

Chapter 7-1 Carbon

- C atom
 - atomic # is 6; it has 6 protons and therefore 6 electrons
 - is in group 14; it has 4 valence electrons
 - atomic mass is 12; it has 6 neutrons
 - shares electrons when forming 4 covalent bonds
 - can combine with itself and other elements in different ways forming straight, ring-like, and branched chains
- Pure forms of Carbon differ by way carbon forms bonds with itself
 - A. Diamond
 - hardest mineral
 - forms within Earth at very high temperatures and pressures
 - each C is strongly bonded to 4 others (tetrahedral crystal) making it a solid that is extremely hard and unreactive
 - used as gems; artificial ones are used in industry for cutting tools
 - B. Graphite
 - each C is bonded tightly to 3 others in flat, straight chain layers but the bonds between the layers are weak; so layers slide past each other
 - since it is slippery it is used as a lubricant in machines to reduce friction between moving parts, also for writing
 - C. Fullerene
 - C atoms are arranged in a repeating patterns (ball-shaped)
 - used to carry substances inside a ball-shaped open area, ex. medicines in the body and computer circuits

Chapter 7-2 Hydrocarbons

- Organic compound: contains carbon and means “of living things”.
Ex. paper, oil, plastics Exception: carbon dioxide
Properties:
 - low melting and boiling points, therefore are gases and liquids at room temperatures
 - strong odors
 - many are non-polar and therefore don't conduct electricity and mix poorly with water
- Hydrocarbons are the simplest organic compounds that contain only carbon and hydrogen in straight, branched, or ring-shaped chains.
Properties:
 - flammable and release large amounts of energy when burnedFormulas: differ in the # of carbons and hydrogens
Molecular formula includes the chemical symbols and subscripts of each atom in the molecule.
Structural formula shows the kind, #, and arrangement of the atoms in a molecule.
Isomers are compounds with the same molecular but different structural formulas. Each has its own properties.

Bonds: 2 carbon atoms can form single, double, or triple bonds.

Saturated hydrocarbons have single bonds and the max. # of hydrogen atoms on the carbon chain. Their names end in -ane.

Unsaturated hydrocarbons have double or triple bonds and fewer hydrogen atoms. Their names end in -ene (double) and -yne (triple).

Substituted hydrocarbons: atoms of other elements replace one or more hydrogen atoms in the original chain.

a. halogen-containing: one or more halogens replace hydrogen(s)

b. alcohol: the hydroxyl group (-OH) replaces hydrogen

c. organic acid: the carboxyl group (-COOH) replaces hydrogen

- Esters are formed when an alcohol and an organic acid combine chemically. They have a pleasant, fruity smell (like in pineapple and banana).
- Polymers: large molecules formed when many smaller organic compounds (called monomers) are linked together. Some polymers are naturally made by living things such as wool by sheep, cotton by cotton plant, and silk by silkworms. Others are synthetic and made in factories such as nylon, polyester, and plastics.

Chapter 7-3 Life with Carbon

Carbohydrates, Proteins, Lipids, and Nucleic Acids

- are organic compounds (found in living things)
- are used as nutrients which break down in the body to provide energy and raw materials for growth and repair of tissues
- are mostly polymers

Carbohydrates

- contain carbon, hydrogen, and oxygen
- are used for quick energy for the body
- 2 types are
 - simple: sugars such as glucose (“blood sugar”), fructose (found in fruits, milk, some vegetables), and sucrose (table sugar)
 - complex: long chains of glucose units linked such as starch (found in bread, pasta, rice, cereal; breaks down into glucose) and cellulose (found in the cell walls of plants; the body can’t digest but needed to provide fiber and help move the food down)

Proteins

- contain carbon, hydrogen, oxygen, nitrogen, and some contain sulfur
- are used for growth and repair; also as enzymes
- muscle, hair, skin, fingernail, bird’s feather, spider’s web, fish’s scale, horns of a rhinoceros are made of proteins
- meat, fish, eggs, milk, beans are good sources
- proteins (polymers) break down to amino acids (monomers)
- there are 20 amino acids in living things. Different proteins are made when amino acids combine in different numbers and arrangements.

- Every amino acid has a carboxyl group (COOH) that is the source of the acid half of the name and an amine group (NH₂) that is the source of the amino part.

Lipids (fats, oils, waxes)

- contain carbon, hydrogen, oxygen like carbohydrates
- source of stored energy in the body; gram for gram lipids release twice as much energy in your body as do carbohydrates
- fats and oils differ

	fats	Oils
Foods	meat, butter, cheese	corn oil, sunflower oil, peanut oil, olive oil
Structure	3 fatty acids and glycerol	3 fatty acids and glycerol
State at room temp.	solid	liquid
Type of fatty acid	saturated	unsaturated
Melting point	higher	lower

- cholesterol
 - waxy
 - in animal cells
 - used for building cell structures to form chemical messengers in the body
 - obtained also from foods of animal origin
 - excess contributes to heart disease; saturated fats can affect its level, so it is wise to limit both in your diet

Nucleic Acids

- contain carbon, hydrogen oxygen, nitrogen, and phosphorus
- contain information about the cell
- 2 types are DNA and RNA
- the monomers are the nucleotides (A, T, U, G, and C)

- the difference among living things depend on the order of the nucleotides in their DNA. When the nucleotides are different, DNA is different, RNA made from DNA is different, amino acids coded by the RNA are different, proteins made of amino acids are different, and therefore traits controlled by proteins are different.

Other Nutrients

- Vitamins are compounds that are needed in small amounts and serve as helper molecules in chemical reactions. Ex. A, B, C, D, E, K found in fruits and vegetables mainly.
- Minerals are elements that are needed in small amounts. Ex. Calcium, Iron, Iodine, and Potassium found in fruits and vegetables mainly.
- If you eat a variety of foods, you will probably get the required vitamins and minerals and you will not need extra vitamin/mineral tablets unless prescribed by the doctor for some reason. Scientists think some vitamins/minerals are not yet discovered and obviously are not included in the tablets.
- Food manufacturers add some vitamins/minerals to packaged foods to replace the lost ones in manufacturing. These foods are said to be “enriched”.
- Sometimes vitamins/minerals are added to food to “fortify” or strengthen its nutrient quality.