equivalent to $\bar{6}$ using stereographic projection in steps. [5]