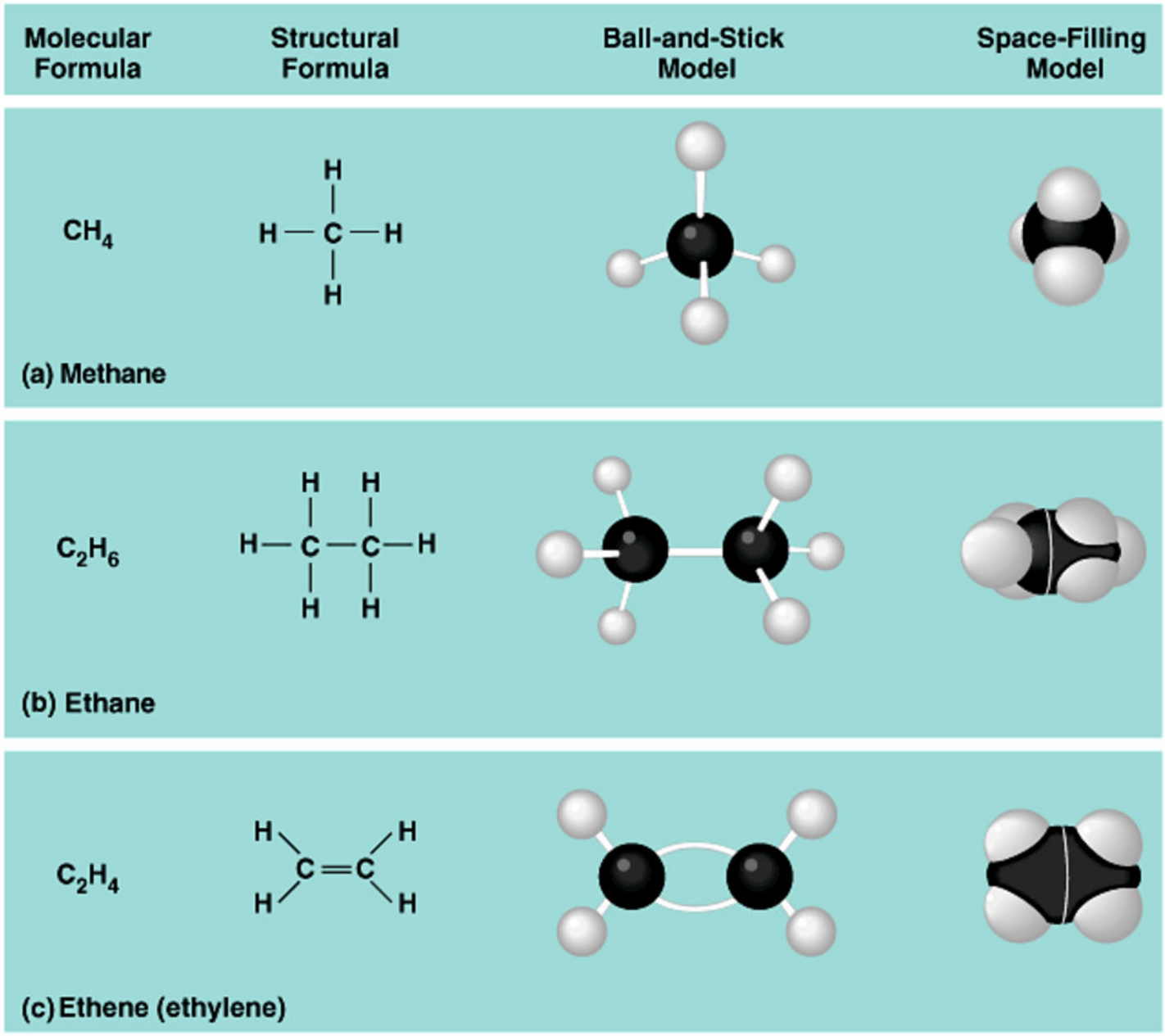
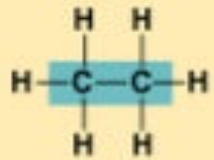
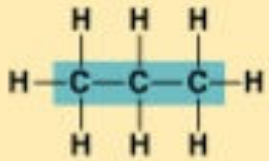
Organic Chemistry

Figure 4.2 The shapes of three simple organic molecules



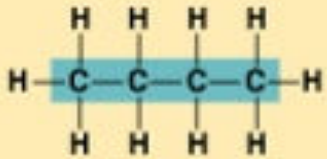


Ethane

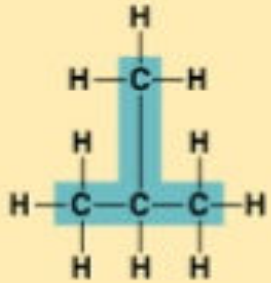


Propane

(a) Length

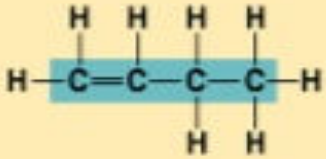


Butane

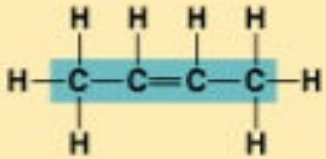


Isobutane

(b) Branching

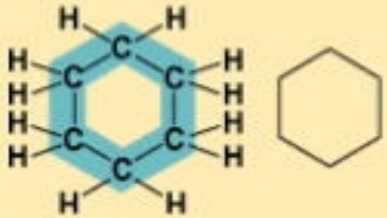


1-Butene

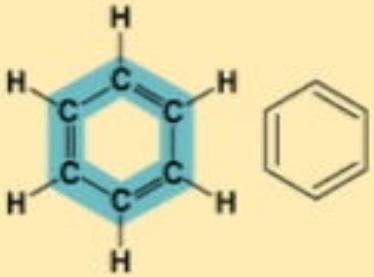


2-Butene

(c) Double bonds



Cyclohexane



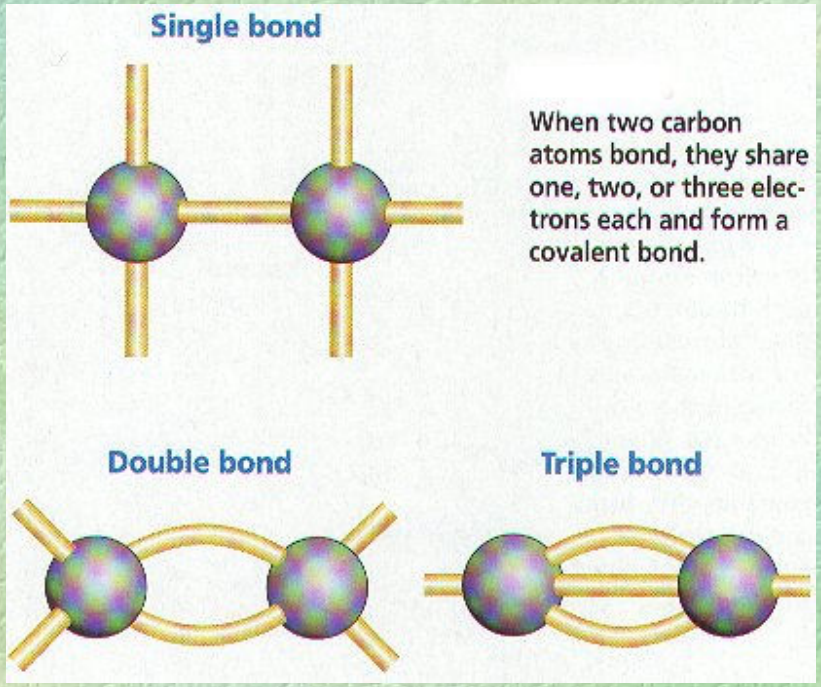
Benzene

(d) Rings

Carbon in Living Things

C easily forms covalent bonds that are strong and stable. How many bonds can it make? 4

Or it can also make →



Organic?

