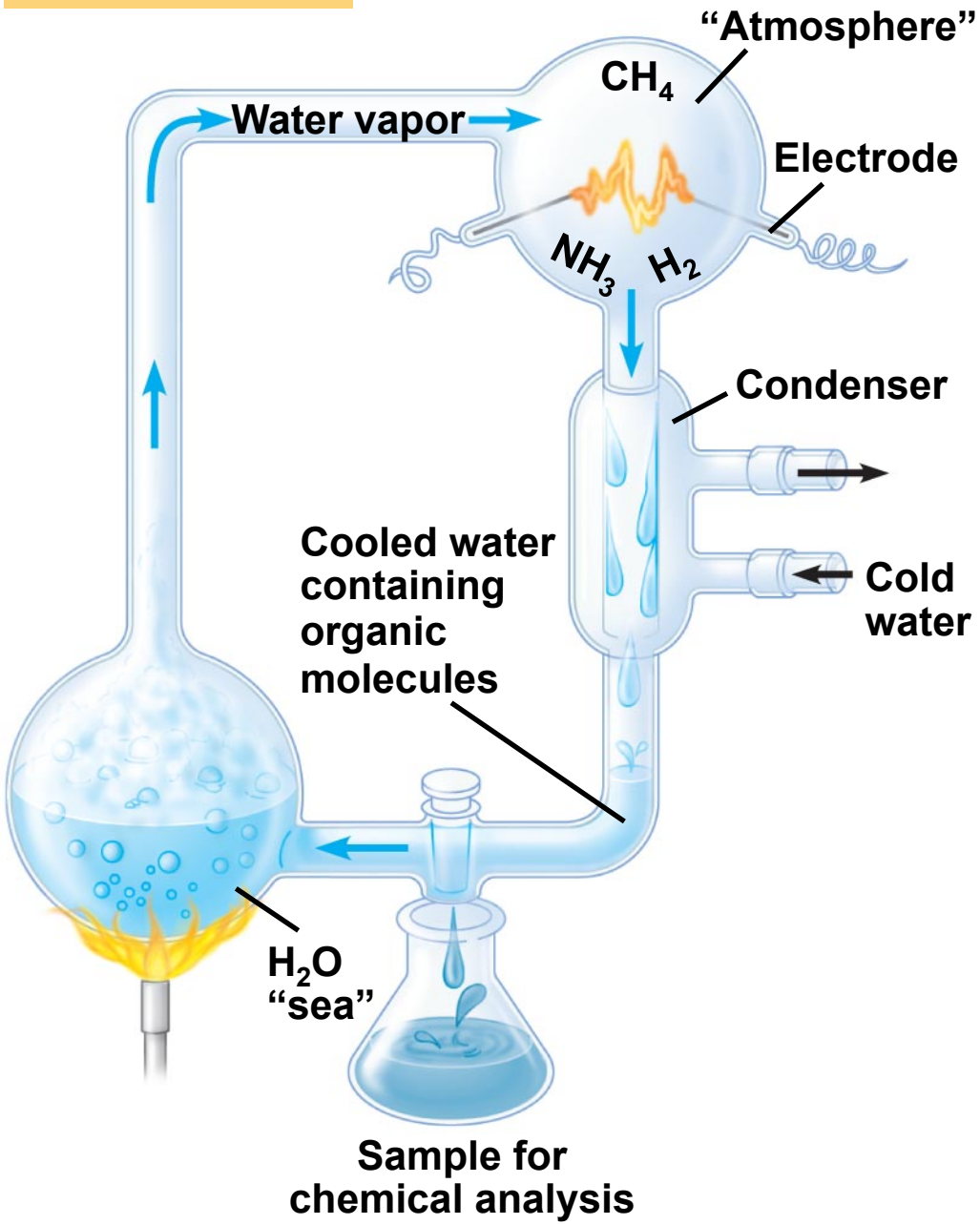
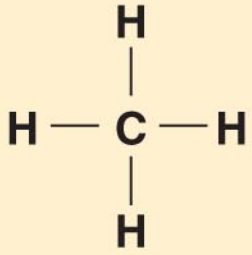
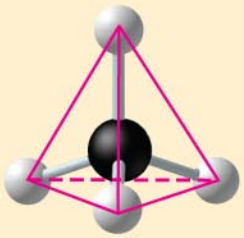
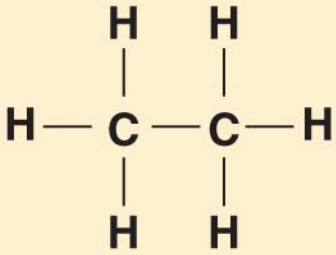
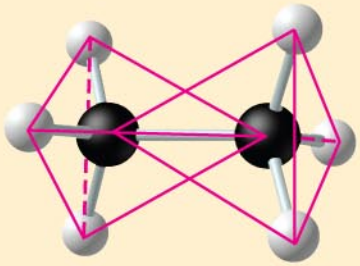
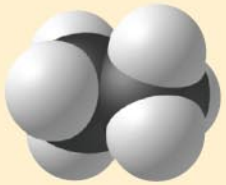
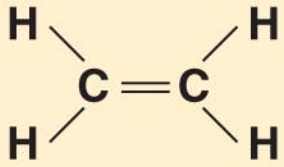
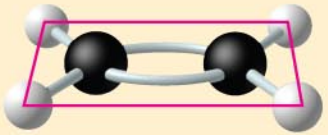
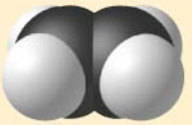
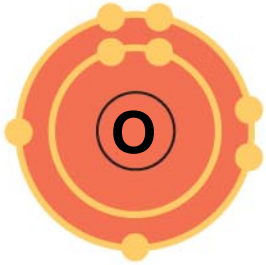
EXPERIMENT



