**Dougherty Valley • AP Chemistry**

**S-43**

Atomic Structure

STUDY LIST From Paul Groves

**What Can I Calculate About Waves?**

I can…

🞎 State the units that are used to measure wavelength (λ) and frequency (ν).

🞎 Convert between Hz & MHz, meters, nanometers (nm) and picometers (pm).

🞎 Calculate , , or E of any wave given one of the other quantities.

🞎 Show my work clearly using units that cancel.

🞎 Relate the size of wavelength to size of frequency and to size of energy.

🞎 Write the equations and constants involved in converting between , , and E.

🞎 Indicate the crest, trough, wavelength, and amplitude of a traveling transverse wave.

🞎 Indicate nodes, antinodes, and wavelengths of a standing wave on a string.

🞎 Explain how nodes and antinodes on a standing wave relate to the constructive and destructive interference of two waves on the same string.

🞎 State the seven types of electromagnetic radiation (EMR) in order of energy, frequency, and wavelength.

**What Does the Hydrogen Spectrum Tell About Atoms?**

🞎 Describe the differences among a continuous emission spectrum, a bright line spectrum, and an absorption spectrum.

🞎 Describe the visible spectrum from a hydrogen gas discharge tube.

🞎 State how Niels Bohr explained the lines in the hydrogen spectrum including the specific transitions that lead to the visible lines in the Balmer series.

🞎 Calculate the energy of any level, n, in the hydrogen atom.

🞎 State whether any specified transition will absorb or emit energy and the type of EMR involved.

🞎 Calculate the energy of the photon from any transition in the hydrogen atom.

🞎 Convert between kJ/mol and the energy of a single photon.

🞎 Identify the Lyman series in terms of electron transitions in the hydrogen atom.

**How Can Electrons Be Both Particles and Waves?**

🞎 Explain the significance of Balmer lines and quantized energy levels.

🞎 Draw standing waves that fit into a Bloogle showing that the frequencies are quantized.

🞎 Describe the photoelectric effect.

🞎 Explain how the photoelectric effect provides evidence that light (waves) must be particles (photons).

🞎 Explain how de Broglie devised the wavelength of a moving particle from E=mc2 and E=h.

🞎 Substitute Joules with kg·m2·s-2.

Calculate the wavelength of any moving particle.

🞎 State that calculating the wavelength () of a particle is a facet of wave-particle duality.

🞎 Explain that electrons, whose energy is quantized, must be waves because waves, not particles, can be quantized.

🞎 Explain what probability waves are.

🞎 Draw the general shapes of orbitals (the standing waves of an electron).

🞎 State the rules of quantum numbers and relate quantum numbers to individual orbitals.

🞎 Relate orbitals to the hydrogen energy levels.