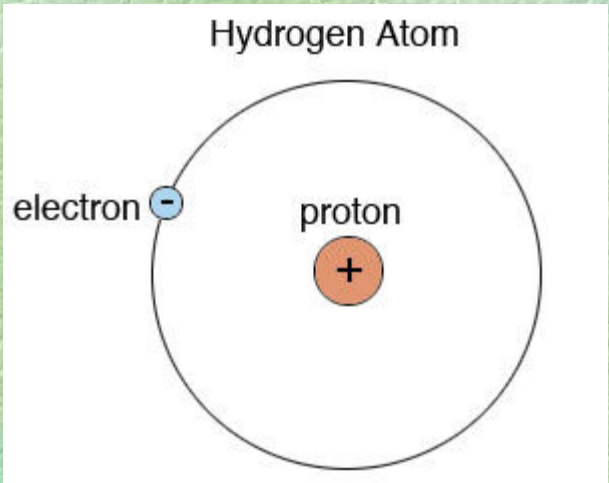
Organic Chemistry

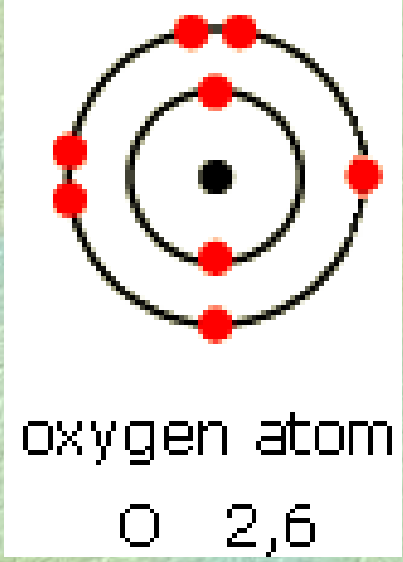
Concept 4.1:Organic Chemistry is the study of carbon compounds

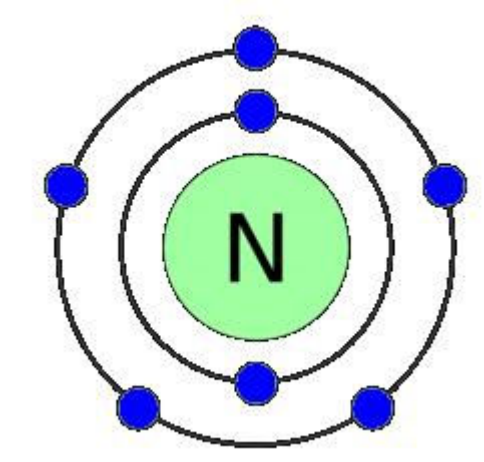
- Anything that has Carbon is considered an organic compound
- Usually they also have Hydrogen

Concept 4.2: Carbon atoms can form diverse molecules by bonding to four other atoms

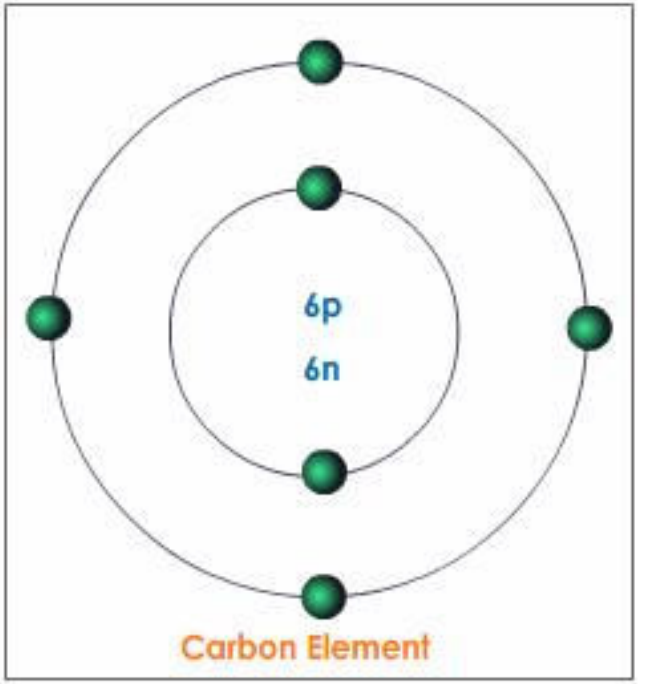
The Big 4





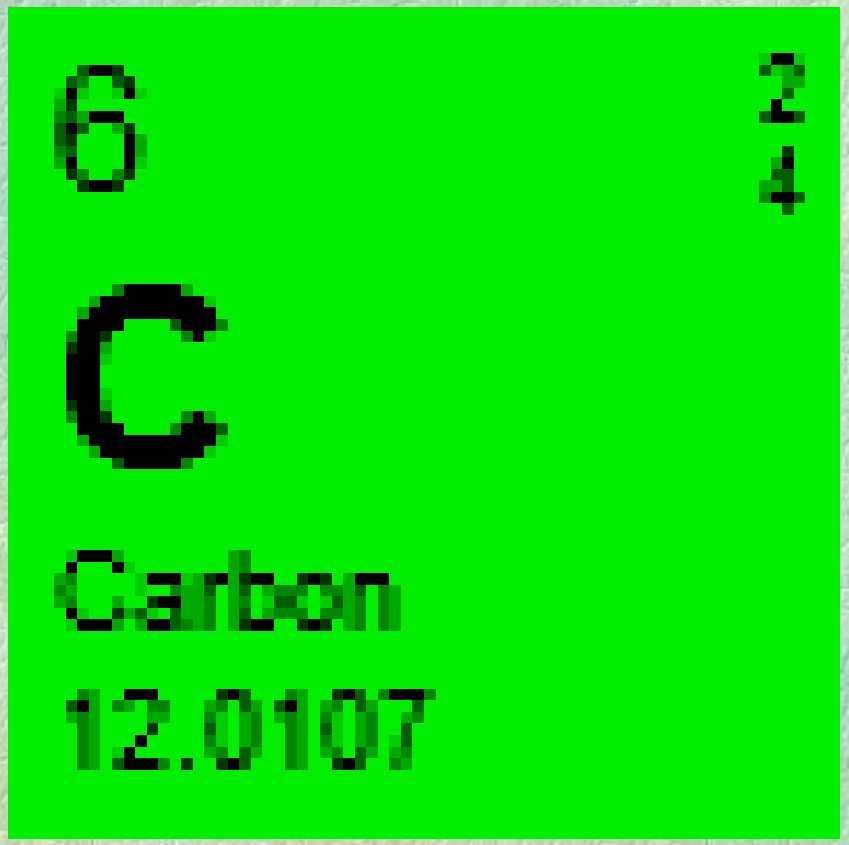


- How many valence electrons in each?



