

QUESTION BANK

- 1) What is Reciprocal Lattice? Write the relation between reciprocal lattice parameters and direct lattice parameters.
- 2) Describe the principle and the whole experimental setup of Laue's Method of crystallography. Explain with the neat diagram.
- 3) Find the packing fraction and the coordination number of the HCP (hexagonal closed packing) structure and then derive the ratio $\frac{c}{a}$ where 'a' is the lattice parameter.
- 4) Explain NaCl crystal structure with a neat labeled diagram showing space lattice and the basis.
- 5) Deduce the Bragg's equation. Explain each terms used. Can we use any ray other than the X-ray for Bragg's reflection? Why?
- 6) Derive Clausius Mossotti relation starting with the Gauss's Law. What are the different types of polarizability? Explain.
- 7) In a crystal, a lattice plane cuts intercepts $a, 2b$ and $3c$ along the three axes, where a, b and c are the primitives of unit cell. Determine the Miller indices of a given plane.
- 8) What is dielectric? Define dielectric constant and dielectric loss.
- 9) Distinguish between polar and nonpolar molecular. Given examples. Explain electric polarization of matter on this basis.
- 10) What is molecular polarisability? Explain the meaning of electronic, ionic and orientation polarisabilities.
- 11) Describe three dimensional crystal system and their Bravais lattices. Derive a one dimensional expression for the internal field in liquids and solids.
- 12) The dielectric constant of He gas at N.T.P IS 1.0000684. Calculate the electronic polarizability of the gas containing 2.7×10^{25} atoms/m³.

- 13) A solid element dielectric with density of 3×10^{28} atoms/m³ show an electronic polarizability of 10^{-40} . Calculate the dielectric constant of the material. Explain the frequency dependence of dielectric constants.
- 14) What is dielectric, Polarization, Susceptibility, Relative permittivity explain them with a neat diagram.
- 15) Explain the Bragg's Spectrometer with a neat and explained diagram. On which law the calculation is based.
- 16) Draw the planes (200), (111), (110), (001) and the directions [212], [001], [111], [011]
- 17) What are miller indices? Deduce the equation for interplaner spacing (d) for the cubic crystal.
- 18) What is a Space lattice, unit cell, Basis of a crystal? What is the coordination number and packing fraction?
- 19) What is the packing fraction and coordination number of Simple Cube, FCC and BCC? Derive it with a neat diagram. The Primitive translation vector (Direct lattice parameters) is
- $$a = (a/2) i + (\sqrt{3}a/2) j$$
- $$b = (-a/2) i + (\sqrt{3}a/2) j$$
- $$c = ck$$
- Find the reciprocal lattice parameters (a^* , b^* , c^*) from given primitive translation vector.
- 20) The Bragg's angle for (220) plane reflection is 60° using an X-ray of wavelength 1.54 \AA . Determine the lattice parameter.
- 21) Calculate the polarizability of the gas of density 5.8×10^{25} atoms/m³ and the dielectric constant of 2.0.