

## GEOL 17.01: MINERALOGY

### CHEMISTRY-RELATED DEFINITIONS

- **Atoms** are the smallest divisible components of matter that have the same properties which differ from the properties of other elements. Each atom consists of a tiny nucleus that contains equal numbers of positively-charged protons and electrically neutral neutrons. This nucleus is surrounded by one or more shells of negatively-charged electrons. A neutral atom has the same number of protons and electrons.
- **Atomic Number:** the number of protons present in an atom.
- **Element:** a basic chemical unit composed of atoms having the same atomic number; elements cannot be separated into simpler parts by chemical means
- **Ion:** an electrically charged atom formed by the loss or gain of one or more electrons.
  - **Anions:** atoms or groups of atoms that have gained electrons and are negatively charged (e.g.  $O^{2-}$ ).
  - **Cations:** atoms or groups of atoms that have lost electrons and are positively charged (e.g.  $Ca^{2+}$ ).
- **Metal:** an element that ionizes easily to form a cation
- **Nonmetal:** an element that ionizes easily to form an anion
- **Valence:** the number of lost or gained electrons. It can be negative or positive, e.g.  $O^{2-}$  has a negative valence of 2 whereas  $Ca^{2+}$  has a positive valence of 2.
- **Orbital:** the region of space where there is a reasonable probability of finding an electron.
  - **s-orbital:** Spherical orbital that can hold one electron pair
  - **p-orbital:** Set of 3 dumbbell-shaped orbitals, each of which can hold one electron pair. Begins in period 2.
  - **d-orbital:** Set of 5 orbitals that generally have a four-leaf-clover-shape, each of which can hold one electron pair. Begins in period 4 (transition metals).
- **Valence Electron:** an unpaired electron in an orbital
- **Ionic Bond:** an ideal electrostatic chemical bond formed between elements with a large difference in electronegativity
- **Covalent Bond:** an ideal chemical bond in which orbital electrons are shared between elements with little or no difference in electronegativity
- **Metallic Bond:** an ideal chemical bond in which electrons are free to move from one atom to another
- **van der Waals Bond:** a weak electrostatic bond created by brief fluctuations in the balance of positive and negative charges