

Introduction to Molecules

Packet #5

Introduction

- * Compound

- * A substance consisting of two or more elements in a fixed ratio

- * Molecule

- * Two or more atoms held together by covalent bonds (type of chemical bond).

- * Chemical Bonds

- * Forces by which atoms are able to bond together.

Chemical Formulas

Molecules

Introduction II




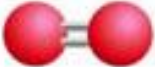




- * Molecular Formulas

- * In chemistry, a molecular formula says what the molecule is made of and how many they are

- * Structural Formula

- * Shows how the molecule is orientated in space

Formulas in Biology II

	Methane	Ammonia	Water	Oxygen
Molecular formulas:	CH ₄	NH ₃	H ₂ O	O ₂
Structural formulas:	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{H}-\text{N}-\text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{O}-\text{H} \\ \\ \text{H} \end{array}$	O=O
Ball-and-stick models:				
Space-filling models:				

Types of Chemical Bonds

- * Covalent Bond
- * Ionic Bond
- * Hydrogen Bond
- * Polar Bond
- * Non-polar Bond

Introduction

Organic Chemistry

Introduction

- * Organic Chemistry

- * The chemistry of carbon

- * Why carbon?

- * Backbone of all life

- * Any object on earth that contains carbon is considered as being organic

- * Not to be confused with organic foods

- * Carbon has the ability to make four chemical bonds

Introduction Continued...

Isomers

Isomers

- * Isomer

- * One of two, or more compounds (molecules), with the same chemical formula but different structural formula.

Isomers II

* Stereoisomer

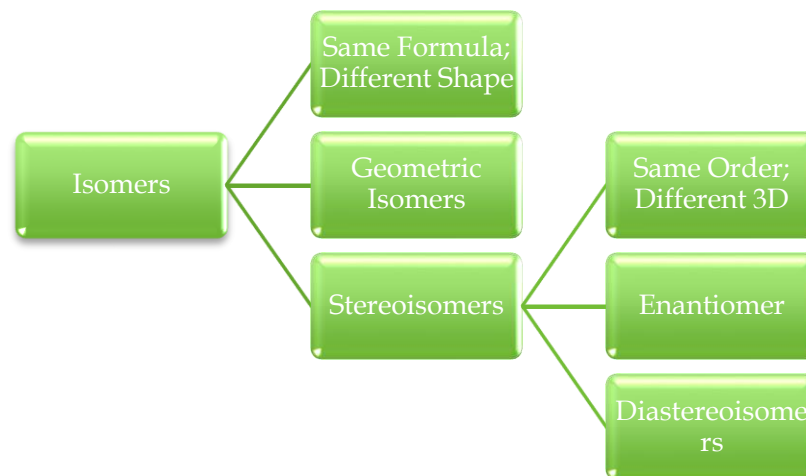
* Atoms are connected in the same order but have different 3D arrangements

* Enantiomer

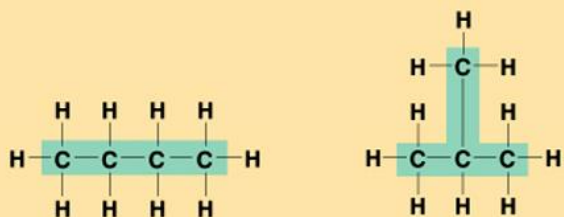
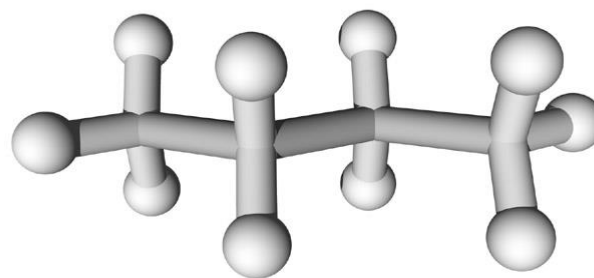
* Stereoisomer that have a mirror-image relationship

