Chain Isomerism

Definition:
Chain isomerism, also known as skeletal isomerism, occurs when two or more compounds with the same molecular formula have different arrangements of the carbon skeleton (or chain). These isomers differ in the branching of their carbon chains, leading to variations in their physical and chemical properties.
Examples:

1. **Butane (C_4H_{10}):**
    - **n-Butane:** A straight-chain alkane with the formula CH_3-CH_2-CH_2-CH_3.
    - **Isobutane (2-Methylpropane):** A branched-chain alkane with the formula $(CH_3)_2CH$-CH_3.
2. **Pentane (C_5H_{12}):**
    - **n-Pentane:** A straight-chain alkane with the formula CH_3-CH_2-CH_2-CH_2-CH_3.
    - **Isopentane (2-Methylbutane):** A branched-chain alkane with the formula CH_3-$CH(CH_3)$-CH_2-CH_3.
    - **Neopentane (2,2-Dimethylpropane):** A more branched-chain alkane with the formula $(CH_3)_4C$.
3. **Hexane (C_6H_{14}):**
    - **n-Hexane:** A straight-chain alkane with the formula CH_3-CH_2-CH_2-CH_2-CH_2-CH_3.
    - **2-Methylpentane (Isohexane):** A branched-chain alkane with the formula CH_3-CH_2-$CH(CH_3)$-CH_2-CH_3.
    - **3-Methylpentane:** Another branched-chain alkane with the formula CH_3-CH_2-CH_2-$CH(CH_3)$-CH_3.
    - **2,2-Dimethylbutane:** A branched-chain alkane with the formula CH_3-$C(CH_3)_2$-CH_2-CH_3.
    - **2,3-Dimethylbutane:** Another branched-chain alkane with the formula $(CH_3)_2CH$-$CH(CH_3)_2$.

Characteristics of Chain Isomers:

- They have the same molecular formula but different structures.
- They exhibit different physical properties such as boiling points, melting points, and densities.
- Their chemical properties can also vary due to differences in the carbon chain structure.

Chain isomerism is commonly observed in alkanes, but it can also occur in other types of organic compounds, such as alkenes and alkynes, where the carbon skeleton can vary while maintaining the same molecular formula.