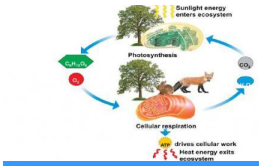
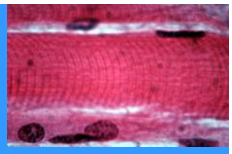
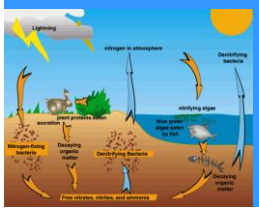
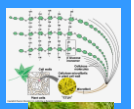
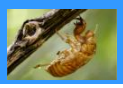


# 1.2 Elements of Life

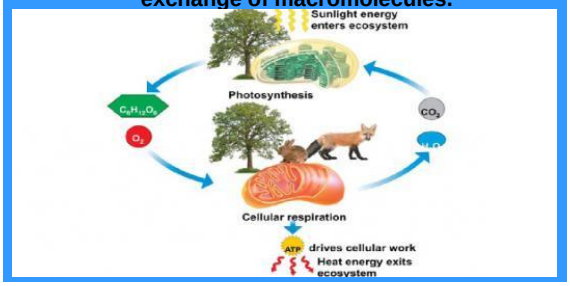




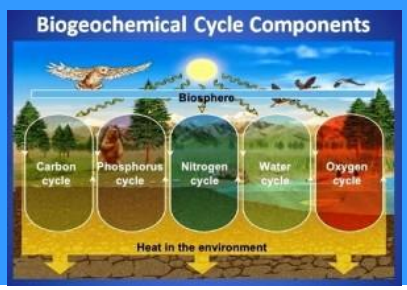
## ENDURING UNDERSTANDING

**ENE-1 The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.**



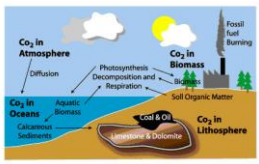

## ENE-1.A Describe the composition of macromolecules required by living organisms.

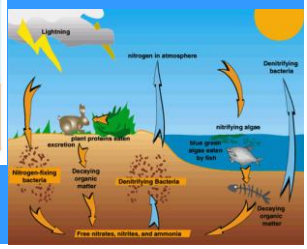
- Organisms must exchange matter with the environment to grow, reproduce, and maintain organization




## ENE-1.A Describe the composition of macromolecules required by living organisms.

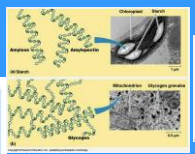
- Atoms and molecules from the environment are necessary to build new molecules

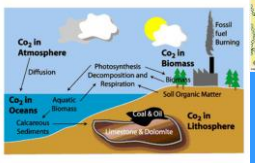


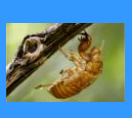




## ENE-1.A Describe the composition of macromolecules required by living organisms.

- Carbon moves from the environment to organisms where it is used to build carbohydrates, proteins, lipids or nucleic acids.
- Carbon is used in storage compounds and cell formation in all organisms.

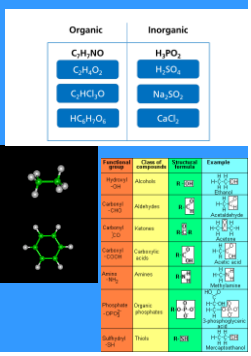


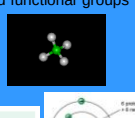


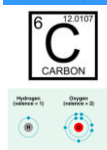



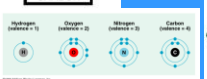
# Organic Chemistry

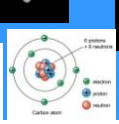
- Inorganic compounds contain no carbon
- Organic compounds contain carbon bonded to other elements
- Carbon is Basis of Life
  - Four electrons in outer shell.
  - Carbon bonds easily with carbon.
  - Carbon bonds easily with hydrogen, oxygen, nitrogen (CHON), and functional groups (CHNOPS)





# Functional Groups

## HYDROXYL

**STRUCTURE**


(may be written HO—)

Ethanol, the alcohol present in alcoholic beverages

**NAME OF COMPOUNDS**

Alcohols (their specific names usually end in *-ol*)

**FUNCTIONAL PROPERTIES**

- Is polar as a result of the electronegative oxygen atom drawing electrons toward itself.
- Attracts water molecules, helping dissolve organic compounds such as sugars (see Figure 5.3).



