Module III: Quiz

1. **Do you agree that periodic solids may be considered as "wave boxes" – with travelling and diffracting waves – resulting in variety of properties?**

2. **What parameter governs the result of the interaction between the wave and the periodic lattice?**

3. **Assuming there are two waves of different nature – e.g. elastic and electron waves – gaining the same *k*-vector in a crystal, are there similarities in the formalism we use to learn their properties?**

4. **Neglecting the electron-electron interaction is one of the assumptions of the free electron gas (FEG) model which may be questioned because electrons might experience a serious repulsion as negatively charged particles. What argument explains the validity of the assumption?**

5. **The electron mean free pass of the order of the interatomic distance is another critical assumption of the FEG model. Is this assumption realistic?**

6. **To find the electron dispersion in a periodic crystal we adapt "one-electron" model to calculate accessible "orbitals" and subsequently "populate" *N* electrons on these orbitals. What are the meanings of E_F and k_F in this formalism?**

7. **Why FEFG contributes so little to the heat capacity of the crystal?**

8. **What mechanisms are responsible for electrical resistance in crystals with FEFG kept at low and high temperatures?**

9. **Why electron density of states (DOS) changes with changing the dimensionality of the crystal?**

10. **What is the origin of the energy bands in crystals?**

11. **Why bands are filling differently in different materials?**