Worksheet #19 Chem177 Awino

Quantum Numbers:
- **Principal Quantum Number**: Represents Shell (n = 1, 2, 3)
- **Angular Momentum Quantum Number**: Defines the shape of the Orbital (s, p, d, f, g)
  - S orbital ($l = 0$): In the shape of a sphere
  - P Orbitals ($l = 1$): Dumb-bell shaped
  - D orbitals ($l = 2$): Clover leaf shaped
- **Magnetic Quantum Number ($m_l$)**: Defines orientation
- **Spin Quantum Number ($m_s$)**: Electron spin, up or down

- Pauli’s Exclusion Principle: No two electrons in an atom can have the same quantum numbers

Example: An electron cannot exist in the energy state described by which set of quantum numbers below? (Assume n, l, $m_l$, $m_s$)
(a) 3, 2, 2, $-\frac{1}{2}$
(b) 4, 3, 3, $\frac{1}{2}$
(c) 2, 1, $-3$, $\frac{1}{2}$
(d) 2, 0, 0, $-\frac{1}{2}$
(e) 1, 0, 1, $-\frac{1}{2}$

Example 2: Identify which sets of quantum numbers are valid for an electron. Each set is ordered (n, ℓ, $m_l$, $m_s$)
(a) 2, 2, $-1$, $\frac{1}{2}$
(b) 0, 2, 1, $\frac{1}{2}$
(c) 2, 0, 0, $-\frac{1}{2}$
(d) 3, $-2$, $-1$, $\frac{1}{3}$
(e) 3, 2, 1, $\frac{1}{2}$
(f) 4, 3, $-5$, $-\frac{1}{2}$
(g) 2, 1, $-1$, $\frac{1}{2}$
(h) 1, 2, 0, $\frac{1}{2}$
(i) 1, 0, 0, $\pm\frac{1}{2}$
(j) 4, 3, 1, $-\frac{1}{2}$
(k) 3.5, 3, 1, $\frac{1}{2}$
(l) 3, 2, 1, $-1$
**Electron Configuration:**

- **Aufbau’s Principle:** Electrons are added one at a time to the orbital boxes from lowest energy to highest in the energy level diagram.

- **Hund’s Rule:** For degenerate orbitals, no pairing occurs until each orbital box is occupied by an electron.

**Example:** Write a ground state electron configuration for each neutral atom. Ground state means that all of the lowest possible energy levels (up to the proper number of electrons for the element) are filled.

1. Na
2. Pb
3. Sr
4. U
5. N

*Elements in the same group have the same valence electron configuration.*
**Example:** Write an excited state electron configuration for each.

17. Al
18. Ar