* Diastereoisomer

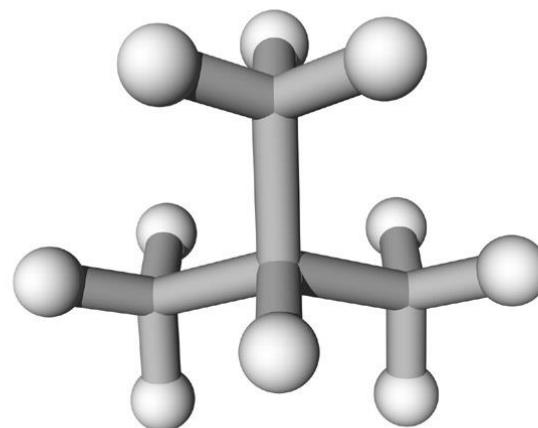
* Stereoisomer that is not a mirror image.



Isomers III



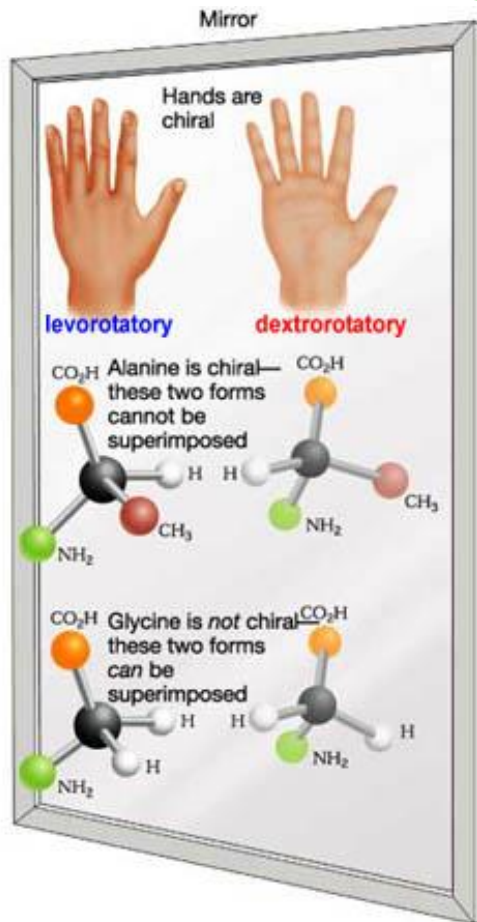
(a) Structural isomers: variation in covalent partners, as shown in the example of butane and isobutane.



