

Problem Set [OBE2]
Solid State Physics
PS - VIth

Q.1. Define Brillouin zone for a lattice by considering simple cubic crystal. How would you construct the first Brillouin zone for a bcc lattice?

Q.2. Calculate the maximum phonon frequency generated by scattering of visible light of vacuum wave length $\lambda = 4000 \text{ \AA}$. Given velocity of sound in medium = $5 \times 10^5 \text{ cm/sec}$ and refractive index 1.5

Q.3 Show that the heat capacity of a monoatomic lattice in one dimensional in the Debye approximation is proportional to T/Θ for low temperature $T \ll \Theta$, where Θ is the effective Debye temperature in one dimension defined as.

$$\Theta = \frac{\hbar \omega}{k} = \frac{\hbar \pi C_s}{k a}$$

where k is Boltzmann constant and a is interatomic separation.

Q.4 The static dielectric constant of water is 8.1 and its refractive index is 1.33. Calculate the percentage contribution of ionic polarizability?

Q.5 Show that greater the diffraction angle, the greater is the accuracy in determining the lattice parameter?