Name	Molecular Formula	Structural Formula	Ball-and-Stick Model	Space-Filling Model
(a) Methane	CH_4			
(b) Ethane	C_2H_6			
(c) Ethene (ethylene)	C_2H_4			

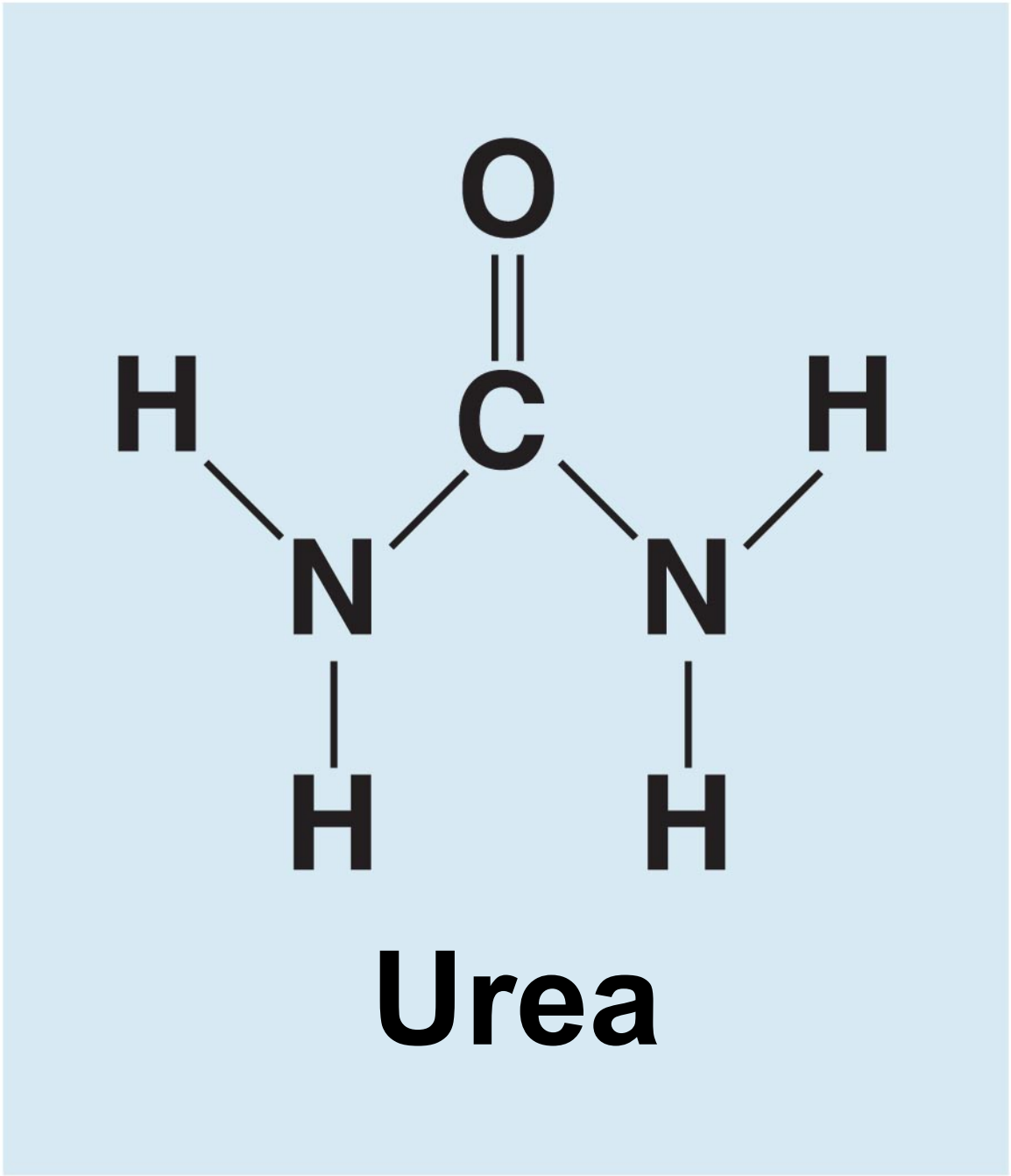
Hydrogen (valence = 1)

Oxygen (valence = 2)

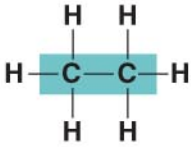


Nitrogen (valence = 3)

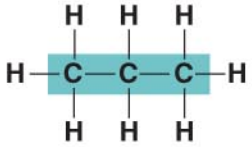
Carbon (valence = 4)



Urea

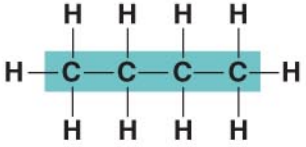


Ethane

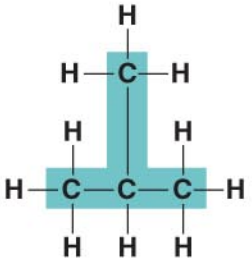


Propane

(a) Length

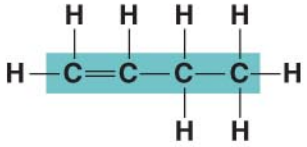


Butane

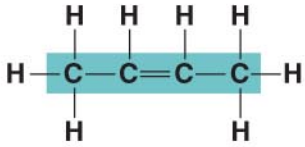


2-Methylpropane
(commonly called isobutane)

