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SS205 - Symmetry and Structure in the Solid State

Assignment - 1

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13242

Materials Engineering

1. Two Students while discussing the point group symmetry ‘ mmm ’ made the following observations. Point out which of these is correct or incorrect and provide justification for your answers.

(i)The corresponding crystal structure is centrosymmectric.

(ii)The crystal system will have a = b = c, α = β = γ = 90°.

(iii)The axes are both proper and improper.

(iv)The full symbol is 4/m 2/m 2/m.

(v)The symmetry operation obey Euler’s theorem.

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1. (a) Draw stereographic projection for the following point groups.

(i) 6mm (ii) 4/mmm (iii) 2/m (iv) -3m (v) 422

( b ) Which of these point groups are centro symmetric ?

Also indicate the equivalent points associated with (iii) and (v)

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1. ( a ) A compound crystallizes in a space group *Cmca.* Write down the number of lattice points, crystal system, and the corresponding point group. Also remark the number of equivalent points you expect in this space group.

( b ) The corresponding polymorph of this compound crystallizes in *Imma.* Write down the number of lattice points, crystal system, point group and the number of equivalent points.

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1. ( a ) Draw a diagram to indicate the following planes.

(i) 11-1 (ii) 201 (iii) 004 (iv) 222

Comment on whether (iv)222 is parallel to (i)11-1

( b ) If a center of symmetry is added to the following point groups. Will it result in an allowed point groups.

(i)222 (ii)-3 (iii)1 (iv)2 (v)632

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1. ( a ) Two students find that a mirror symmetry is present in a monoclinic system with a = 4 Å,

b = 6 Å, c = 8 Å , β = 100° and a = 6 Å, b = 4 Å, c = 8 Å , α = 100° respectively. Can you justify that both are correct ?

( b ) If the point group is 2/m and the bravais lattice is *I,* write the equivalent points for this space

group.

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