

Nature of Carbon and Hydrocarbons

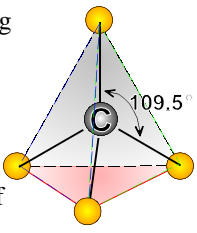
Aim

- to describe bonding in carbon and the type of compounds it typically forms

Notes

Nature of Carbon

- ★ Family - Group 14
 - ☆ Metalloid - can bond with metals and nonmetals
 - ☆ Most active member of family
 - ☆ Electron configuration
 - ★ 4 valence electrons
 - ★ can bond with up to four elements at once
- ★ Bonding
 - ☆ forms compounds by covalent bonding
 - ★ single bond - one shared pair of electrons

$$\begin{array}{c} | \\ -C- \\ | \end{array}$$
 - ★ forms a regular tetrahedron
 
 - ★ double bond - two shared pairs of electrons

$$\begin{array}{c} \diagup \quad \diagdown \\ C=C \\ \diagdown \quad \diagup \end{array}$$
 - ★ triple bond - three shared pairs of electrons

$$-C \equiv C-$$
 - ☆ forms bonds with other elements or with other carbons
 - ☆ can form chains of carbon of unlimited length
 - ★ chains can be straight
 - ★ chains can be branched
 - ★ chains can be closed to form rings
- ★ The variety and complexity of carbon compounds is unlimited

Characteristics of organic compounds

- ★ Formed as a result almost exclusively of covalent bonding
- ★ Generally nonpolar
- ★ Generally insoluble in water
 - ★ usually soluble in nonpolar solvents (other organic compounds)
- ★ Nonelectrolytes except organic acids which are weak electrolytes

- ★ Have low melting points (due to weak intermolecular forces that hold them together)
- ★ Have slower reaction rates than inorganic compounds
 - ★ covalent bonds within organic molecules are strong
 - ★ activation energies are high
 - ★ catalysts are often used to increase reaction rates

Hydrocarbons

- ★ Definition - compounds composed of only hydrogen and carbon
- ★ Homologous series - group of organic compounds with similar properties and related structures (differ from each other by CH_2)
 - ☆ Aliphatic - hydrocarbon chains
 - ★ Saturated
 - ★ Definition - has no bonds that can be broken to add extra hydrogens
 - ★ called **Alkanes**
 - family of hydrocarbons with all single bonds
 - general formula $\text{C}_n\text{H}_{2n+2}$
 - named with suffix "**ANE**"
 - ★ Unsaturated - has double or triple bonds that can be broken to add more hydrogens
 - ☆ **Alkenes**
 - family of hydrocarbons with one double bond
 - general formula C_nH_{2n}
 - named with suffix "**ENE**"
 - ☆ **Alkynes**
 - family of hydrocarbons with one triple bond
 - general formula $\text{C}_n\text{H}_{2n-2}$
 - named with suffix "**YNE**"




ON-LINE: Check out the web sites below.

- 📄 Electronic Properties of Carbon <http://www.webelements.com/webelements/scholar/elements/carbon/electronic.html>
- 📄 The Chemistry of Carbon <http://www.nyu.edu/pages/mathmol/modules/carbon/carbon1.html>
- 📄 It's Elemental <http://education.jlab.org/itselemental/ele006.html>
- 📄 Carbon <http://www.encyclopedia.com/searchpool.asp?target=@DOCTITLE%20carbon>

Carbon	http://www.resource-world.net/C.htm
Carbon	http://pearl1.lanl.gov/periodic/elements/6.html
Structure and Bonding	http://chipo.chem.uic.edu/web1/ocol/SB/CH1sum.htm
Atom World: Carbon, Single Bond	http://www.jlc.net/~aretee/atomworld/carbonsb.html
The Alkane Family	http://members.aol.com/logan20/alkanes.html
The Alkene Family	http://members.aol.com/logan20/alkenes.html
The Alkyne Family	http://members.aol.com/logan20/alkynes.html
Glossary of Organic Chemistry	http://www.petrik.com/PUBLIC/library/misc/glossary_of_org_chem.htm
Organic Chemistry	http://www.visionlearning.com/library/science/chemistry-2/CHE2.4-organic_chem.htm
Unsaturated Hydrocarbons	http://www.chem.latech.edu/~deddy/chem121/Alkene_Alkyne_Aromatic.htm