(b) Branching

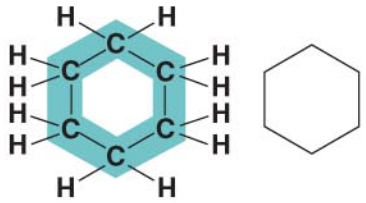


1-Butene

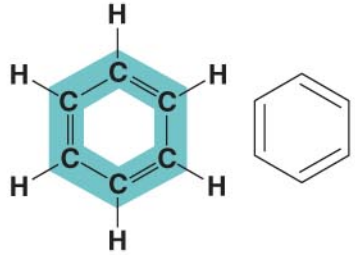


2-Butene

(c) Double bonds

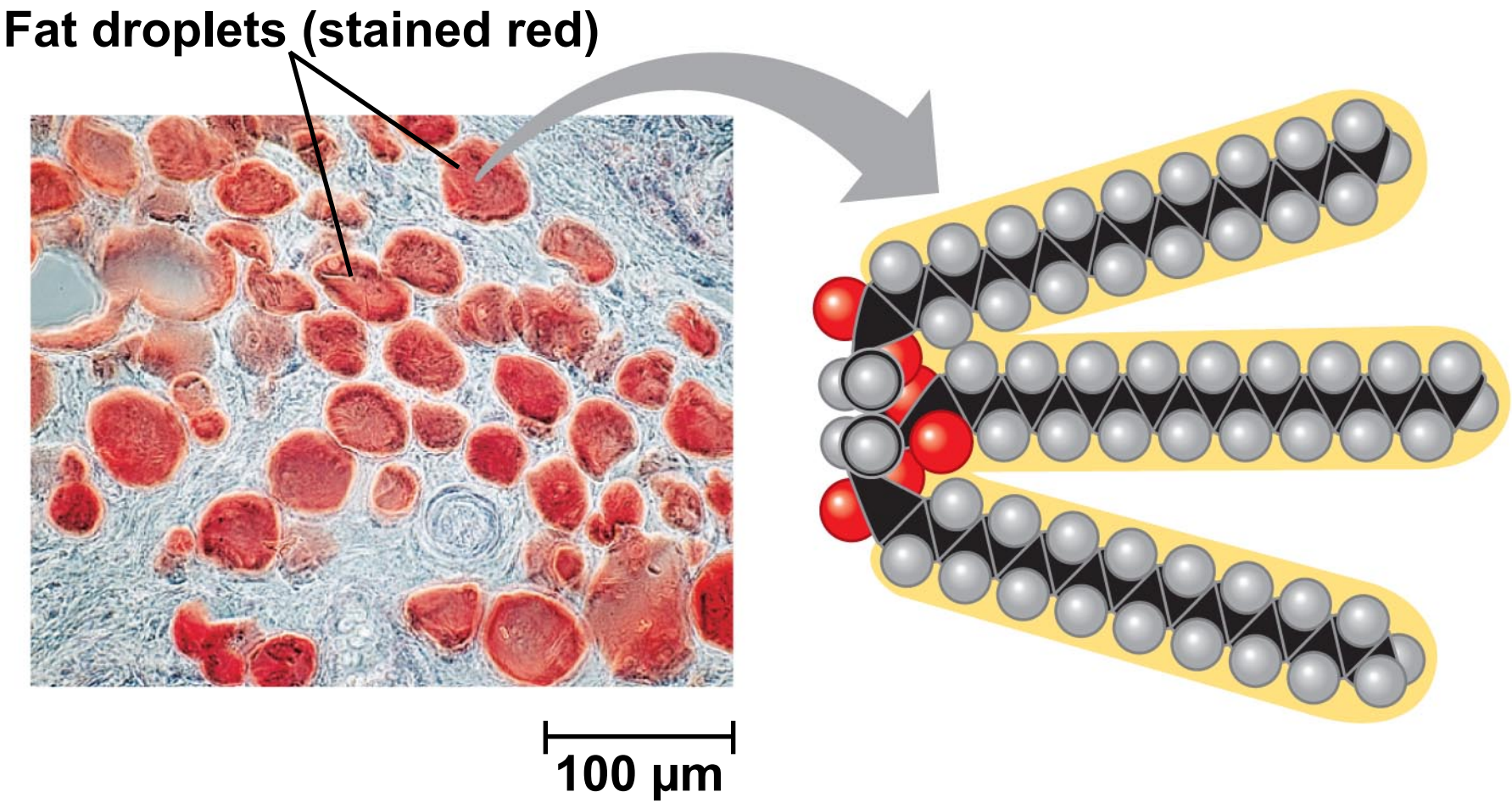


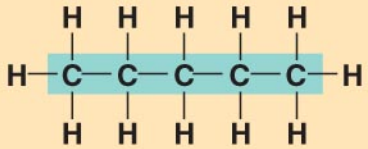
Cyclohexane



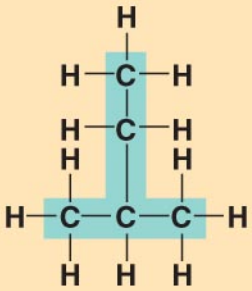
Benzene

(d) Rings



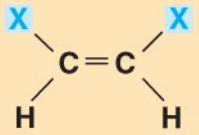


