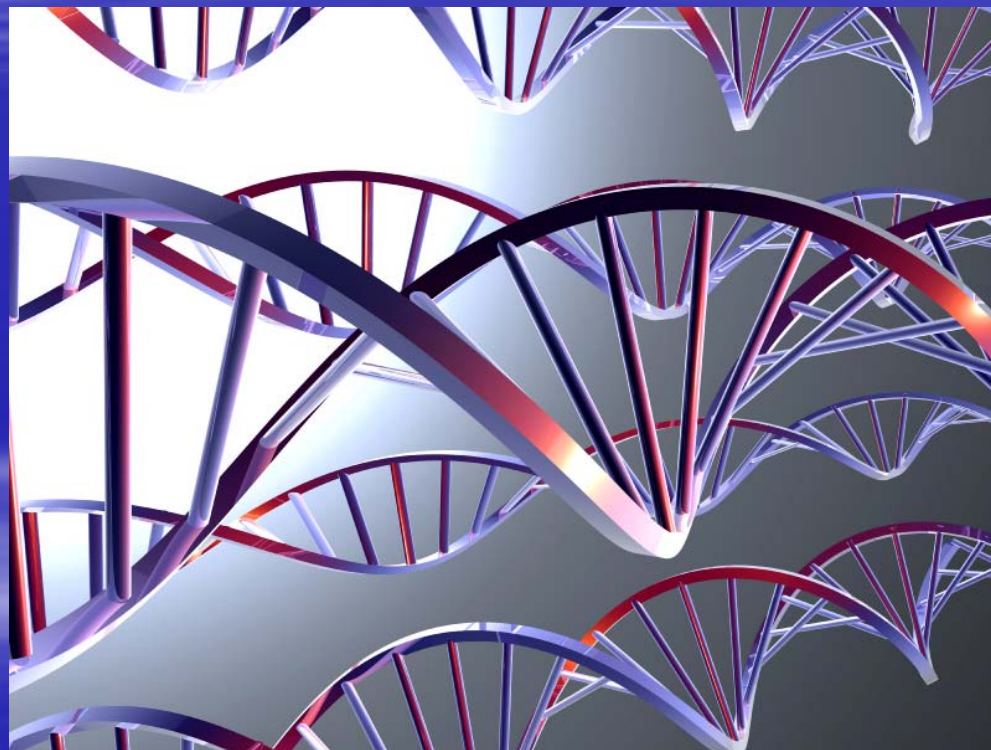


Chapter 6

The Chemistry of Life



Atoms: The Building Blocks of Life

- Both living and non-living things have atoms
- Everything, living and non, is made of **Atoms**.
- An element is something you can break down into a smaller part – even with chemicals.

