

Carbon Chemistry

Properties of Carbon
Carbon Compounds
Life With Carbon





Properties of Carbon

How is carbon able to form such a huge variety of compound?

- Few elements have the ability of carbon to bond with both itself and other elements in so many different ways.
- With four valence electrons, each carbon atom is able to form four bonds.



Properties of Carbon

What are the four forms of pure carbon?

- Diamond, graphite, fullerenes, and nanotubes are four forms of the element carbon.
 - Diamond: a form of the element carbon in which the atoms are arranged in a crystal structure
 - Graphite: a form of the element carbon in which a carbon atom is bonded tightly to three other carbon atoms in flat layers
 - Fullerene: a form of carbon that consists of atoms arranged in the shape of a hollow sphere
 - Nanotube: a form of carbon that consists of atoms in the form of a long, hollow cylinder



Carbon Compounds

What are some properties of organic compounds?

- Many organic compounds have similar properties in terms of melting points, boiling points, odor, electrical conductivity, and solubility.
 - Organic compound: most compounds that contain carbon



Carbon Compounds

What are some properties of hydrocarbons?

- Hydrocarbons mix poorly with water.
- All hydrocarbons are flammable.
 - Hydrocarbons: an organic compound that contains only carbon and hydrogen



Carbon Compounds

What kind of structures and bonding do hydrocarbons have?

- The carbon chains in a hydrocarbon may be straight, branched, or ring-shaped.
 - Structural formula: a description of a molecule that shows the kind, number, and arrangement of atoms
 - Isomers: compounds that have the same chemical formula but different structures



Carbon Compounds

What kind of structures and bonding do hydrocarbons have?

- In addition to forming a single bond, two carbon atoms can form a double bond or a triple bond.
 - Saturated hydrocarbons: a hydrocarbon in which all the bonds between carbon atoms are single bonds
 - Unsaturated hydrocarbons: a hydrocarbon in which one or more of the bonds between carbon atoms is double or triple



Carbon Compounds

What are some characteristics of substituted hydrocarbons, esters, and polymers?

- If just one atom of another element is substituted for a hydrogen atom in a hydrocarbon, a different compound is created.
 - Substituted hydrocarbon: a hydrocarbon in which one or more hydrogen atoms have been replaced by atoms of other elements
 - Hydroxyl group: an -OH group, found in alcohols
 - Alcohol: a substituted hydrocarbon that contains one or more hydroxyl groups
 - Organic acid: a substituted hydrocarbon with one or more of the -COOH group of atoms
 - Carboxyl group: a -COOH group, found in organic acids



Carbon Compounds

What are some characteristics of substituted hydrocarbons, esters, and polymers?

- Many esters have pleasant, fruity smells.
 - Ester: an organic compound made by chemically combining an alcohol and an organic acid



Carbon Compounds

What are some characteristics of substituted hydrocarbons, esters, and polymers?

- Organic compounds, such as alcohols, esters, and others, can be linked together to build polymers with thousands or even millions of atoms.
 - Polymer: a large molecule in which many smaller molecules are bonded together
 - Monomers: one molecule that makes up the links in a polymer chain



Life With Carbon

What are the four main classes of organic compounds in living things?

- Carbohydrates: an energy-rich organic compound made of the elements carbon, hydrogen, and oxygen
 - Glucose: a simple carbohydrate; the monomer of many complex carbohydrates
 - Complex carbohydrate: a long chain, or polymer, of simple carbohydrates
 - Starch and cellulose are both polymers built from glucose, but the glucose molecules are arranged differently in each case.
 - Starch: a complex carbohydrate in which plants store energy
 - Cellulose: a simple carbohydrate found in plant structures



Life With Carbon

What are the four main classes of organic compounds in living things?

- Proteins: an organic compound that is a polymer of amino acids
 - Amino acids: one of 20 kinds of organic compounds that are the monomers of proteins
 - Different proteins are made when different sequences of amino acids are linked into long chains.



Life With Carbon

What are the four main classes of organic compounds in living things?

- Lipids: an energy-rich organic compounds made of carbon, oxygen, and hydrogen.
- Fats, oils, waxes, and cholesterol are lipids.
 - Gram for gram, lipids release twice as much energy in your body as do carbohydrates.
 - Fatty acids: an organic compound that is a monomer of a fat or oil
 - Cholesterol: a waxy lipid in animal cells



Life With Carbon

What are the four main classes of organic compounds in living things?

- Nucleic acids: a very large organic compound made up of carbon, oxygen, hydrogen, nitrogen, and phosphorus
 - DNA: deoxyribonucleic acid, one type of nucleic acid
 - RNA: ribonucleic acid, a type of nucleic acid
 - Nucleotides: an organic compound that is one of the monomers of nucleic acids
 - The differences among living things depend on the order of nucleotides in their DNA.



Life With Carbon

How are the organic compounds in living things different from one another?

- Unlike the nutrients discussed so far, vitamins and minerals are needed only in small amounts.