Pentane

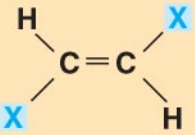


2-methyl butane

(a) Structural isomers

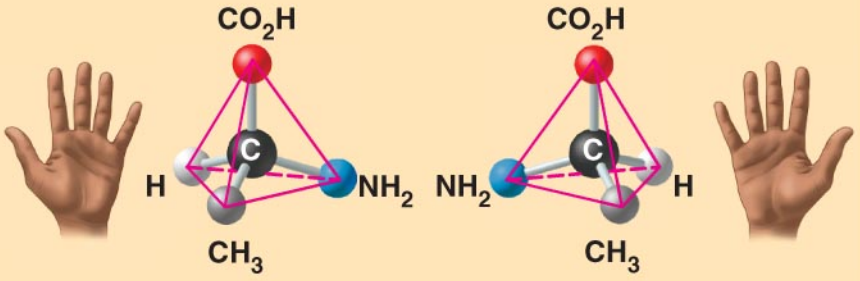


cis isomer: The two Xs are on the same side.



trans isomer: The two Xs are on opposite sides.

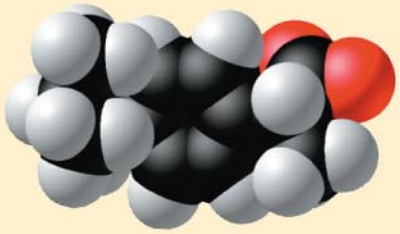
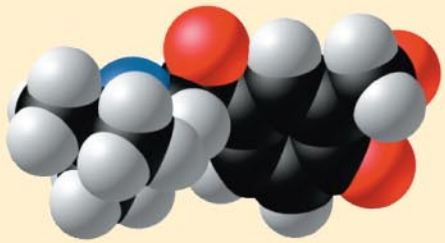
(b) Geometric isomers