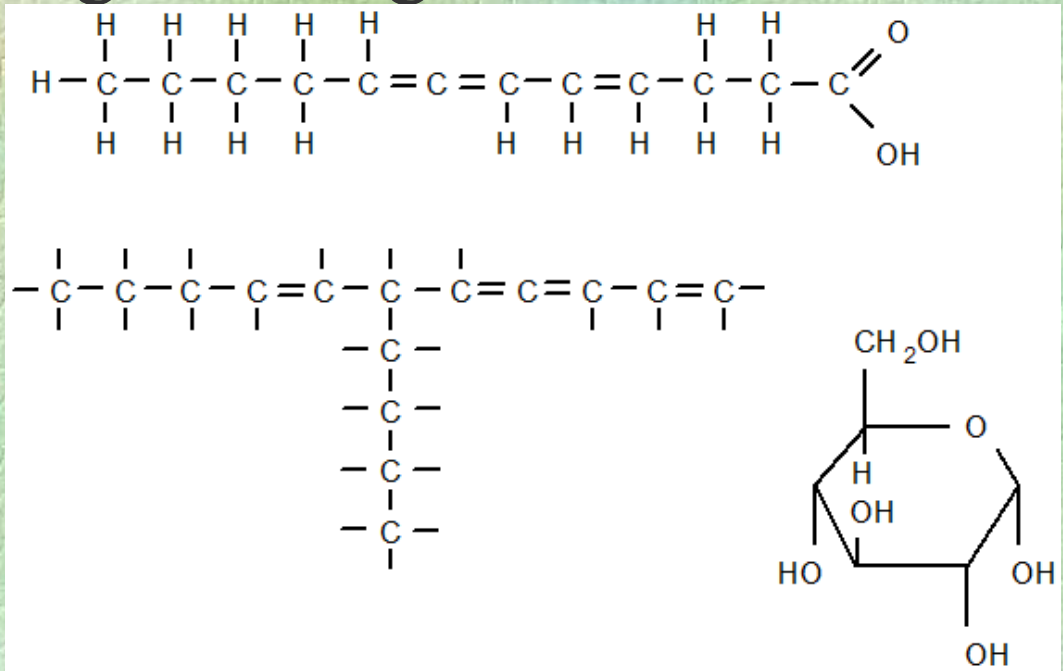
The Carbon Atom

- Looking at the Periodic table, draw an atom of carbon
- List:
  - Protons
  - Neutrons
  - Electrons
  - Valence Electrons



Carbon Chains

- Most organic molecules are based on a chain
- Lots of variation in bonds (1 or 2), branching and length

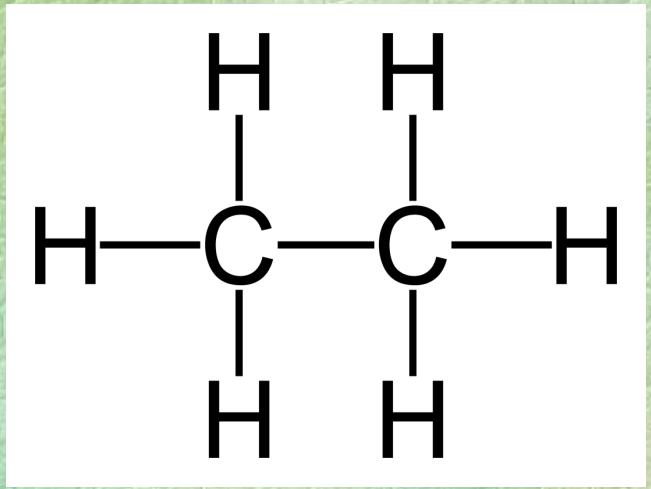


Time to build!

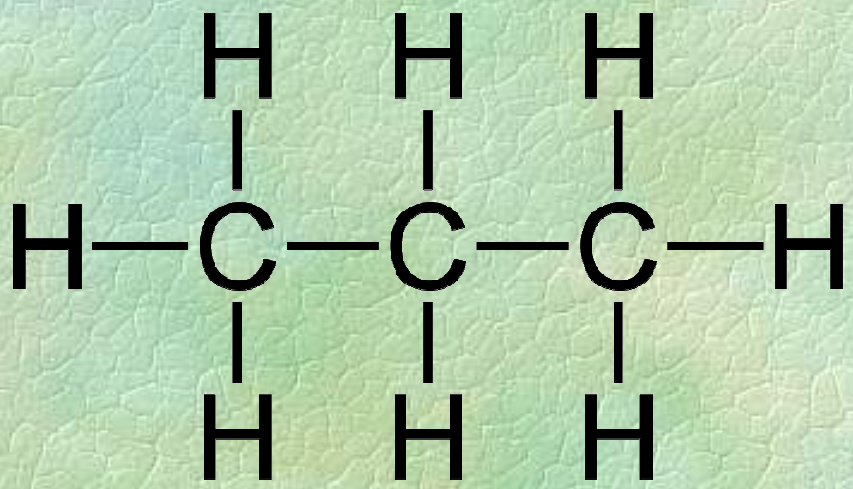
- Carbon = Black
- Hydrogen = White
- Oxygen = Red
- Nitrogen = Blue
- Single Bond = Normal Tube
- Double Bond = Long Tube

