

CHAPTER 7

ATOMIC STRUCTURE & PERIODICITY

BASIC SKILLS

1. Using the equations $c = \lambda\nu$ and $\Delta E = h\nu$, describe and calculate the relationships between the wavelength, frequency, and energy of the electromagnetic spectrum.
2. Use the de Broglie wave equation, $\lambda = h/mv$ to describe and demonstrate the wave nature of matter.
3. Describe and calculate the quantized nature of the hydrogen atom, as demonstrated by Bohr, by calculating the various energy transitions within the atom using the equation

$$E = -2.178 \times 10^{-18} \text{J} \left[\frac{z^2}{n^2} \right]$$

and how these transitions lead the atomic spectrum of hydrogen.

4. Solve problems relating to the Heisenberg Uncertainty Principle.
5. Describe the four quantum numbers n , l , m_l , & m_s and the relationship between them.
6. Use the Aufbau Principle to write the electron configurations, both conventional, core form, and orbital diagram, of the atoms in the periodic table. Determine electron configuration based on position in the periodic table.
7. Explain the inconsistencies in filling order, given the atoms which do not seemingly follow the Aufbau Principle.
8. Describe and calculate the difference between Z and Z_{eff} and the effect this difference has on ionization energy because of shielding as caused by electron-electron repulsion and electron penetration. Use the following equation to calculate Z_{eff}

$$IE = 1312 \text{ kJ/mol} \left[\frac{Z_{\text{eff}}^2}{n^2} \right]$$

9. Use your understanding of electronic configuration and the structure of the periodic table to predict the trends in ionization energy, electron affinity, atomic radius, and metallic character.