Chapter 2: Atoms and Molecules of Ancient Earth

Life requires about 25 elements

- Carbon (C)
- Oxygen (O)
- Hydrogen (H)
- Nitrogen (N)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Element</th>
<th>Atomic Number</th>
<th>Mass Number</th>
<th>Percentage of Mass (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Oxygen</td>
<td>8</td>
<td>16</td>
<td>0.04</td>
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<tr>
<td>C</td>
<td>Carbon</td>
<td>6</td>
<td>12</td>
<td>0.05</td>
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<tr>
<td>H</td>
<td>Hydrogen</td>
<td>1</td>
<td>2</td>
<td>9.3</td>
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<tr>
<td>N</td>
<td>Nitrogen</td>
<td>7</td>
<td>14</td>
<td>1.5</td>
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<tr>
<td>Ca</td>
<td>Calcium</td>
<td>20</td>
<td>40</td>
<td>1.3</td>
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<tr>
<td>P</td>
<td>Phosphorus</td>
<td>15</td>
<td>31</td>
<td>1.0</td>
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<td>K</td>
<td>Potassium</td>
<td>19</td>
<td>39</td>
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<td>S</td>
<td>Sulfur</td>
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<td>32</td>
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<td>Cl</td>
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<tr>
<td>Mg</td>
<td>Magnesium</td>
<td>12</td>
<td>24</td>
<td>0.1</td>
</tr>
</tbody>
</table>

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Atoms and molecules:

- Atomic number
- Mass number
- The energy levels of electrons:
  - Electrons vary in energy
  - Potential energy

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Energy levels of electrons:

Electron configuration and chemical properties:
- Chemical behavior due to electrons
Atoms combine by chemical bonding to form molecules:

* Chemical behavior depends on valence electrons

**Covalent bond**

Examples:
- Covalent bond
- Double Covalent bond

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Atoms combine by chemical bonding to form molecules:

Another example:

**Compounds**

- *electronegativity
  - nonpolar covalent bond
  - polar covalent bond

Example:

H₂O - water

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Atoms combine by chemical bonding to form molecules:

**Ionic bonds**

- *ion
- *cation
- *anion

ionic compounds or salts
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Atoms combine by chemical bonding to form molecules:

* Bonding between molecules
  - Hydrogen bonding

Hydrogen bonds:

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Water: what's the big deal?

Polarity of water:

* Hydrogen bonding
* Cohesion

Water transport in plants

Adhesion

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Water is the solvent of life

* Solution
* Solvent
* Solute
* Aqueous solution

* Polar and ionic molecules can be dissolved in water
Chapter 2: Chemical Components of Cells

Hydrophilic and hydrophobic substances

*hydrophilic
*hydrophobic

The dissociation of water molecules

\[ \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{OH}^- \]

Acids and bases

*acid
*base