



21/4/2016

DOON UNIVERSITY, DEHRADUN
Mid Semester Examination, Second Semester, 2015-16
School of Physical Sciences
Generic Elective test paper of 5 Years (Integrated) MSc Programmes
Course: PHC-453: Solid State Physics-I

Time Allowed: 2Hours

Maximum Marks: 30

Note: Attempt All Questions from Sections A,B,C.

SECTION: A

(Marks: 1 X 6 =6)

1. For a cubic crystal lattice, what do the following represent?
(a) $\langle 111 \rangle$ (b) $[010]$ (c) (111) (d) $\{100\}$
2. Assuming iron sodium (Na) has a lattice parameter, a , of 0.287 nm, what is its atomic radius?
3. Name two types of non-directional bonding. What type of bonding is present in (a) Diamond (b) NaCl (c) H_2O
4. What does the term polycrystalline mean? Draw the X-ray pattern for crystalline and amorphous materials.
5. How many crystal systems are there? Write down the lattice parameters for tetragonal crystal structure.
6. Draw $[\frac{1}{2}, 1, 0]$ in (110) .

SECTION: B

(Marks: 4 X 3=12)

7. What do you understand by Lennard Jones Potential? Explain the shape of a typical interatomic potential along with parameters A and B.
8. Cu crystallizes in a face centred cubic.
(a) Determine which X-ray reflections will be observed for Cu.
(b) Write down the extinction rule for the allowed reflections.
9. What is the family of planes $\{hkl\}$ with an interplanar spacing of $d = 1.246 \text{ \AA}$ in nickel (Ni) with $a = 3.524 \text{ \AA}$? Calculate the packing fraction of the face-centred cubic structure.

SECTION: C

(Marks: 6 X 2=12)

10. (a) Define the term reciprocal lattice and explain its relation to Bragg reflection.
(b) What is Brillouin Zone (BZ). Explain in detail about Ist, IInd and IIIrd BZ.
11. (a) Calculate the volume of unit cell for a hexagonal close packed structure in which the atom occupying the lattice points has radius of 1.6 \AA .
(b) For Au, calculate the planar packing fraction (fractional area occupied by atoms) of the (110) plane and the linear packing density (atoms/cm) of the $[100]$ direction.
Given, $r = 4.05 \times 10^{-8} \text{ cm}$