Earth
Fire
AIR
Water

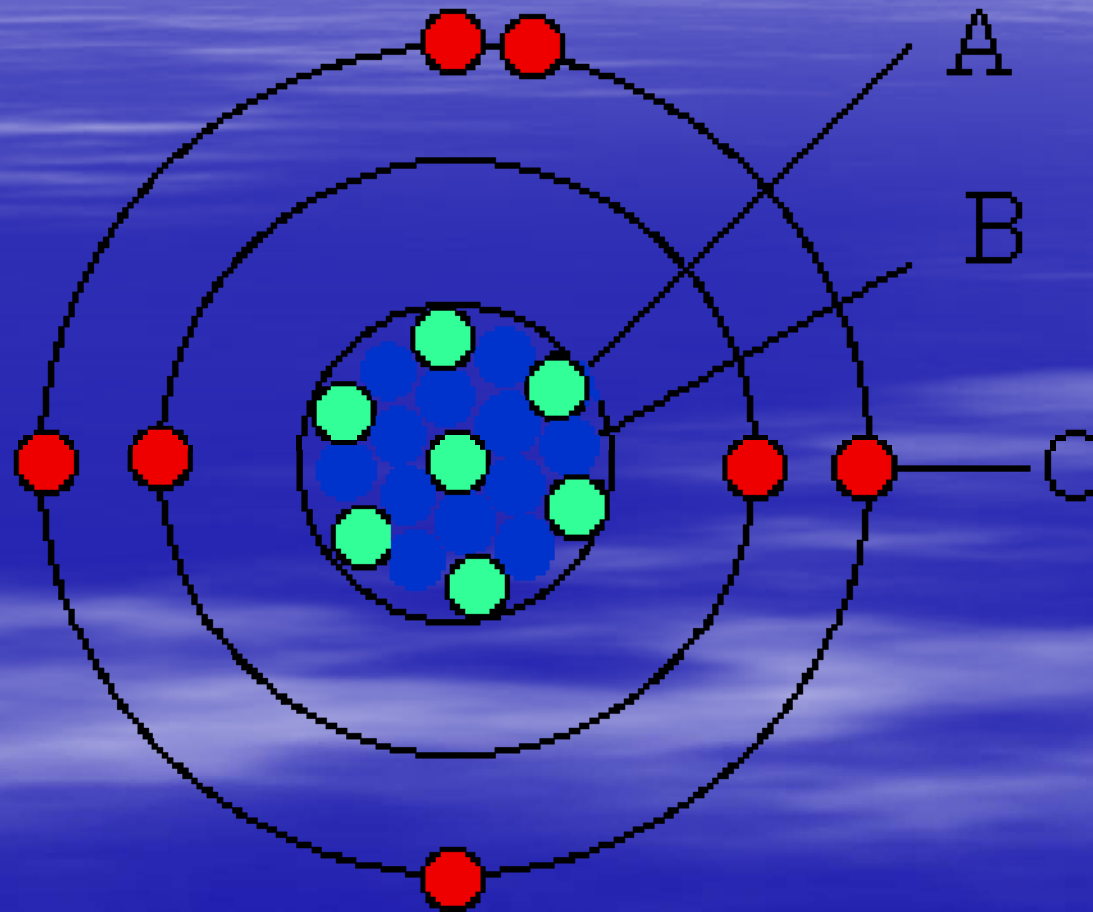


You can't see elements with your eyes

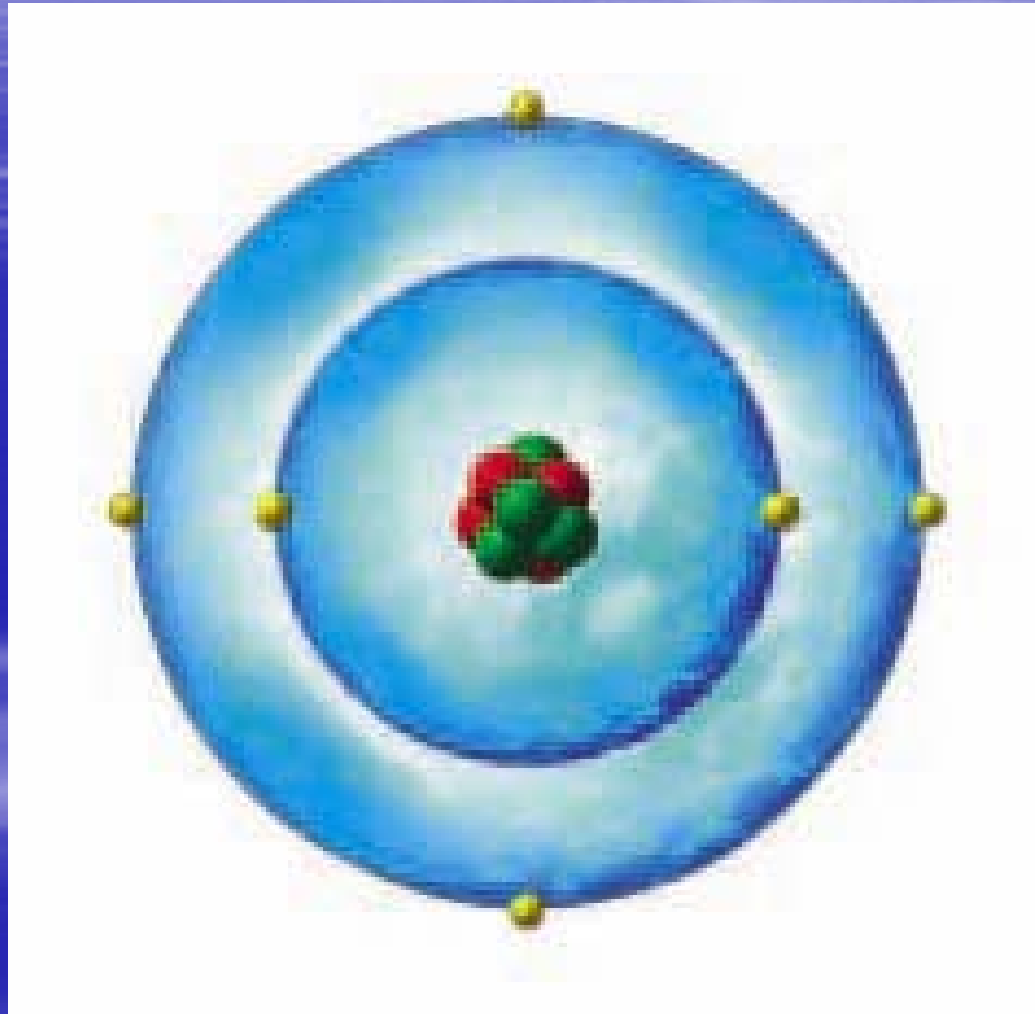
Of the naturally occurring elements, only 25 are essential to life.