Length

- Ethane

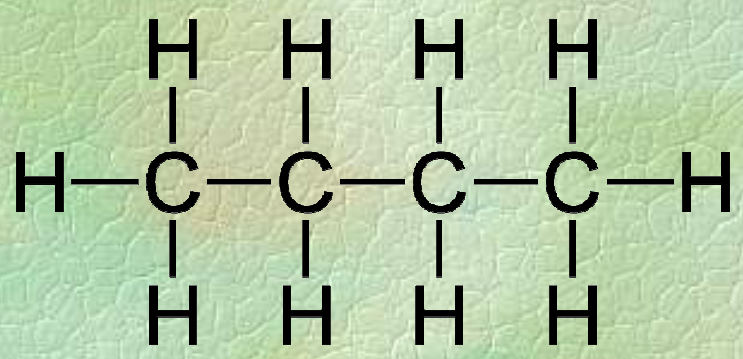


Propane

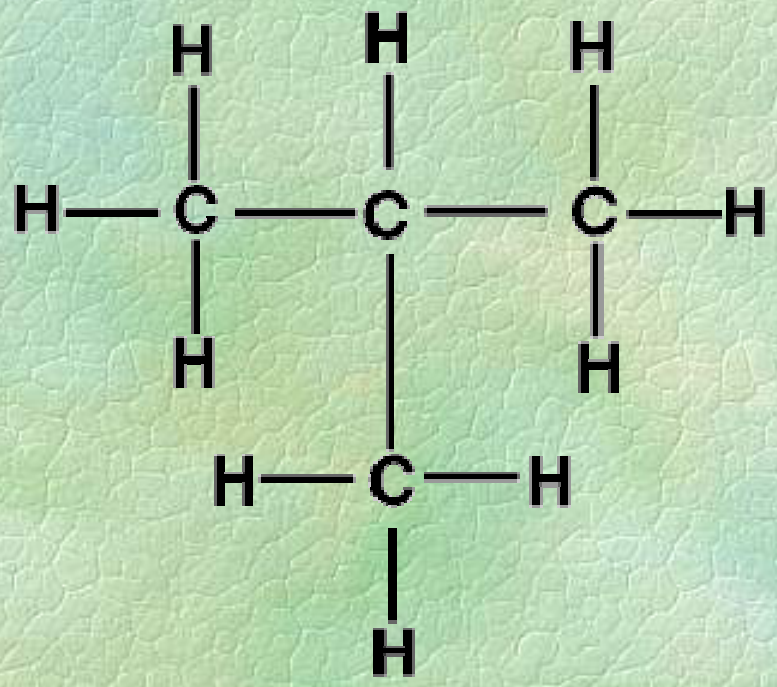


Branching

- Butane

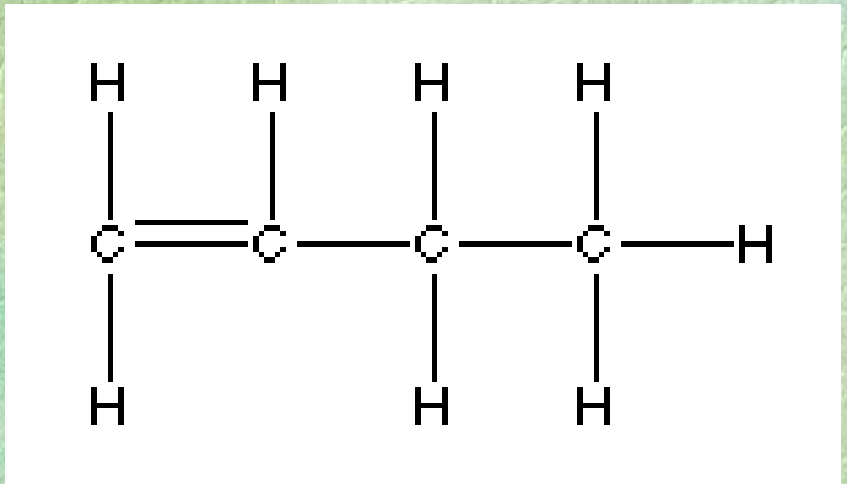


Isobutane

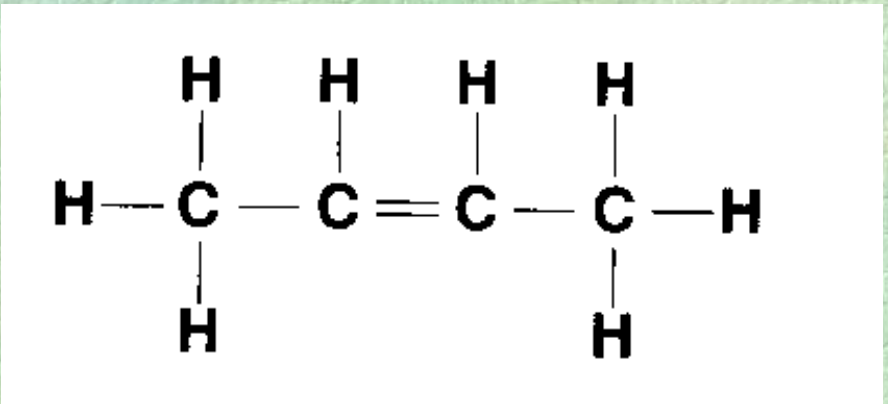


Bonds

- 1-Butene

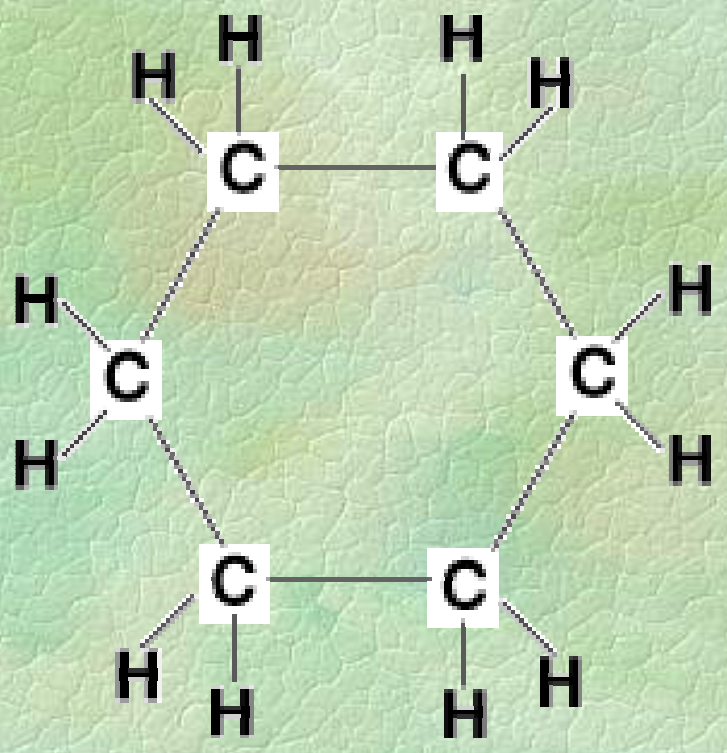


2-Butene

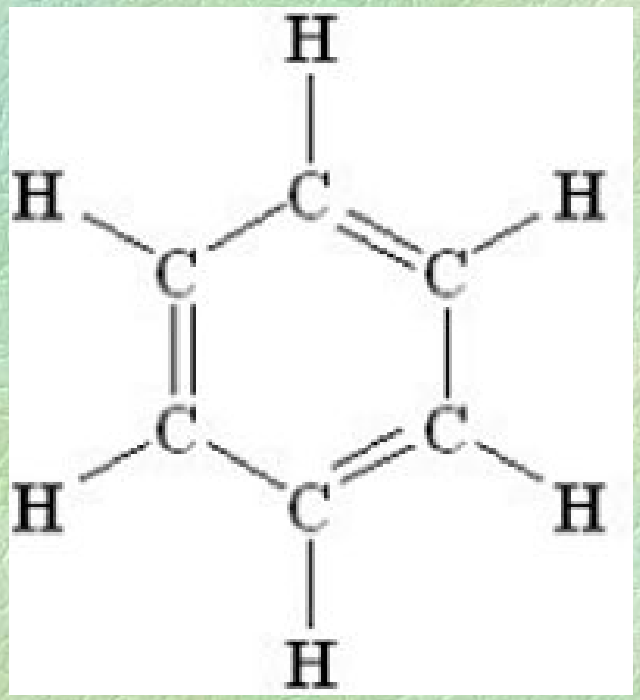


Rings

- Cyclohexane



Benzene



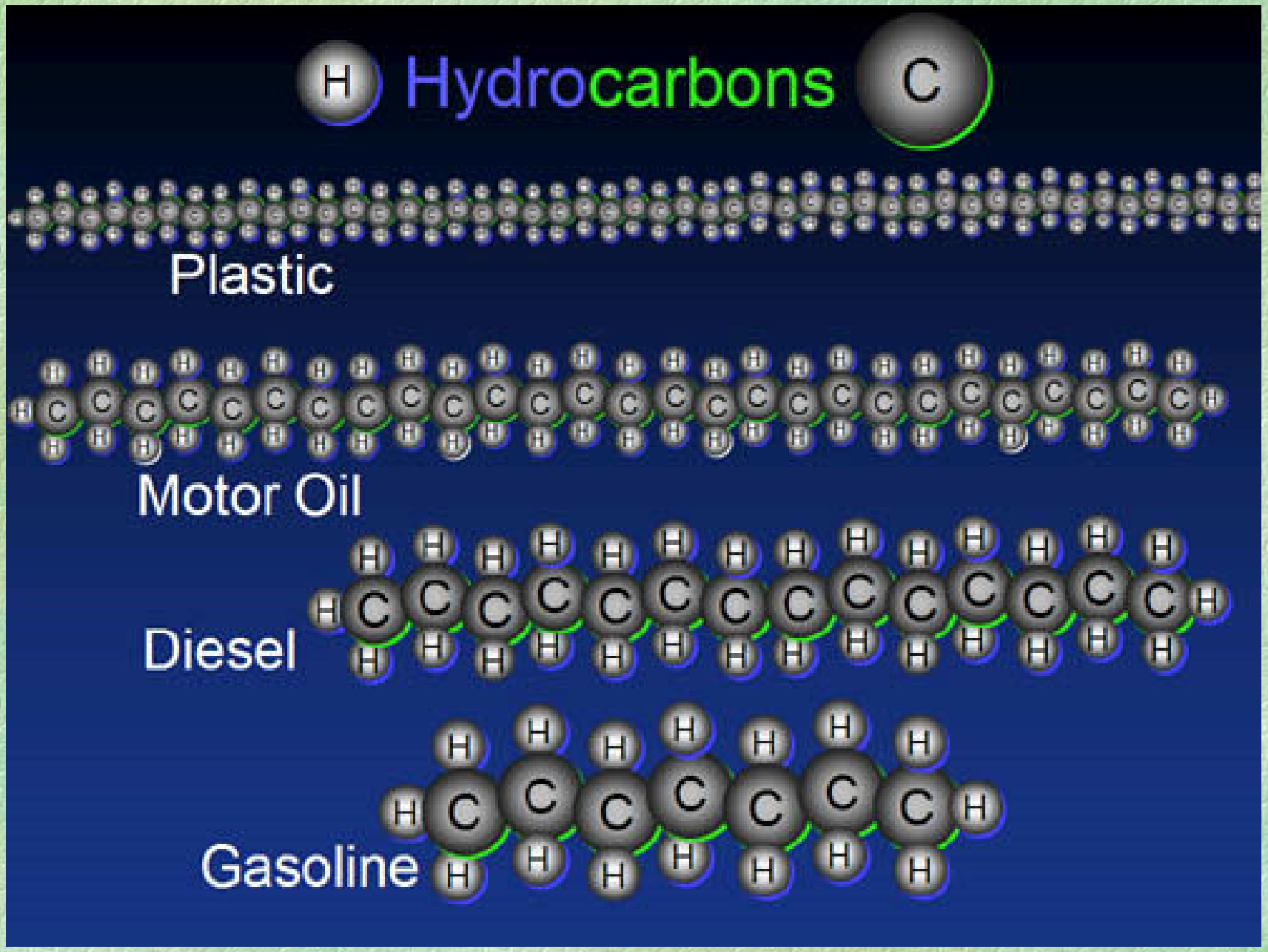
Hydrocarbons

A molecule made of only Carbon and Hydrogen