# Functional Groups

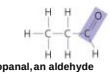
## CARBONYL

**STRUCTURE**

Acetone, the simplest ketone

**EXAMPLE**

Acetone, the simplest ketone



Propanal, an aldehyde

**NAME OF COMPOUNDS**

Ketones if the carbonyl group is within a carbon skeleton

Aldehydes if the carbonyl group is at the end of the carbon skeleton

**FUNCTIONAL PROPERTIES**

- A ketone and an aldehyde may be structural isomers with different properties, as is the case for acetone and propanal.



# Functional Groups

## SULFHYDRYL

**STRUCTURE**


(may be written HS—)

**EXAMPLE**

Ethanethiol

**NAME OF COMPOUNDS**

Thiols

**FUNCTIONAL PROPERTIES**

- Two sulfhydryl groups can interact to help stabilize protein structure (see Figure 5.20).

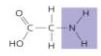


# Functional Groups

## AMINO

**STRUCTURE**

**EXAMPLE**



Glycine

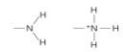
Because it also has a carboxyl group, glycine is both an amine and a carboxylic acid; compounds with both groups are called amino acids.

**NAME OF COMPOUNDS**

Amine

**FUNCTIONAL PROPERTIES**

- Acts as a base; can pick up a proton from the surrounding solution:



(nonionized) (ionized)

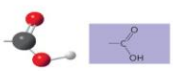
- Ionized, with a charge of 1+, under cellular conditions



# Functional Groups

## CARBOXYL

**STRUCTURE**



**EXAMPLE**

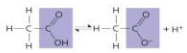
Acetic acid, which gives vinegar its sour taste

**NAME OF COMPOUNDS**

Carboxylic acids, or organic acids

**FUNCTIONAL PROPERTIES**

- Has acidic properties because it is a source of hydrogen ions.
- The covalent bond between oxygen and hydrogen is so polar that hydrogen ions ($H^+$) tend to dissociate reversibly; for example,



Acetic acid Acetate ion

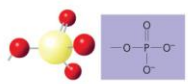
- In cells, found in the ionic form, which is called a carboxylate group.



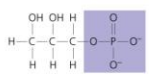
# Functional Groups

## PHOSPHATE

**STRUCTURE**



**EXAMPLE**



Glycerol phosphate

**NAME OF COMPOUNDS**

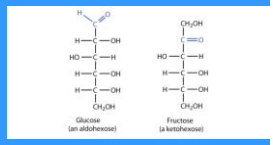
Organic phosphates

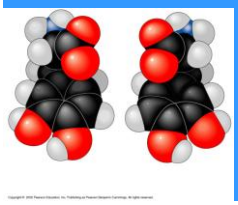
**FUNCTIONAL PROPERTIES**

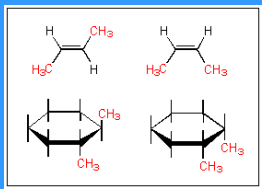
- Makes the molecule of which it is a part an anion (negatively charged ion).
- Can transfer energy between organic molecules.

# Isomers

- Structural Isomers- Differ in covalent arrangement of same atoms
- Geometric Isomers- Differ in spatial arrangement of same atoms
- Enantiomers- Molecules are mirror images or each other

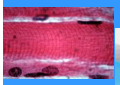


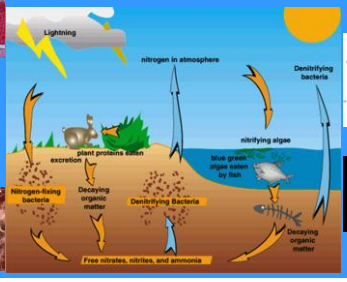



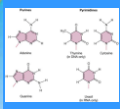


## ENE-1.A Describe the composition of macromolecules required by living organisms.

- Nitrogen moves from the environment to organisms where it is used in building proteins and nucleic acids.



## ENE-1.A Describe the composition of macromolecules required by living organisms.

- Phosphorus moves from the environment to organisms where it is used in nucleic acids and certain lipids.