

Jashore University of Science and Technology

Department of Physics

Bachelor of Science with Honours in Physics

2nd semester of 3rd year (2023–2024)

Course code: PHY 3205

Course title: Solid State Physics I

Assignment no.: 1

Date: 01 December 2025

Deadline for submission: 04 December 2025, 10:00 PM

1. Derive an expression for the attractive interaction between atoms in a solid composed of inert gases. Provide a detailed explanation of the underlying physical principles and assumptions.
2. What is the Madelung constant? Derive its expression for a one-dimensional ionic crystal and discuss its significance in determining the lattice energy of ionic solids.
3. Derive the dispersion relation for lattice vibrations in a one-dimensional crystal with a monatomic basis. Discuss the physical meaning of the acoustic phonon branch obtained from the relation.
4. Establish the Debye T^3 law for the heat capacity of solids at low temperatures. Define the Debye temperature and explain its significance in this model.