

CITY COLLEGE
Online Internal Assessment 2020-21
Physics (Hons.) CBCS Semester-V
Paper: CC-12: Solid State Physics
Time: 1 Hour; Full Marks: 20

Answer any ten:-

$10 \times 2 = 20$

1. A plane intercepts at $(a, 2a, a/3)$ in a simple cubic unit cell. What are the Miller indices of the plane?
2. Find out the density of atoms per unit area on a (110) plane of a bcc lattice of cube edge 'a' (one atom occupying each lattice point).
3. The first order (100) reflection angle is 18° for a cubic crystal using X-rays of wavelength 1.54\AA . Determine the distance between the (100) planes and the (111) planes of the crystal.
4. The molar specific heat of a solid at constant volume is $2.77 \text{ J.K}^{-1}\text{mol}^{-1}$ at 36.8 K. Determine the Debye temperature of the solid.
5. The energy wave vector dispersion relation for a one-dimensional crystal of lattice constant a is given by $E(k) = E_0 - \alpha - 2\beta \cos ka$, where E_0 , α and β are constants. Obtain the effective mass of the electron at the bottom and at the top of the band.
6. Mention two important applications of Hall Effect.
7. What is Curie-Weiss law? Discuss the significance of Curie temperature.
8. A paramagnetic material has a magnetic field intensity of 10^4 A/m . If the susceptibility of the material at room temperature is 3.7×10^{-3} , calculate the magnetization and flux density of the material.
9. Calculate the diamagnetic susceptibility of atomic hydrogen in the ground state at STP. [Assume the mean square distance of electronic charge distribution of atomic hydrogen from the nucleus as $\langle r^2 \rangle = 3a_0^2$, a_0 being the radius of the first Bohr orbit of hydrogen.]
10. What do you mean by electronic polarizability and ionic polarizability?
11. For a certain gas molecule, the permanent dipole moment is 1.35 Debye units. Calculate the orientational polarizability at room temperature.
12. Compare Ferroelectricity with Piezoelectricity.

Answer scripts must be emailed to sem5hcityphysics@gmail.com within 15 minutes of the end of the examination.