Writing Molecular Formulas
and Introduction to Organic Molecules

Video Notes
In this lesson, you will:

• Define and identify organic compounds.
• Learn to write formulas for a variety of molecular compounds, including some classified as organic.
Octet Formation

- Ions combine to try to achieve the stable noble gas formation.
- They will give up and gain electrons to achieve this formation.
- Transferred electrons create Ionic Bonds
- Shared electrons create Covalent Bonds.
Ionic bonding - Review

- Produces ions
- Balances charges
- Formula unit - the positive charges equal negative charges in the simplest ratio form.
Molecular compounds- Covalent Bonding

There is no charge to balance!

- Formula represents the number of atoms of each element in a single molecule
- No ions are present.
The very same elements may form several different compounds…

- Nitrogen monoxide \( \text{NO} \)
- Nitrogen dioxide \( \text{NO}_2 \)
- Dinitrogen monoxide \( \text{N}_2\text{O} \)
- Dinitrogen trioxide \( \text{N}_2\text{O}_3 \)
- Dinitrogen pentoxide \( \text{N}_2\text{O}_5 \)
The Prefix system of nomenclature

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono-</td>
<td>1</td>
</tr>
<tr>
<td>Di-</td>
<td>2</td>
</tr>
<tr>
<td>Tri-</td>
<td>3</td>
</tr>
<tr>
<td>Tetra-</td>
<td>4</td>
</tr>
<tr>
<td>Penta-</td>
<td>5</td>
</tr>
<tr>
<td>Hexa-</td>
<td>6</td>
</tr>
<tr>
<td>Hepta-</td>
<td>7</td>
</tr>
<tr>
<td>Octa-</td>
<td>8</td>
</tr>
<tr>
<td>Nona-</td>
<td>9</td>
</tr>
<tr>
<td>Deca-</td>
<td>10</td>
</tr>
</tbody>
</table>
Examples

- **Dinitrogen monoxide**
  - $\text{N}_2\text{O}$ (remember the subscript of 1 is understood, not written)- also notice that the O (or A) is dropped in mono if the beginning of the element is a vowel... we do not write mono oxide.

- **Tetrathosphorus deoxide**
  - $\text{P}_4\text{O}_{10}$
A rule....

- The first atom named only gets a prefix if it contributes more than one molecule to the compound. (example- carbon dioxide isn’t monocarbon dioxide) Never a prefix of mono in first element in a compound.
Organic compounds

- Foods we eat are organic... proteins, sugars, carbohydrates, etc...
- Organic compounds are formed by covalent bonds
- Plastics are made from complex carbon compounds
- Bonds are weak
- Have low boiling and melting points
- Can have a strong odor
- Poor conductors of electricity (this is why plastic or rubber insulate electric wires)
- Weak bonds are essential for life... Allows for bonds to be broken and reformed easily (think of digestion- break down food, use elements for nutrients)
Any covalently bonded compound containing carbon with the exception of carbonates and oxides.

- Hydrocarbons- composed of only hydrogen and carbon
  - Saturated
    - Contain only single bonds (alkanes)
  - Unsaturated
    - Contain double (alkenes) and triple (alkynes) carbon-carbon bonds
    - Very reactive because of double and triple bonds.
      Common hydrocarbon is methane...
    Petroleum is also created by decay of living organism... separated out by fractional distillation.
• Simplest hydrocarbon
• \( \text{CH}_4 \)

• Only has single bonds so it is an alkane - Notice, -ane is at the end of methane as well.

Basic Example of alkane series (\( \text{C}_n \text{H}_m \))
<table>
<thead>
<tr>
<th>Prefix</th>
<th># of Carbon atoms (n)</th>
</tr>
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<tbody>
<tr>
<td>Meth-</td>
<td>1</td>
</tr>
<tr>
<td>Eth-</td>
<td>2</td>
</tr>
<tr>
<td>Prop-</td>
<td>3</td>
</tr>
<tr>
<td>But-</td>
<td>4</td>
</tr>
<tr>
<td>Pent-</td>
<td>5</td>
</tr>
<tr>
<td>Hex-</td>
<td>6</td>
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<tr>
<td>Hept-</td>
<td>7</td>
</tr>
<tr>
<td>Oct-</td>
<td>8</td>
</tr>
<tr>
<td>Non-</td>
<td>9</td>
</tr>
<tr>
<td>Dec-</td>
<td>10</td>
</tr>
</tbody>
</table>
Examples

• Remember \((C_nH_{2n+2})\)

• Propane- \(C_3H_8\)

• Nonane- \(C_9H_{20}\)
Alkenes

- Unsaturated… Not all of the bonds are single bonds…
- There is a double bond between carbon atoms.
- Basic formula for alkenes is \( C_nH_{2n} \)

Butene? (you know it is an alkene due to the suffix ene…) - Use the chart to find \( n \)

\( C_4H_8 \)
CR1. Chemistry is the study of:

a. Candles
b. Properties
c. Reactions
d. Matter
Chemistry Quiz

CR2. When writing the formula of an ionic compound:

a. The net charge must be zero
b. The total positive charge equals the total negative charge.
c. The cation is written first followed by the anion
d. All of the above are true.
Chemistry Quiz

1. All carbon containing compounds are classified as being organic
   a. true
   b. false
2. What prefix represents the number two in a molecular formula?

a. di-
b. bi-
c. tri-
d. dos-
3. The correct formula for butane is
   a. \( \text{C}_4\text{H}_8 \)
   b. \( \text{C}_4\text{H}_{10} \)
   c. \( \text{C}_4\text{H}_6 \)
   d. \( \text{C}_4\text{H}_4 \)
4. Hydrocarbons are organic compounds containing only hydrogen and ____.
   a. Oxygen
   b. The hydroxide ion
   c. The carbonate ion
   d. carbon
5. The distinguishing feature of an alkene is that it contains ________________.

a. All single bonds
b. A double bond
c. A triple bond
d. An ionic bond