Solid State Physics – Questions

* Tight binding method, limitations and effective mass
* LCAO ad its coefficients
* Bragg reflections and X-Ray scattering
* Density of states when we have perturbation
* Van Hove singularity, diagram and band structure
* Van Hove: optical properties
* Free electron model
* Fermi magnitudes
* Non idealities of crystals
* Additional symmetry operations (glide plane, screw axis)
* Trend of effective mass for both electrons and holes
* Effective mass approaching BZ boundaries (Bragg reflection)
* Bragg scattering experiment: from the spectrum, what datum gives you info about the basis (intensity)
* How intensity is related to basis
* Rules for BCC crystal
* Name some FCC metals
* Name some HCP metals (Titanium)
* Similarities between FCC and HCP
* Hopping integral
* Main symmetry properties of crystals
* Define reciprocal lattice
* Reciprocal lattice of BCC -> FCC
* Symmetry with basis
* Crystals with these properties (diamond, silicon (FCC + 2 basis) and germanium)
* Primitive unit cell of silicon
* Wigner-Seitz cell construction, advantages and meaning in RL
* Borders of first BZ -> Bragg planes
* Nearly free electron model
* Perturbation theory
* Band structure
* Position of basis, which property of spectrum we analyze
* Geometrical structure factor
* Graphene band structure -> tight binding
* Define holes
* How to know about unknown crystal (X-Ray/particles diffraction)
* Bloch theorem
* Dispersion relation
* Dynamics of electrons – semiclassical dynamics
* Chemical bonding of crystals
* Reciprocal vectors from direct wavevectors
* Scattering + Von Laue diffraction
* Geometrical and atomic structural factor
* NFEM (specifically band gap being two times Ug)
* Density of states
* Equivalent Hamiltonian and applications (semiconductor doping)
* Tight binding limitations and LCAO (Copper 3d 4s bands and avoided crossing
* Info from angular position and peak intensity in a scattering pattern – structure and atomic factors
* Egap in NFEM
* Glide planes and screw axis
* Point group discrete rotation operations
* Type of crystals according to chemical bonding