

# Atomic Structure Overview



## Terms, Symbols, and Definitions in Atomic Structure

### 1. Electromagnetic Radiation

- **Symbol:**  $\lambda$  (wavelength),  $\nu$  (frequency)
- **Definition:** A form of energy that exhibits wave-like behavior as it travels through space. It includes visible light, radio waves, gamma rays, and X-rays, all of which are part of the electromagnetic spectrum.

### 2. Photoelectric Effect

- **Symbol:**  $E = h\nu$
- **Definition:** The phenomenon where electrons are emitted from a material when it absorbs light of sufficient energy.

### 3. Bohr Model of the Hydrogen Atom

- **Symbol:**  $E_n = -\frac{13.6\text{eV}}{n^2}$
- **Definition:** A model proposing that electrons orbit the nucleus in specific, quantized orbits and that the energy of the electrons is quantized.

### 4. Quantum Numbers

- **Principal Quantum Number ( $n$ ):** Indicates the main energy level or shell of an electron.
- **Angular Momentum Quantum Number ( $l$ ):** Indicates the shape of the orbital (s, p, d, f).
- **Magnetic Quantum Number ( $m_l$ ):** Indicates the orientation of the orbital in space.
- **Spin Quantum Number ( $m_s$ ):** Indicates the spin direction of the electron (+1/2 or -1/2).

### 5. de Broglie Wavelength

- **Symbol:**  $\lambda = \frac{h}{mv}$
- **Definition:** The wavelength associated with a moving particle, showing the wave-particle duality.

### 6. Heisenberg Uncertainty Principle

- **Symbol:**  $\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$
- **Definition:** It is impossible to simultaneously determine the exact position and momentum of a particle.

### 7. Atomic Orbitals

- **Symbol:**  $\Psi$  (wave function)

- **Definition:** Mathematical functions that describe the probability distribution of an electron in an atom.

## 8. Aufbau Principle

- **Definition:** Electrons fill atomic orbitals of the lowest available energy levels before occupying higher levels.

## 9. Pauli Exclusion Principle

- **Definition:** No two electrons in an atom can have the same set of four quantum numbers.

## 10. Hund's Rule

- **Definition:** Every orbital in a subshell is singly occupied with one electron before any one orbital is doubly occupied.

## 11. Electron Configuration

- **Definition:** The distribution of electrons of an atom or molecule in atomic or molecular orbitals.

## 12. Orbitals and their Shapes

- **s Orbital:** Spherical shape.
- **p Orbital:** Dumbbell shape.
- **d Orbital:** Complex, cloverleaf shape.
- **f Orbital:** Even more complex shapes.

## 13. Atomic Spectrum

- **Definition:** The spectrum of frequencies of electromagnetic radiation emitted or absorbed during transitions of electrons between energy levels within an atom.

## 14. Energy Levels

- **Symbol:**  $n$
- **Definition:** Discrete levels of energy that an electron in an atom can occupy.

## 15. Orbital Diagram

- **Definition:** A pictorial representation of the arrangement of electrons in the orbitals of an atom.

## Symbols

- $h$ : Planck's constant ( $6.626 \times 10^{-34}$  Js)
- $c$ : Speed of light ( $3 \times 10^8$  m/s)
- $E$ : Energy
- $\lambda$ : Wavelength
- $\nu$ : Frequency

- $n$ : Principal quantum number
- $l$ : Angular momentum quantum number
- $m_l$ : Magnetic quantum number
- $m_s$ : Spin quantum number
- $\Psi$ : Wave function
- $\Delta x$ : Uncertainty in position
- $\Delta p$ : Uncertainty in momentum
- $Z$ : Atomic number
- $A$ : Mass number

These terms and definitions provide a foundational understanding of atomic structure and the principles governing the behavior of electrons in atoms.