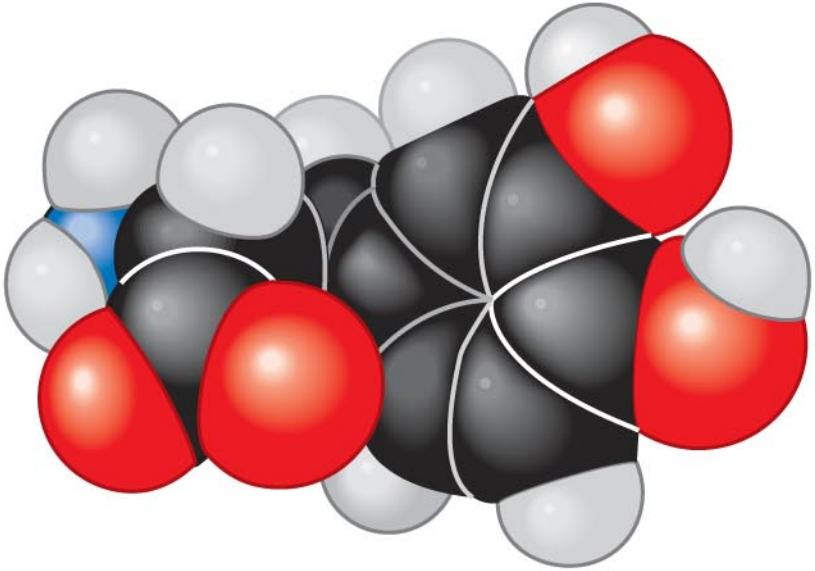


L isomer

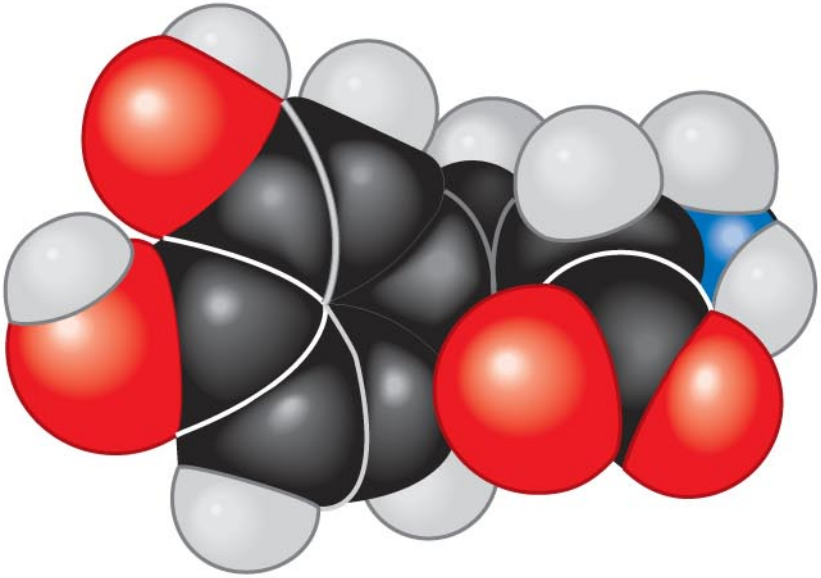
D isomer

(c) Enantiomers

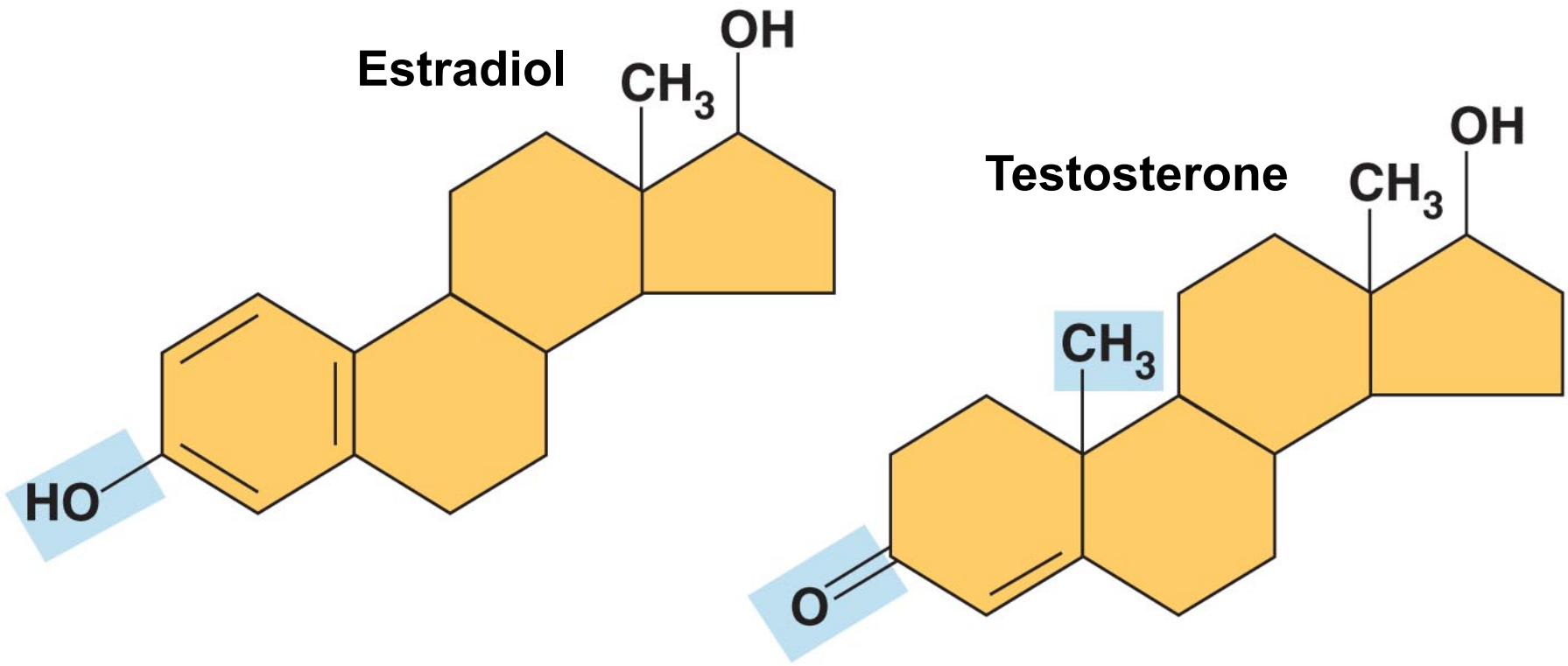
Drug	Condition	Effective Enantiomer	Ineffective Enantiomer
Ibuprofen	Pain; inflammation	 *S*-Ibuprofen	 *R*-Ibuprofen
Albuterol	Asthma	 *R*-Albuterol	 *S*-Albuterol

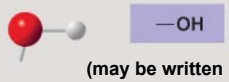
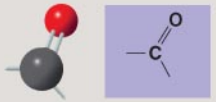
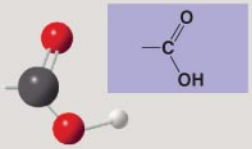
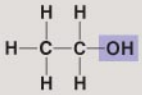
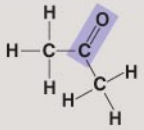
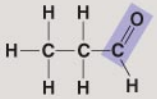
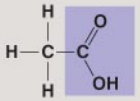
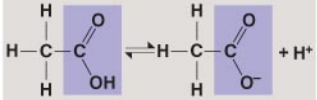


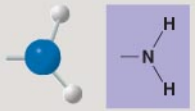
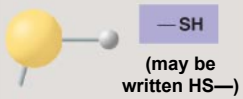
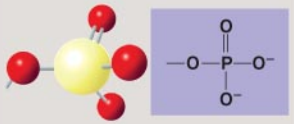
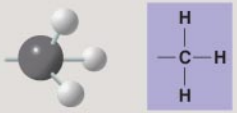
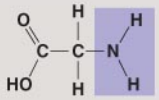
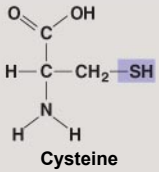
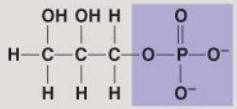
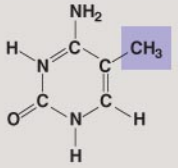
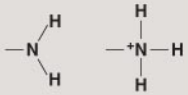
L-dopa



