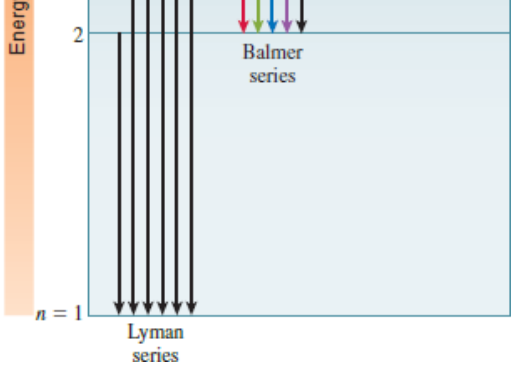


6.4: Wave Properties of Matter

Nodes: a collection of points at which electron density in an atom is 0; amplitude of the wave at this point is 0

Equation 6.8 $2\pi r = n\lambda$

- r = radius of the orbit
- λ = wavelength of the electron wave
- n = a positive integer

*Because n is an integer, r can only have certain values (integral multiples of λ) as n increases.
*Because the energy of the electron depends on the size of the orbit (or the value of r), the energy can have only certain values, too.
*de Broglie's reasoning led to the conclusion that waves can behave like particles and particles can exhibit wavelike properties.

$$\lambda = \frac{h}{mu}$$ Equation 6.9

- λ = wavelength of moving particle
- m = mass (in kg)
- u = velocity (m/s)

de Broglie Wavelength: wavelength calculated by the aforementioned equation (Equation 6.9)

6.5: Quantum Mechanics

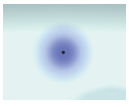
Heisenberg Uncertainty Principle: it is impossible to know simultaneously both the momentum (p) [defined as mass m * velocity u] and the position (X) of a particle with certainty

$$\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$$ Equation 6.10

$$\Delta x \cdot m\Delta u \geq \frac{h}{4\pi}$$ Equation 6.11

- Δx = uncertainty in measuring the position
- Δu = uncertainty in measuring the velocity
- m = mass in units kg

*If the measured uncertainties of position and velocity are large, their product can be substantially greater than $h/4\pi$, hence the > sign.
*Even in the most favorable conditions for measuring the position and velocity, the product of the uncertainties can never be less than $h/4\pi$, hence the = sign.
*If the velocity is more precise, the position is less precise and vice versa.
*The Schrodinger equation specifies the possible energy states the electron can occupy in a hydrogen atom and identifies the corresponding wave functions. (ex: cloud model)

- 
- **Electron Density:** the probability that an electron will be found in a particular region of an atom
- **Atomic Orbital:** the wave function of an electron in an atom, has a characteristic energy as well as a characteristic distribution of electron density