They store energy and are non polar

Ex: Petroleum- gasoline

Fats have a major hydrocarbon component

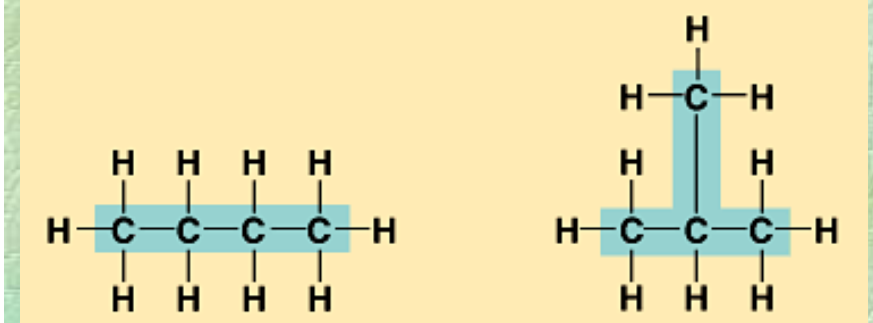

H
Hydrocarbons
C
Plastic
Motor Oil
Diesel
Gasoline

Organic Variations

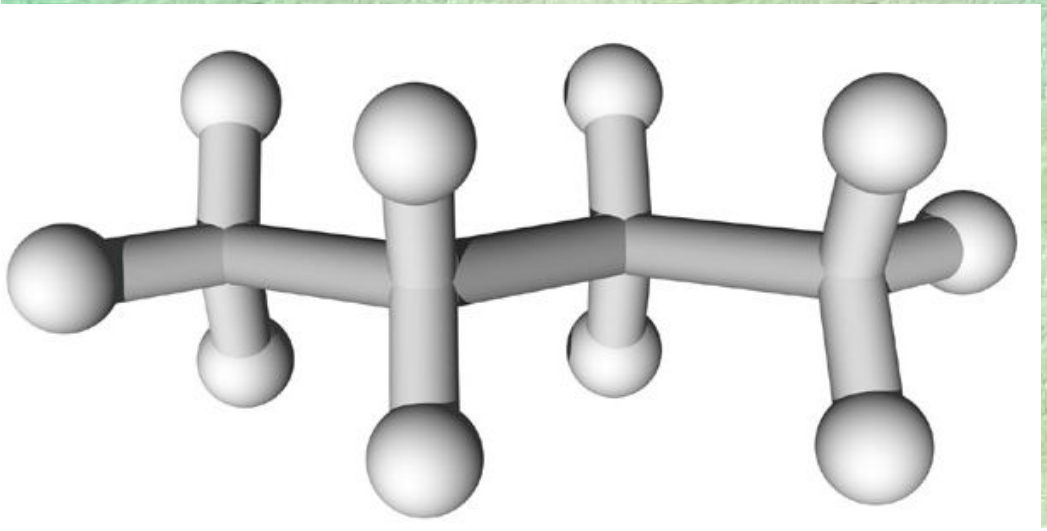
- Organics can vary by their shape
- Molecules made of the same number and type of atoms, but arranged in different ways,= **Isomers** (same-part)
- Three basic types
  - Structural
  - Geometric
  - Enantiomers (Optical)

