Physics 6 **Spring 2006**

Some concepts covered since first exam

Blackbody radiation
- Wien's Law
- Ultraviolet catastrophe
- Planck's quantum

Photoelectric effect
- Einstein's photon

Particle kinetic energy (non-relativistic)
- $E = \frac{1}{2} m v^2$
- or $E = p^2/2m = (p c)^2 / 2mc^2$

[Hints for calculating numbers: Given velocity in meter/sec & mass in Kg this first form of the equation gives energy in Joules. Given momentum in eV·sec/meter, as the deBroglie relation could give, then p·c is easier to use – it will be in eV – and the last form of the equation will give $(eV)^2$ / eV or just eV units.]

Photon energy $E = h f$
- Power of light and photons (watt = Joule/sec)

EM waves $\lambda = c/f$ true for photons but not massive particles

Atomic spectra
- What is wrong with Rutherford's classical planetary model?

Bohr model of atom
- Quantized orbits, discrete energies & quantum numbers

deBroglie waves $\lambda = h/p$

wave-particle duality

particle in one-dimensional box
- wavelengths, quantum numbers, discrete momenta and energies

Schrödinger equation:
- Wavefunction Ψ - wave modes or states
- Allowed wavelengths
- Quantum numbers
- Quantized energies
- Energy level diagrams
- Hydrogen atom (QM vs. Bohr model)
- One dimensional box or tube –
  - allowed wavelength, momentum, kinetic energy
- Transitions, energy level diagrams and photon emission or absorption

Probability
- Mutually exclusive or independent
- Coin tosses, dice rolls, random processes

Copenhagen Interpretation of Quantum Mechanics

$\Psi(x,t)$ (wave function or probability amplitude)

and $|\Psi(x,t)|^2$ (probability density)

What is observed?

Heisenberg Uncertainty Relation

Double slit experiment

Schrödinger's cat experiment

Collapse of the wavefunction

Spin of electron and other particles

Pauli exclusion principle

The play “Copenhagen”

Why did Bohr and Heisenberg meet?

What was Margrethe’s role?

What was the importance of the diffusion equation?

See PowerPoint slides for more questions