READING ASSIGNMENT

 Chapter No 25

SECTIONS

25.1–25.2, 25.4

ASSIGNMENT

 Chapter No 25

PAGES

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QUESTIONS

7–9

11

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Answer the questions below by circling the number of the correct response

- Which formula may represent an unsaturated hydrocarbon? (1) C₂H₆ (2) C₃H₆ (3) C₄H₁₀ (4) C₅H₁₂
- In an homologous series, the second member has the formula C₃H₆. What is the formula of the fourth member of this series. (1) C₄H₈ (2) C₄H₁₀ (3) C₅H₁₀ (4) C₅H₁₂
- As the molecular mass of the compounds of the alkane series increases, their boiling point (1) decreases (2) increases (3) remains the same
- Which represents an unsaturated hydrocarbon? (1) C₂H₄ (2) C₂H₆ (3) C₃H₈ (4) C₄H₁₀
- Which is a saturated hydrocarbon? (1) C₃H₈ (2) C₆H₆ (3) C₂H₅OH (4) C₂H₄O₂
- Which compound is a hydrocarbon? (1) R–CH₃ (2) R–OH (3) R–COOH (4) R–Cl
- Which molecule contains a triple covalent bond? (1) C₂H₂ (2) C₂H₄ (3) C₃H₆ (4) C₃H₈
- Which compound is a member of the alkane series? (1) C₂H₆ (2) C₃H₆ (3) C₄H₆ (4) C₆H₆
- The general formula for the alkyne series is (1) C_nH_n (2) C_nH_{n-2} (3) C_nH_{2n} (4) C_nH_{2n-2}
- Which is the formula of a saturated hydrocarbon? (1) C₂H₂ (2) C₂H₄ (3) C₅H₈ (4) C₅H₁₂
- Which formula represents an unsaturated hydrocarbon? (1) C₃H₈ (2) C₃H₇Cl (3) C₃H₆ (4) CCl₄
- The compound CH₃CH₂CH₂CH₃ belongs to the series that has the general formula (1) C_nH_{2n-2}, (2) C_nH_{2n+2}, (3) C_nH_{n-6}, (4) C_nH_{n+6}
- Which molecule contains a triple covalent bond between adjacent carbon atoms? (1) C₂H₄ (2) C₂H₂ (3) C₃H₆ (4) C₃H₈
- Each member of the alkane series differs from the preceding member by one additional carbon atom and (1) 1 hydrogen atom (2) 2 hydrogen atoms (3) 3 hydrogen atoms (4) 4 hydrogen atoms
- Which formula represents a saturated hydrocarbon? (1) C₂H₂ (2) C₂H₄ (3) C₃H₆ (4) C₃H₈
- Which formula represents a hydrocarbon with a double covalent bond? (1) CH₃Cl (2) C₂H₃Cl (3) C₂H₂ (4) C₂H₄
- Organic compounds differ from inorganic compounds in that organic compounds generally have (1) high melting points and are electrolytes, (2) high melting points and are nonelectrolytes, (3) low melting points and are electrolytes, (4) low melting points and are nonelectrolytes
- The compound C₂H₂ belongs to the series of hydrocarbons with the general formula (1) C_nH_n (2) C_{2n}H_{2n} (3) C_nH_{2n-2} (4) C_{2n}H_{2n-2}
- Which normal alkane has the highest boiling point at 1 atmosphere? (1) C₂H₄ (2) C₃H₆ (3) C₄H₈ (4) C₅H₁₀
- Which element is composed of atoms that can form more than one covalent bond with each other? (1) hydrogen (2) helium (3) carbon (4) calcium