D-dopa



CHEMICAL GROUP	Hydroxyl	Carbonyl	Carboxyl
STRUCTURE	 (may be written HO—)		
	In a hydroxyl group (—OH), a hydrogen atom is bonded to an oxygen atom, which in turn is bonded to the carbon skeleton of the organic molecule. (Do not confuse this functional group with the hydroxide ion, OH^-.)	The carbonyl group ($>CO$) consists of a carbon atom joined to an oxygen atom by a double bond.	When an oxygen atom is double-bonded to a carbon atom that is also bonded to an —OH group, the entire assembly of atoms is called a carboxyl group (—COOH).
NAME OF COMPOUND	Alcohols (their specific names usually end in *-ol*)	Ketones if the carbonyl group is within a carbon skeleton Aldehydes if the carbonyl group is at the end of the carbon skeleton	Carboxylic acids, or organic acids
EXAMPLE	 Ethanol, the alcohol present in alcoholic beverages	 Acetone, the simplest ketone  Propanal, an aldehyde	 Acetic acid, which gives vinegar its sour taste
FUNCTIONAL PROPERTIES	• Is polar as a result of the electrons spending more time near the electronegative oxygen atom. • Can form hydrogen bonds with water molecules, helping dissolve organic compounds such as sugars.	• A ketone and an aldehyde may be structural isomers with different properties, as is the case for acetone and propanal. • These two groups are also found in sugars, giving rise to two major groups of sugars: aldoses (containing an aldehyde) and ketoses (containing a ketone).	• Has acidic properties because the covalent bond between oxygen and hydrogen is so polar; for example,  Acetic acid Acetate ion • Found in cells in the ionized form with a charge of 1– and called a carboxylate ion (here, specifically, the acetate ion).

CHEMICAL GROUP	Amino	Sulfhydryl	Phosphate	Methyl
STRUCTURE		 (may be written HS—)		
	The amino group (—NH_2) consists of a nitrogen atom bonded to two hydrogen atoms and to the carbon skeleton.	The sulfhydryl group consists of a sulfur atom bonded to an atom of hydrogen; resembles a hydroxyl group in shape.	In a phosphate group, a phosphorus atom is bonded to four oxygen atoms; one oxygen is bonded to the carbon skeleton; two oxygens carry negative charges. The phosphate group (—OPO_3^{2-}, abbreviated Ⓟ) is an ionized form of a phosphoric acid group (—OPO_3H^2; note the two hydrogens).	A methyl group consists of a carbon bonded to three hydrogen atoms. The methyl group may be attached to a carbon or to a different atom.
NAME OF COMPOUND	Amines	Thiols	Organic phosphates	Methylated compounds
EXAMPLE	 Glycine	 Cysteine	 Glycerol phosphate	 5-Methyl cytidine
	Because it also has a carboxyl group, glycine is both an amine and a carboxylic acid; compounds with both groups are called amino acids.	Cysteine is an important sulfur-containing amino acid.	In addition to taking part in many important chemical reactions in cells, glycerol phosphate provides the backbone for phospholipids, the most prevalent molecules in cell membranes.	5-Methyl cytidine is a component of DNA that has been modified by addition of the methyl group.
FUNCTIONAL PROPERTIES	• Acts as a base; can pick up an H^+ from the surrounding solution (water, in living organisms).  (nonionized) (ionized) • Ionized, with a charge of 1+, under cellular conditions.	• Two sulfhydryl groups can react, forming a covalent bond. This "cross-linking" helps stabilize protein structure. • Cross-linking of cysteines in hair proteins maintains the curliness or straightness of hair. Straight hair can be "permanently" curled by shaping it around curlers, then breaking and re-forming the cross-linking bonds.	• Contributes negative charge to the molecule of which it is a part (2– when at the end of a molecule; 1– when located internally in a chain of phosphates). • Has the potential to react with water, releasing energy.	• Addition of a methyl group to DNA, or to molecules bound to DNA, affects expression of genes. • Arrangement of methyl groups in male and female sex hormones affects their shape and function.