

# Homework 1

Phys 155, Winter 2008, UCSC

Due Jan 17

Each problem is 5 points. For problems from H&H, please note that solutions are included in the textbook. However, use those solutions simply as a guide, if necessary. If you do, your answers should show clear evidence (your own words, logic, details, diagrams, etc.) for your own understanding.

1. H&H, 1.6
2. H&H, 1.7
3. In order to satisfy the Bragg condition, the wavelength  $\lambda$  of a quantum particle that probes a crystal needs to be on the order of, or smaller than, the spacing  $d$  of lattice planes. Since the typical lattice spacing of a crystal is a few Å, the wavelength of about 1 Å can be taken as a typical required value. Find corresponding energies in unit of eV (electron volt) when the probing particle is (a) a photon, (b) an electron, and (c) a neutron. (d) Which particle can be described as “thermal” in the sense that its energy is on the order of the room temperature 300 K (think the equipartition energy  $3k_B T/2$ ). You may find the table in “00 - Physical Constants.pdf” useful.