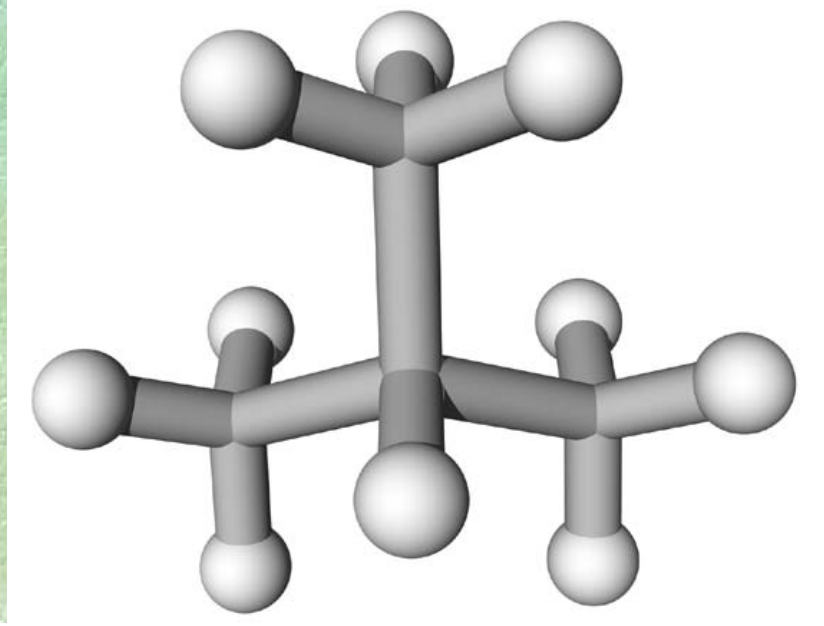
Structural Isomers

- Differ in covalent arrangement of their atoms



Butane and **ISO**butane

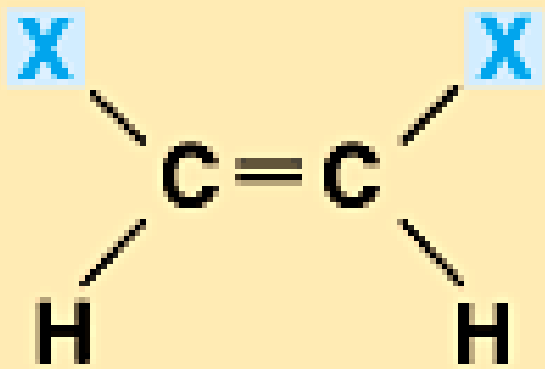


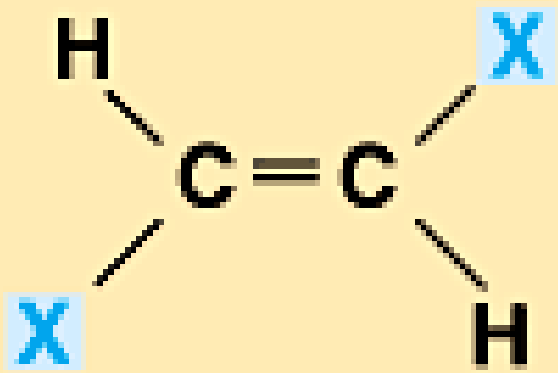


Geometric Isomers

- Have identical covalent bonds, but differ in the order in which the atoms are arranged in space;
- usually around a double bond

Cis and Trans

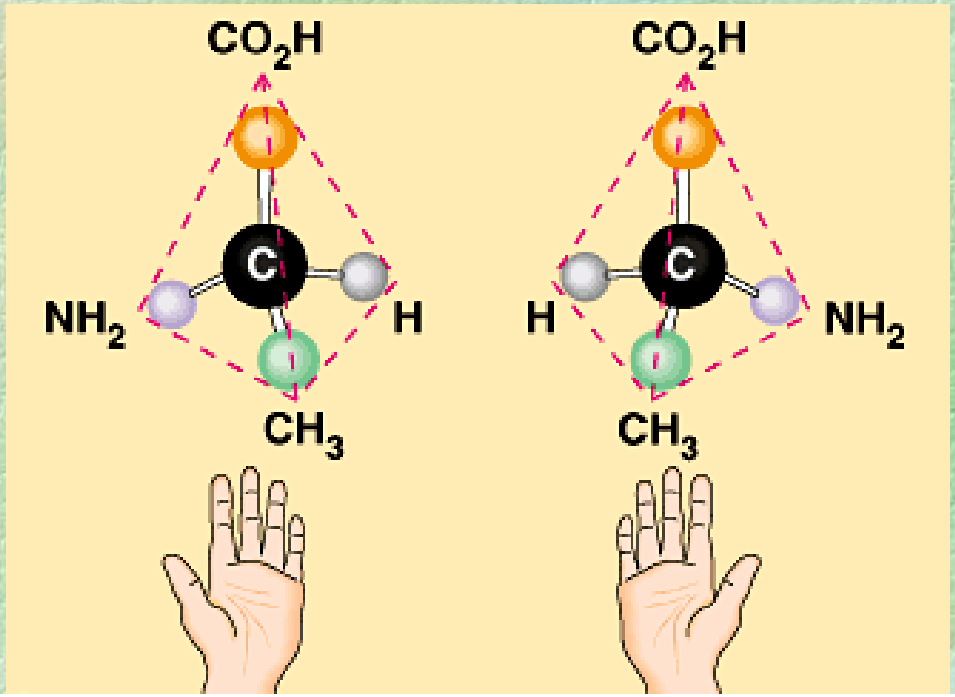




Enantiomers

- Mirror images of each other
- Because of their three-dimensional structure, they cannot be superimposed no matter how they are rotated

L



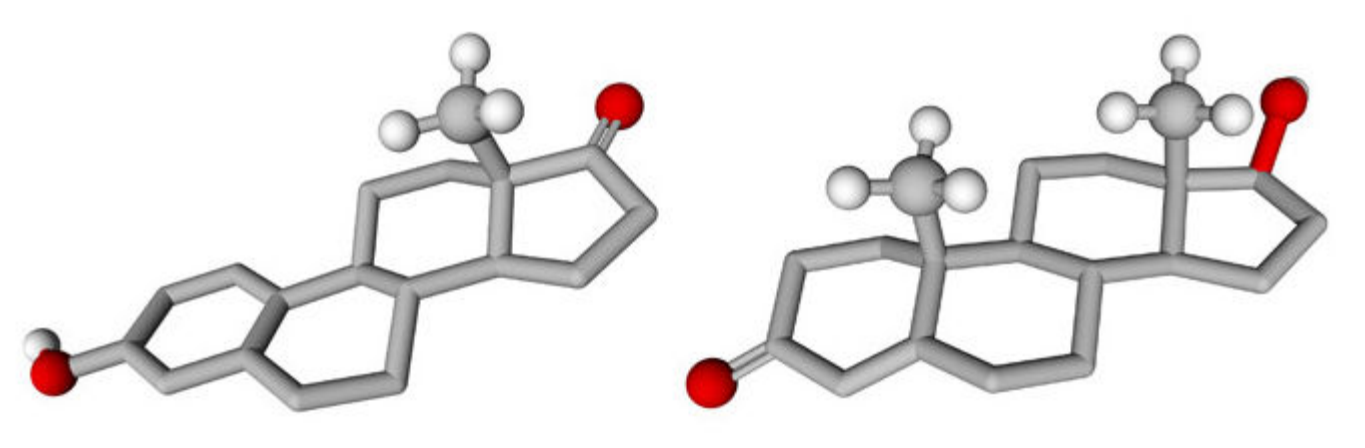
D

Concept 4.3: Functional groups are the parts of molecules involved in chemical reactions