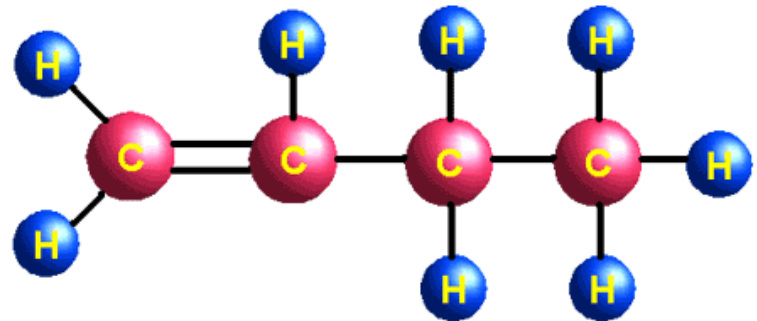
Benjamin
Cummings

Benjamin
Cummings

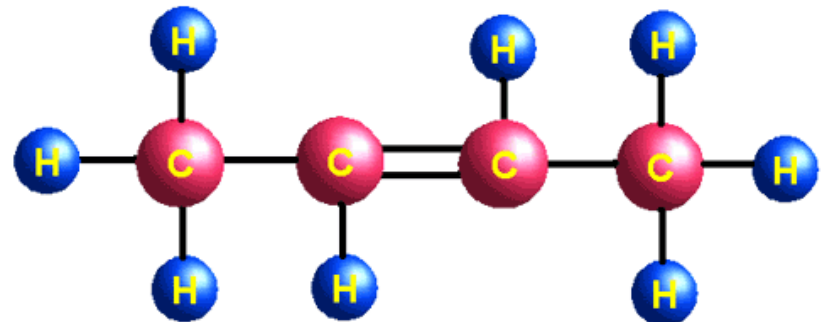
Isomers IV



Structural Isomer 1



Structural Isomer 2



Importance of Recognizing Isomers

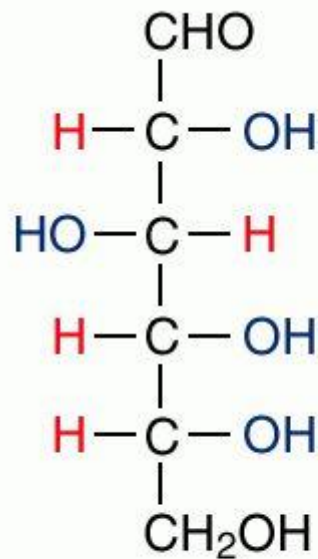
* Sugars

- * There are different isomers of sugars used in different steps during cell respiration & photosynthesis. There are different sugars in nucleic acids (DNA/RNA)

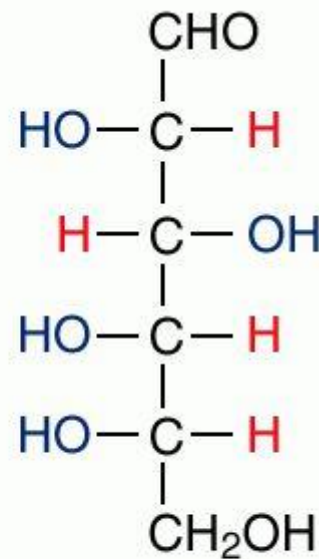
* Hormones & Steroids

- * Different isomers of hormones, and steroids, are critical to proper development and sexual development.

Isomers of Glucose

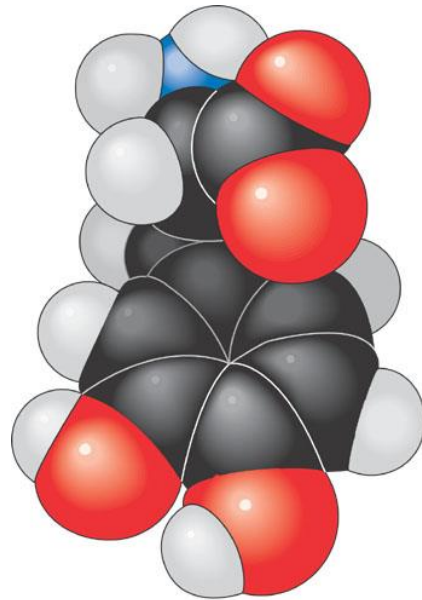


D-glucose

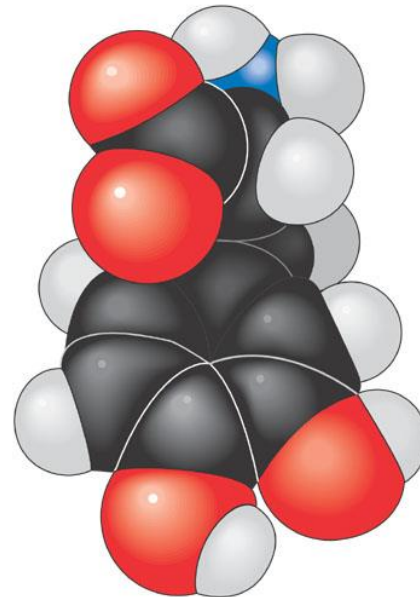


L-glucose

Isomers of Hormones

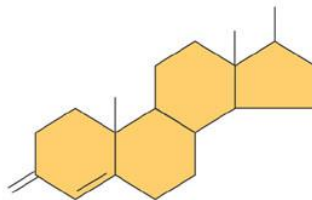
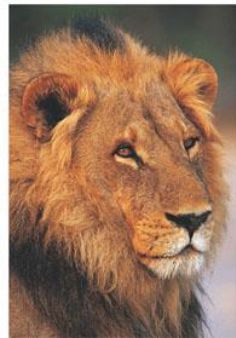
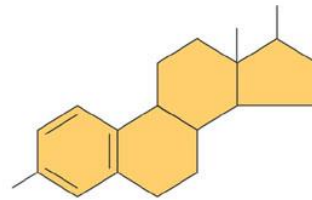