There are 4 elements that make up 96% of the mass of a human body.

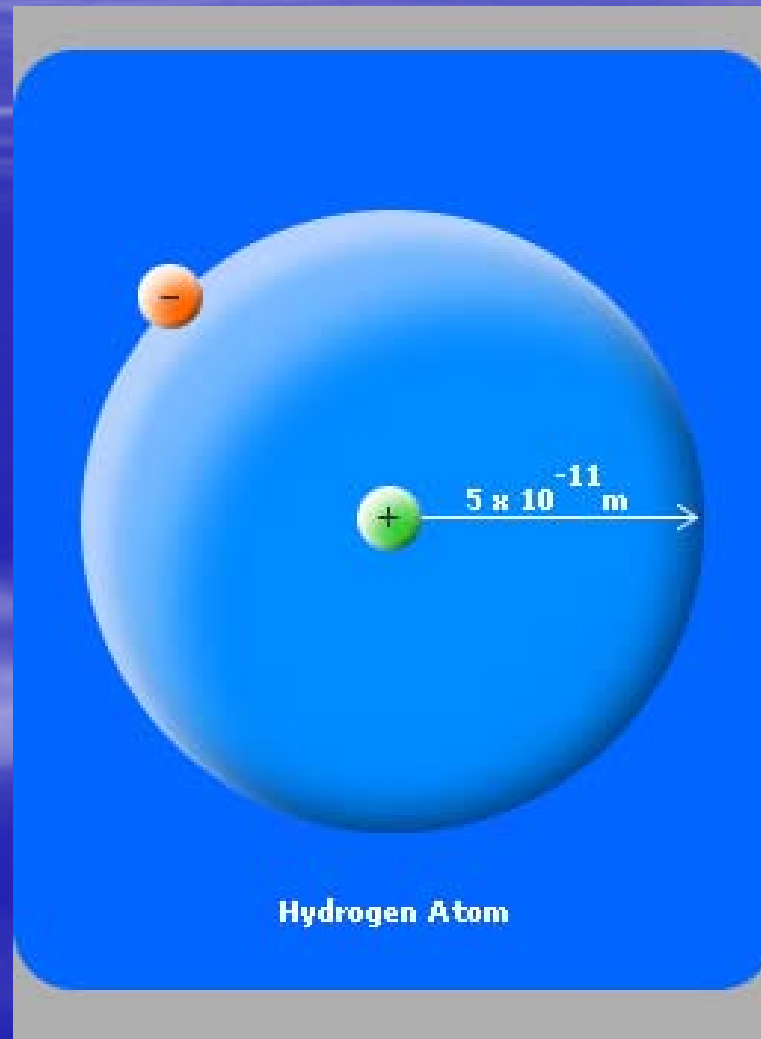
Nitrogen - N



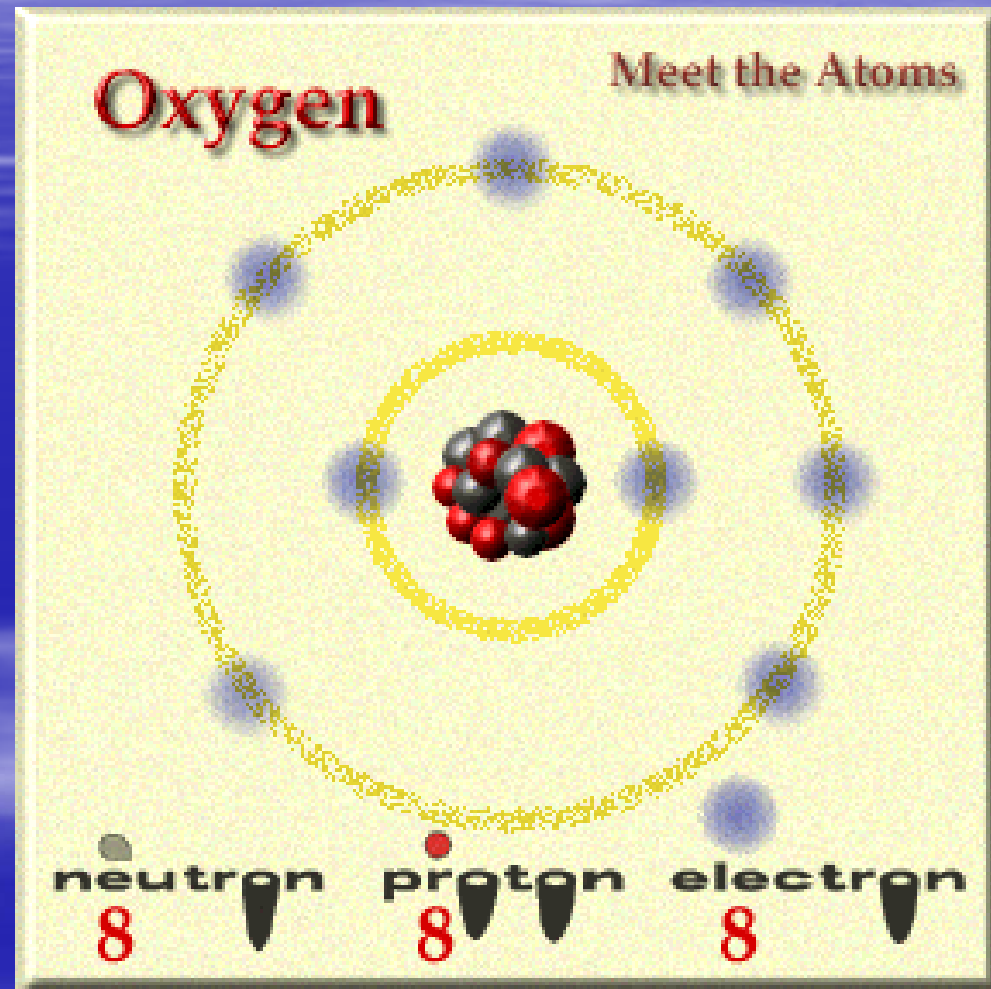
Carbon - C



Hydrogen - H



Oxygen - O



Atom

- It is the smallest part of an element
- They are the building blocks of all matter

Atoms

As we work fill out your notes

- **Nucleus** is the center of an Atom
- It contains protons (p^+) that are positive
- It contains neutrons (n) that have no charge
- The nucleus has a positive + charge!

The area around the nucleus has small electrons (e^-) which are negatively charged.

They stick together like magnets – the positive and negative charges hold it together.

Go back into your notes and compare the pictures of the elements – how are they different????

Energy Levels

- There are 3 levels
 - The first level can only hold 2 electrons
 - The second level can no more than 8 (e^-)
 - The third level can hold no more than 10 (e^-)
- * *Similar to orbits, think of Saturn's moons*



Skip 6.2

Begin with 6.3

Life Substances

Atoms contain = numbers of
electrons and protons so
there is *no charge*

The Atom Activity

Atom Activity

Time to play with play doe!



- Take out a piece of paper
- Marker/Crayon/Colored Pencil
- Draw Three Rings
- Make a Carbon Atom
- Pick an element and try a new one!

Isotopes of an Element

Read page 144 – 147

Stop before Chemical
Reactions

Isotopes

Isotope: Atoms of the same element that have different numbers of neutrons.

Compounds and Bonding

A **compound** is a substance that is composed of atoms of 2 or more different elements that are chemically combined.