- Functional Groups: The part of an organic molecule that is most commonly involved in chemical reactions

Organic Variations

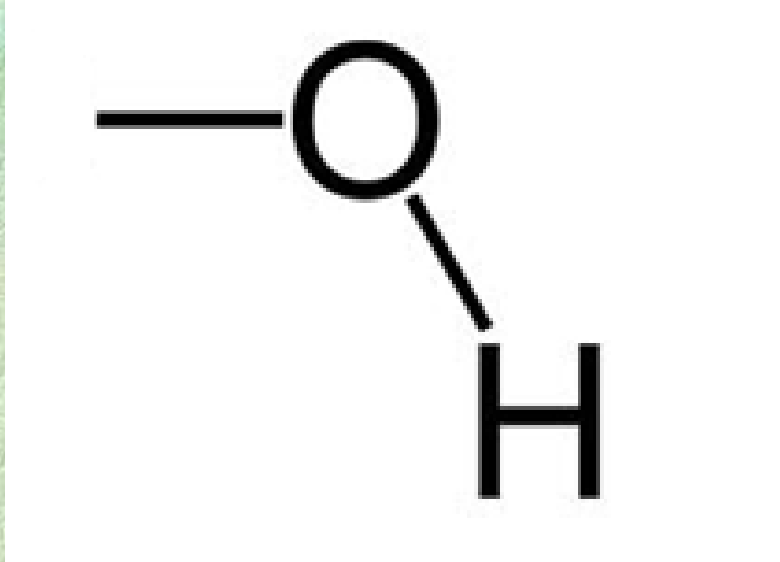
- Organics can vary by the “danglies” off of the Carbon skeleton
- A change in placement or type of functional group can completely alter the function of the overall molecule
  - Estradiol vs. Testosterone in vertebrates



Functional groups

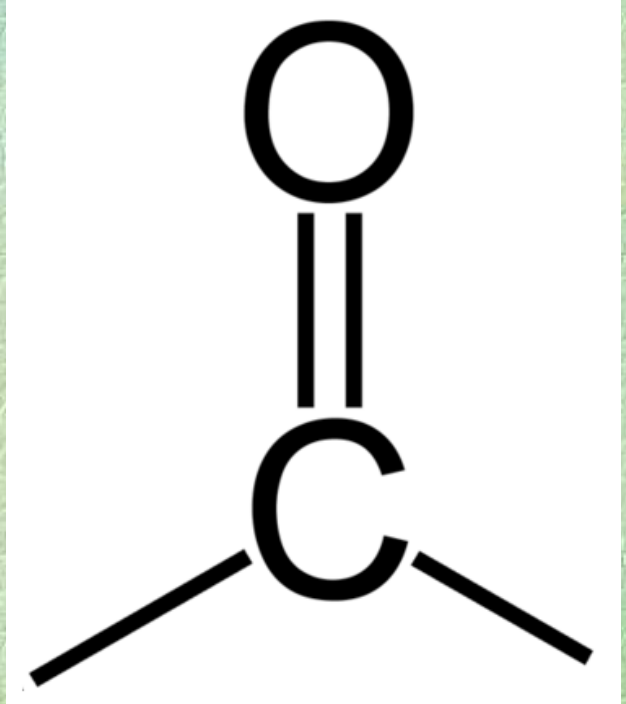
- Hydroxyl
- Carbonyl
- Carboxyl
- Amino
- Sulfhydryl
- Phosphate

Hydroxyl Groups



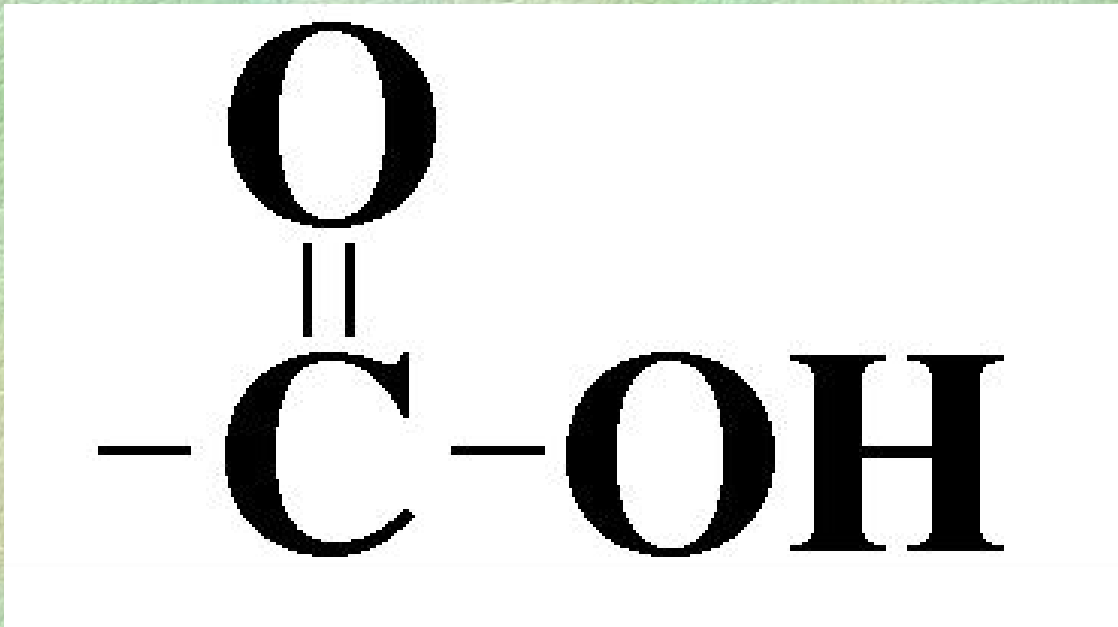
- Polar
- Attracts water
- Found in alcohols
- EX: Ethanol

Carbonyl Groups



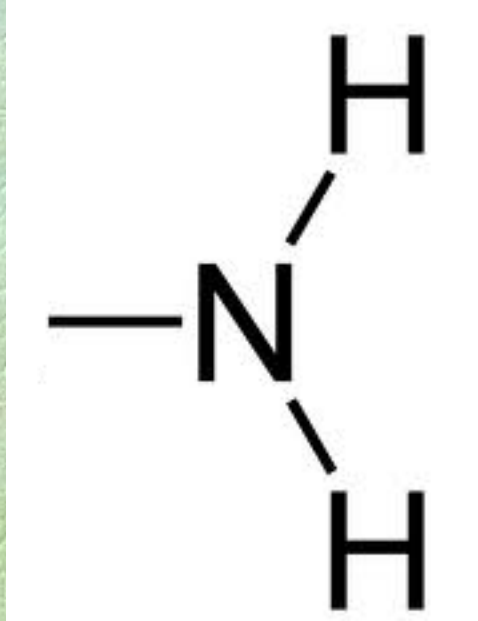
- Found in Aldehydes and Ketones

Carboxyl Groups



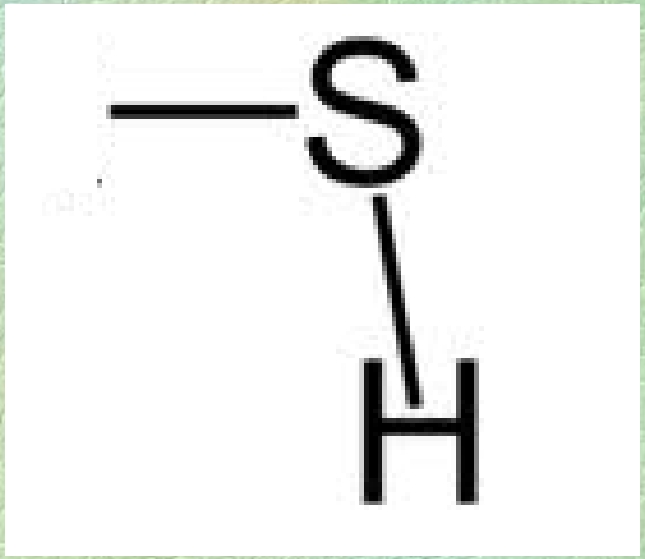
- Acidic
- Found in Carboxylic acids
- EX: Acetic Acid

