PHY 481/581 - Final Exam Review Fall 2018

1 Specific Heat in Solids in Ch. 2

- Einstein solid − the discrete allowed energy values lead to a temperature-dependent heat capacity

- Debye solid − Debye's model incorporated the coupling between harmonic oscillators further modifying the heat capacity at low-T

2 Free electrons in metals Ch. 3 & Ch. 4

- Classical theory for electrons in electric and magnetic fields − Drude theory − electrons modeled as a charged classical "gas."

- Fermi-Dirac statistics − the Pauli exclusion principle places restrictions upon energy values for the electrons in a gas

3 Phonons Ch. 9 & Ch. 10

- Monatomic 1D solid vibrations − as wavelength of sound wave approaches the inter-atomic spacing, the dispersion relation deviates from linear

- Diatomic 1D solid vibrations − for two atoms of different mass, the dispersion relation splits into two branches: acoustic and optical

4 Crystal geometry Ch. 12, Ch. 13, & Ch. 14

- Crystal structure − unit cells, Bravais lattices, and the rest

- Waves in crystals − reciprocal lattice, families of planes

- The Bragg and Laue conditions − waves typically pass through a periodic potential unimpeded unless these equivalent conditions are met, at which time reflection occurs

- X-ray diffraction − structure factor, selection rules

5 Electronic band theory Ch. 15, Ch. 16, Ch. 17, & Ch. 18

- Electrons in a periodic potential − nearly free electron model, Bloch's theorem

- Electrical conductivity in solids − metals, semiconductors and insulators, band-gaps, Fermi surface

- Semiconductor physics − doping, heterojunctions