Minerals and the Rock Cycle

Chemistry and Structure
Physical Properties
Rocks

Elements in Earth's Crust

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>O</td>
<td>45%</td>
</tr>
<tr>
<td>Silicon</td>
<td>Si</td>
<td>27%</td>
</tr>
<tr>
<td>Aluminum</td>
<td>Al</td>
<td>8%</td>
</tr>
<tr>
<td>Iron</td>
<td>Fe</td>
<td>6%</td>
</tr>
<tr>
<td>Calcium</td>
<td>Ca</td>
<td>5%</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Mg</td>
<td>3%</td>
</tr>
<tr>
<td>Sodium</td>
<td>Na</td>
<td>2%</td>
</tr>
<tr>
<td>Potassium</td>
<td>K</td>
<td>2%</td>
</tr>
</tbody>
</table>

Other: Fluorine (F); Chlorine (Cl); Sulfur (S), Carbon (C).

Most simple model for an atom.
Most simple model for an atom.

**Oxygen Atom Schematic Representation**
- Protons (8 are present)
- Neutrons (usually 8 are present)
- Electrons

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**Ions, Chemical Compounds**
Silica Tetrahedron: Four Oxygen + One Silicon = SiO$_4^{4-}$

In order for the silica tetrahedron to be balanced within a mineral:

A) balanced by enough positively charged cations (Mg, Fe, Na, etc.)

B) balanced by sharing oxygen atoms with adjacent silica tetrahedrons

Isolated Silicate Structure
Chain Silicates

Common Silicate Structures

- **Isolated silicate structure**: Example - Olivine
- **Single chain structure**: Pyroxene group
- **Double chain structure**: Amphibole group
Minerals

• Basic building blocks of all rocks

• All rocks are composed of minerals

Definition of a Mineral

• Must naturally occurring

• Must be an inorganic solid

• Definite chemical composition

• Characteristic crystalline structure