Amino Groups



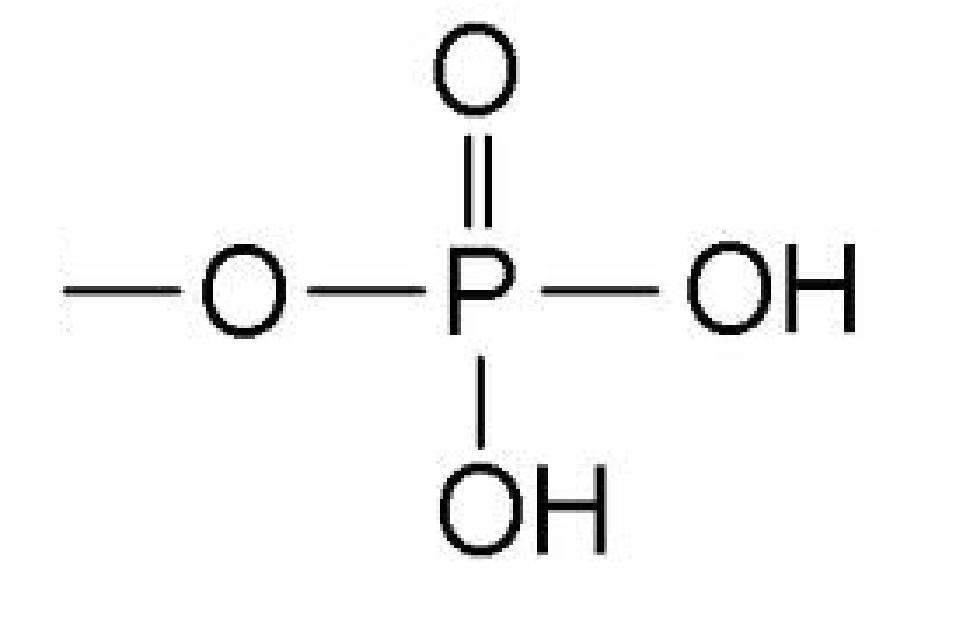
- Found in amino acids
- Acts as a base
- EX: Glycine, an amino acid. Has amino and carboxyl groups

Sulfhydryl Groups



- Found in Thiols
- Help form 2^{O} and 3° protein structure (stabilizes internal protein structure at "disulfide bridges")

Phosphate Groups



- Found in organic phosphates
- Found in ATP, other nucleotides, DNA, RNA, many proteins, and phospholipids

Phosphates in ATP

- Used for energy transfer

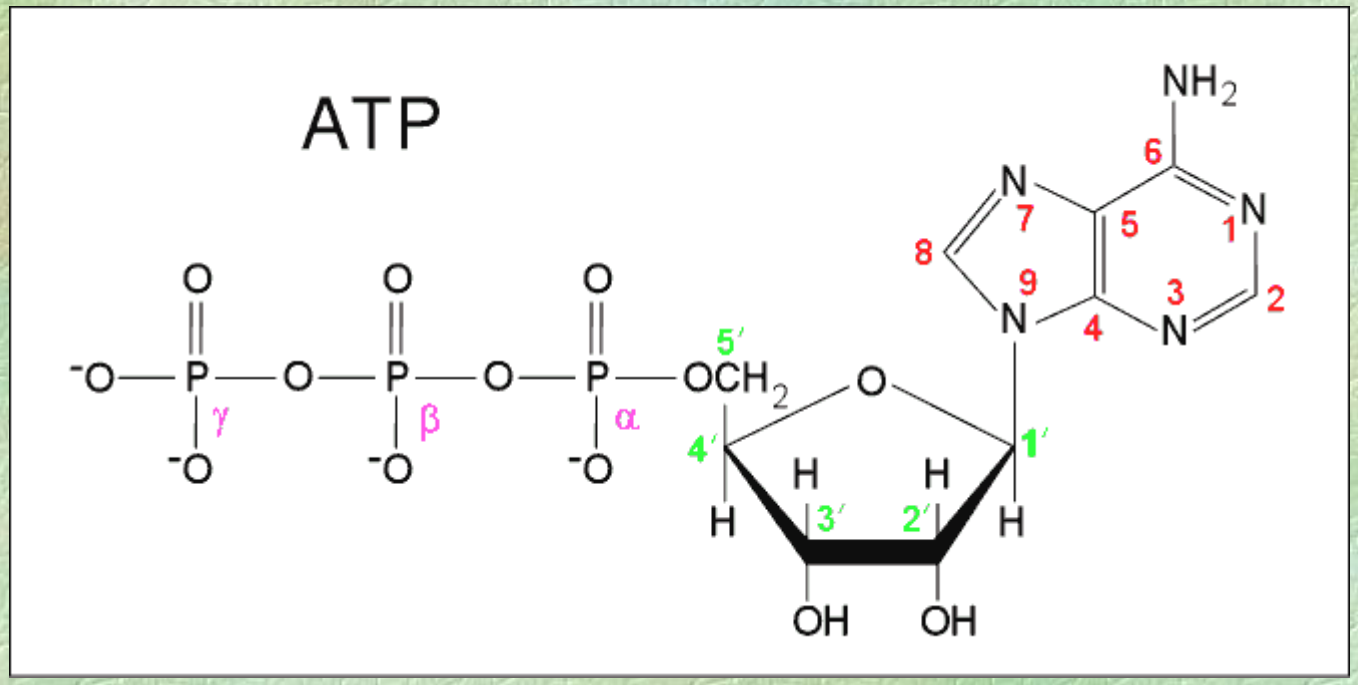


Fig. 4.10
Page 64-65

Table 4.1 Functional Groups of Organic Compounds

Functional Group	Formula	Name of Compounds	Example
Hydroxyl	—OH	Alcohols	Ethanol (the drug of alcoholic beverages)
Carbonyl		Aldehydes	Propanal
		Ketones	Acetone
Carboxyl	(non-ionized) (ionized)	Carboxylic acids	Acetic acid* (the acid of vinegar)
Amino	(non-ionized) (ionized)	Amines	Glycine* (amino acid)
Sulfhydryl	—SH	Thiols	Ethanethiol
Phosphate		Organic phosphates	Glycerol phosphate

*The ionized form of the carboxyl and amino groups present in cells. However, acetic acid and glycine are represented here in their non-ionized forms.