Welcome to solid state physics! In this class we will learn about the some of the many cool properties of solids and as you will see, most of them are due to the quantum mechanical effects. A first introductory course to quantum mechanics is a prerequisite to this course and we will heavily rely on some of the techniques you might've seen in PHYS 211 (or equivalent) and definitely in PHYS 405. I will briefly mention some of the important quantum topics as they come and introduce them in the context of the course, but I will assume that you are familiar with the "big topics" as to not spend too much time on reviewing topics from a prereq course.

The following list of concepts are those that I highly suggest you review for this class. This list itselt IS NOT TO SERVE AS THE REVIEW. In other words, this sheet does not represent a complete or adequate understanding of these topics for the course. You need to supplement this with a proper review of these topics on your own. I suggest using the introductory quantum mechanics text you used when taking either PHYS 405 (Griffiths, probably) or PHYS 211 (Harris, probably). See suggested reading and exercises (SRE) after each topic for some reading material.

1. Wave-particle duality

    (a) Energy of a photon, $E_{\mathrm{ph}} = h\nu$

    (b) de Broglie Wavelength

    (c) Photoelectric effect (work functions of metals)

    SRE: Harris Ch.3 (3.2, 3.6) and Ch. 4 (4.2), Exercises Ch. 3: 17, 20, 23, 47 and Ch. 4: 12, 20, 23, 25, 54

2. Pauli Exclusion Principle (Fermions vs. Bosons)

    SRE: Harris Ch. 8 (8.3)

3. Schrodinger Equation and its solutions

    (a) wavefunction eigenstates, expectation values, superposition

    (b) Braket notation

    (c) Solutions to various potentials along with the allowed energy eigenvalues

        i. Free Particle

        ii. Particle in a box

        iii. Simple harmonic oscillator

        iv. Hydrogen atom (quantum numbers!)

    SRE: Harris Ch. 5 (5.1, 5.2, 5.5, 5.6, 5.7), and Ch. 7, Exercises Ch. 5:5, 12, 21, 25, 34, 35, 50, 51 and Conceptual Questions Ch. 7: 1, 32

4. Quantum statistical distributions (Fermions and Bosons)

    SRE: Harris Ch. 9 (9.5, 9.6, 9.7, 9.9)

5. Heat capacity