L-Dopa
(effective against
Parkinson's disease)



D-Dopa
(biologically
inactive)

Isomers of Hormones II



Organic Chemistry

Functional Groups

Functional Groups

- * Functional groups are groups of atoms that are consistently found in a variety of biological molecules.
- * Each functional group has specific properties and when attached to a larger molecule, confers (puts) those properties on that molecule.

Functional Groups II

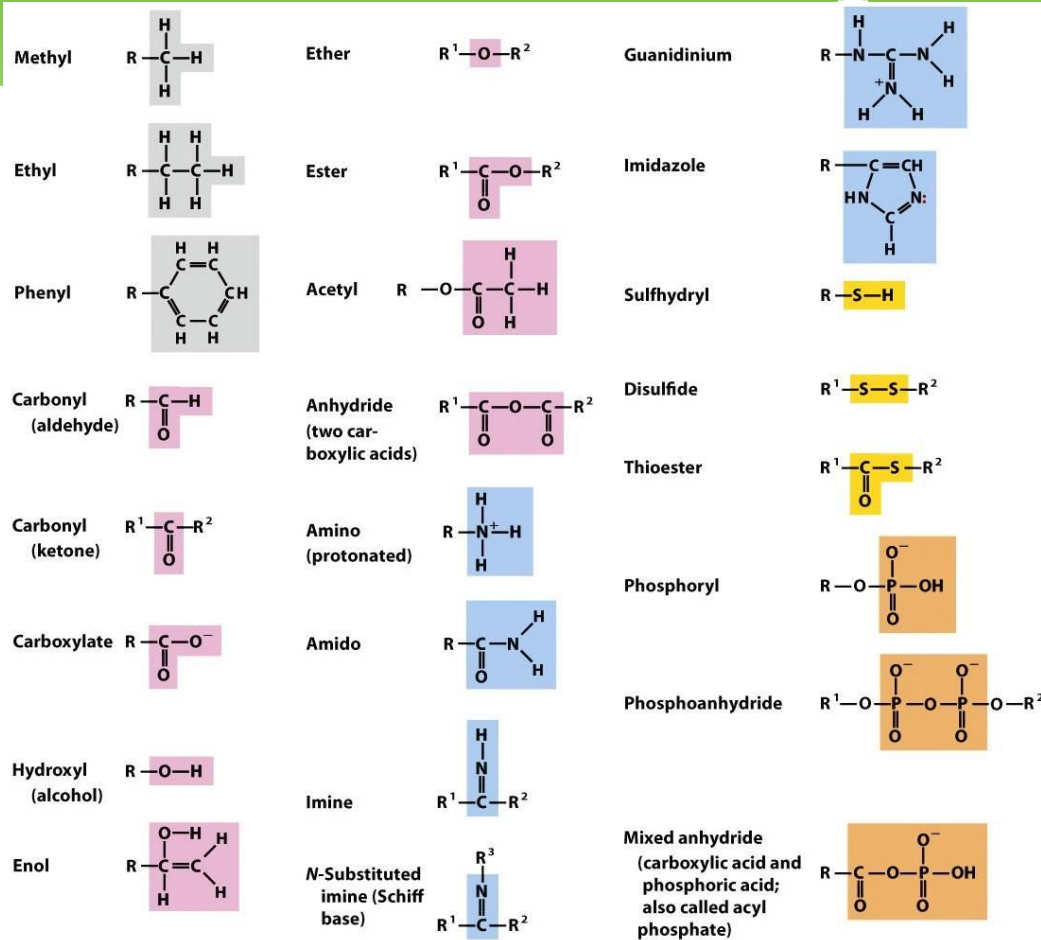
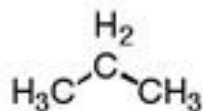


