Chapters 3 and 4

What we've derived from first principles

- Compton scattering
- Predictions for scattering particles from an atom
  - Impact parameter equation, number and fraction of incident particles scattered by an angle $\geq\theta$, number incident particles scattered through an angle θ to $(\theta+d\theta)$, number scattered seen at detector
- Radius of quantized atomic orbits
- Energy of quantized atomic orbits

Chapters 3 and 4

Examples done in class

- Equilibrium T of Earth, assuming black body
- Wavelength, frequency, #ϒ/sec emitted, # reach eye some distance away, all for a black body radiator (light bulb)
- Prove cannot have p-e effect with free electrons
- Compton wavelength of particles
- Bremsstrahlung wavelength
- Work function

- Upper limit on a nucleus radius (gold)
- E needed to penetrate to surface of nucleus
- Effective nuclear charge
- Rydberg atoms with n=600, diameter, v of ele in orbit, compare to v for n=1
- E of K_α, K_β from Mo, how to filter for a pure K_α beam
- Unusual atoms and Bohr radius
- X-ray spectra
- Alpha scattering

Chapters 3 and 4

Suggested problems from book

- CMB max λ, f, power incident on Earth from CMB
- Wavelength where energy distribution function is maximum
- Threshold f for p-e effect in Mo, will a certain λ cause p-e effect
- Compton scattering
- Minimum V of tube creating x-rays, when looking at Bragg diffraction data
- Fraction of Sun's E radiated in visible portion of spectrum
- Compton edge/incident E, λ

- Fraction of particles scattered at various angles
- Ratio of particles scattered per area, at detector
- Distance of closest approach to a nucleus
- Radius of orbits in H/H-like atoms
- Radius of muonic atom, E of lowest state, λ of transitions between E levels
- E and λ of states in positronium
- Final speed of ele in x-ray tube
- Transitions in an ion
- Number of particles counted per second at detector, for various angles
- E and v of ele in Bohr orbits in H-like atom (relativistic)

Chapters 3-4

Possible Theory-esque Questions

**** All contained material comes 100% from the lecture notes**

- What experiment did Millikan perform, describe the experimental setup, and its relevance
- What is a black body
- Describe the experiment used to create/study the photo-electric effect
- How are x-rays produced
- How do solar cells work
- What are the steps involved in Rutherford's derivation of expected deflections observed at a detector (don't need to work out the physics, just describe in words)

- What are the 4 predictions of the Rutherford equation
- What underlying assumption is built into the Rutherford calculation
- What is the correspondence principle

Chapters 3-4

Possible Derivations

**** All contained material comes 100% from the lecture notes**

- Derive the Compton change in wavelength equation
- Starting from the equation for the impact parameter, derive the number of alphas scattered through an angle θ to $\theta+d\theta$ (step 2 of Rutherford's derivation), or amount scattered seen at a detector (step 3 of the derivation).
  - impact param eqn is something you would have to know/program in to your graphulator/derive on the spot)