### **5.1 – Igneous Rocks**

**A) Igneous:**Formed from the cooling and crystallization of magma or lava.

1. **Magma** = hot molten rock below the Earth’s surface  
   **Lava** = magma that flows onto the Earth’s surface
2. **The type of igneous rock that forms depends on the composition of the magma.**
   * Magma is made of the same major elements found in Earth’s crust (Si, O, Fe, Al, Ca, etc.).
     + **Silica (SiO₂) is the most abundant.**
   * **Silica content** affects the melting temperature of magma and impacts its viscosity (resistance to flow).
     + High silica = slower flow (“thicker”)
     + Low silica = faster flow (“thinner”)
   * **Basaltic**: Dark-colored, low silica, flows easily (“syrup”)
   * **Andesitic**: Medium silica, medium flow (“honey”)
   * **Rhyolitic**: Light-colored, high silica, flows slowly (“peanut butter”)
3. **Lava composition** is slightly different from magma.

### **5.1b – Fractional Crystallization**

**A) Fractional Crystallization**

1. The process by which different minerals crystallize at different temperatures.
2. As minerals form, they will drop out of the melt and will no longer react with the magma.
3. This happens in the opposite order of partial melting.

**B) Crystal Settling**

1. Bowen’s reaction series and fractional crystallization are related.
   * Bowen’s reaction series (BRS) shows the order of crystallization.
   * Fractional crystallization (FC) explains how olivine & Ca-rich feldspar appear in certain rocks.
   * As newly formed crystals are separated from the magma, the chemical reactions between the magma and minerals stop.
2. The minerals will settle to the bottom of the magma. If the magma is squeezed upward, this can result in two distinct igneous bodies.

### **D1) Four Factors That Affect the Formation of Magma**

1. **Temperature**
   * Temperature increases with depth (the geothermal gradient).
2. **Pressure**
   * Pressure increases with depth.
   * Affects melting points of rock: as pressure increases, so does melting point.
3. **Water Content**
   * Rocks contain small amounts of water.
   * As water content increases, melting point decreases.
4. **Mineral Content**
   * Different minerals melt at different temperatures.
   * Rocks rich in iron and magnesium melt at higher temps than those rich in silicon.