Dougherty Valley • AP Chemistry

Atomic Structure

S-43

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 λ, ν, 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 λ, ν, 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 $E=mc^2$ and $E=h\nu$.
- ☐ Substitute Joules with $kg \cdot m^2 \cdot s^{-2}$. Calculate the wavelength of any moving particle.
- ☐ State that calculating the wavelength (λ) 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.