Grade 11 Chemistry Notes: Atomic Structure

1.1 The Atom: A Quick Overview

- **Atoms** are the basic building blocks of matter.
- An atom consists of three subatomic particles:
    - **Protons**: Positively charged particles found in the nucleus.
    - **Neutrons**: Neutral particles also located in the nucleus.
    - **Electrons**: Negatively charged particles that orbit the nucleus in energy levels.

1.2 Electron Configuration and Orbitals

- **Electron Configuration** describes the arrangement of electrons in an atom's orbitals.
- Electrons occupy orbitals in a specific order based on energy levels:
    - **s-orbitals**: Spherical shape, can hold 2 electrons.
    - **p-orbitals**: Dumbbell shape, can hold 6 electrons (3 orbitals × 2 electrons each).
    - **d-orbitals**: Complex shapes, can hold 10 electrons (5 orbitals × 2 electrons each).
    - **f-orbitals**: More complex shapes, can hold 14 electrons (7 orbitals × 2 electrons each).
- **Aufbau Principle**: Electrons fill the lowest energy orbitals first.
- **Pauli Exclusion Principle**: An orbital can hold a maximum of 2 electrons with opposite spins.
- **Hund's Rule**: Electrons will fill empty orbitals in a subshell before pairing up.

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1.3 Quantum Numbers

- **Quantum numbers** describe the properties of atomic orbitals and the electrons in them:
    - **Principal Quantum Number (n)**: Indicates the main energy level occupied by the electron. (n = 1, 2, 3,…)
    - **Angular Momentum Quantum Number (l)**: Indicates the shape of the orbital. (l = 0 for s, 1 for p, 2 for d, 3 for f)
    - **Magnetic Quantum Number (m_l)**: Indicates the orientation of the orbital in space. (m_l ranges from -l to +l)
    - **Spin Quantum Number (m_s)**: Indicates the spin direction of the electron. (m_s = +½ or -½)