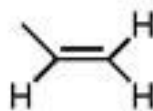
Figure 1-15
Lehninger Principles of Biochemistry, Fifth Edition
 © 2008 W. H. Freeman and Company

Functional Groups III

Functional groups - The Main Players



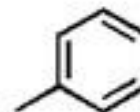
alkane



alkene



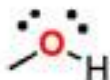
alkyne



benzene ring
(phenyl)



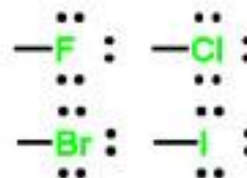
amine



alcohol



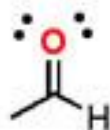
ether



alkyl halide



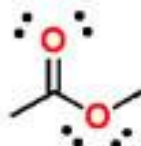
thiol



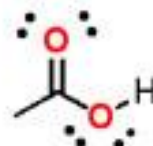
aldehyde



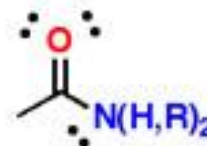
ketone



ester



carboxylic
acid

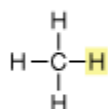


amide

Functional Groups III

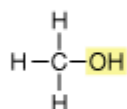
The leading families of organic compounds

Hydrocarbon



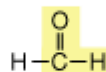
methane
(CH₄)

Alcohol



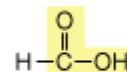
methyl alcohol
(CH₃OH)

Aldehyde



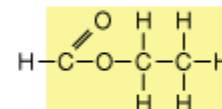
formaldehyde
(HCHO)

Acid



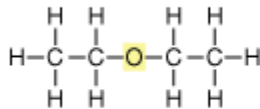
formic acid
(HCOOH)

Ester



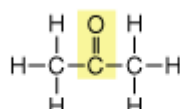
ethyl formate
(C₂H₅COOH)

Ether



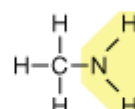
diethyl ether
(C₂H₅OC₂H₅)

Ketone



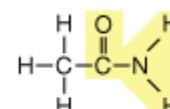
acetone
(CH₃COCH₃)

Amine



methyl amine
(CH₃NH₂)

Amide

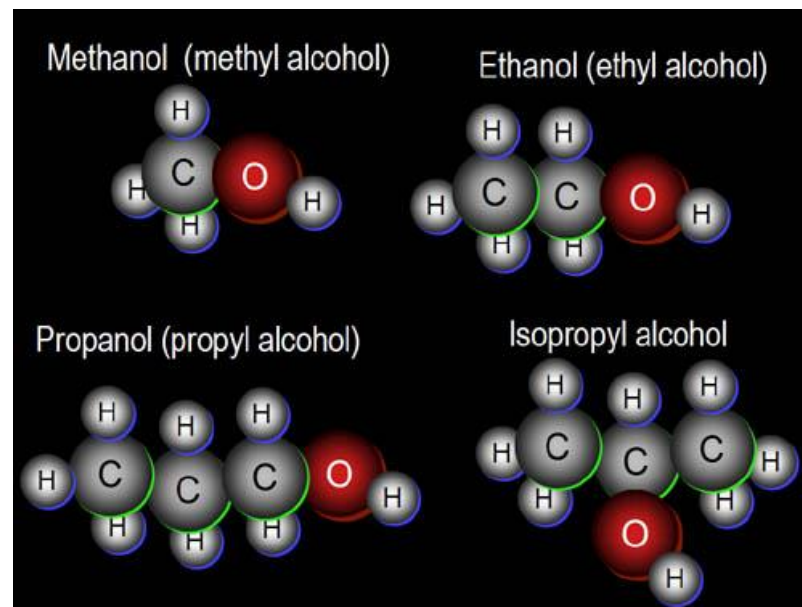


acetamide
(CH₃CONH₂)

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Alcohols

- * Example of molecules with functional group (alcohol).



Review