An example is Table Salt



Sodium and Chlorine

Covalent Bond

These happen in nature because the “compound” is more stable than the individual atom.

Elements prefer to have all of their energy levels full, so they share!

Periodic Table
with two bottom
rows added.

The image shows a schematic periodic table with 18 columns. The first two columns are on the left, and the last two are on the right. The table consists of 8 rows. The first two rows have 1 element each in the first and last columns. The next two rows have 2 elements each in the first and last columns. The next two rows have 10 elements each, filling the middle 16 columns. The final two rows at the bottom are highlighted in orange and also have 10 elements each, filling the middle 16 columns.

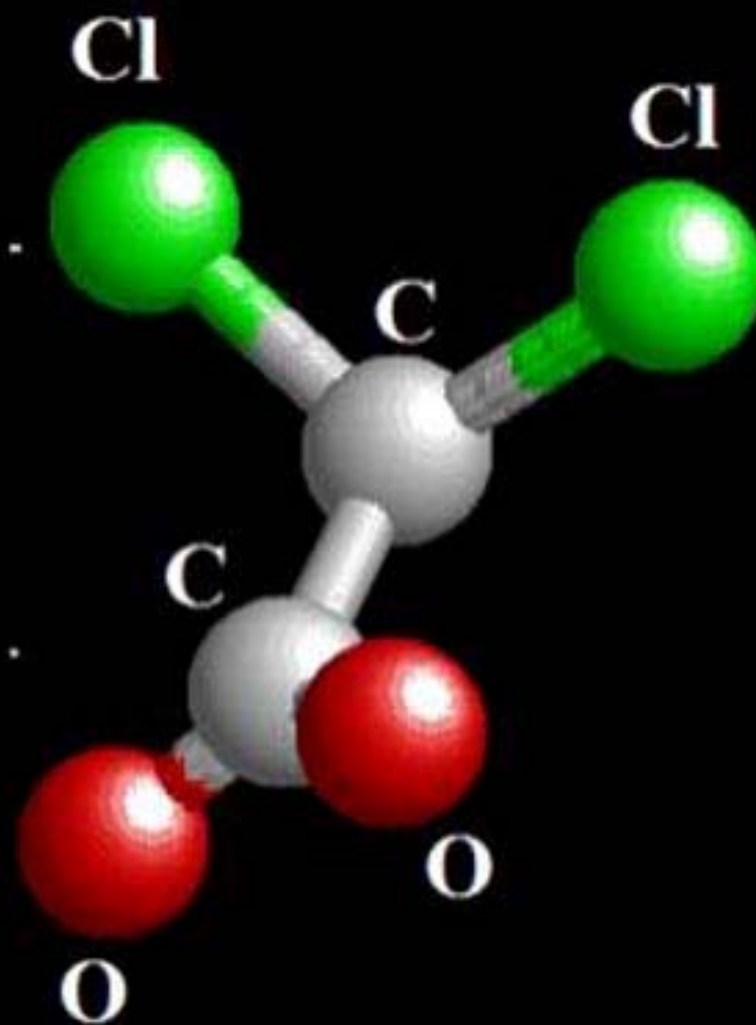
Two rows below table are
orange.

A **covalent** bond is the force that holds 2 atoms together.

The shared electrons move around each nuclei.

A **molecule** is a group of atoms held together by covalent bonds.

Dichloroacetate



Ion

An ion is a charged particle made of atoms.

Sometimes atoms combine by first gaining or losing electrons.

Ionic Bond: the attractive force between 2 ions of opposite charge.

Ionization Energy

Chemical Reactions

This is when bonds are formed or broken causing a substance to recombine into something else (another substance)

All chemical reactions that happen inside an organism are that organisms *metabolism*.

Read Pages 148-149

Mixtures – This is when a combination of substances where the individual substances retain their own properties.

Sand and sugar activity

Solution – is a mixture where 1 or more substances are distributed evenly.



Read Mixtures and Solutions

Pg 148-151

What to make Kool Aid!!!

pH – the measure of how acidic or basic a solution is.

Acid is a substance with a pH below 7

Base is a substance with a pH above 7

ACIDIC

NEUTRAL

ALKALINE

4.5 to 6.0
Most "Purified" Waters

6.5 to 7.5
Most Tap Waters

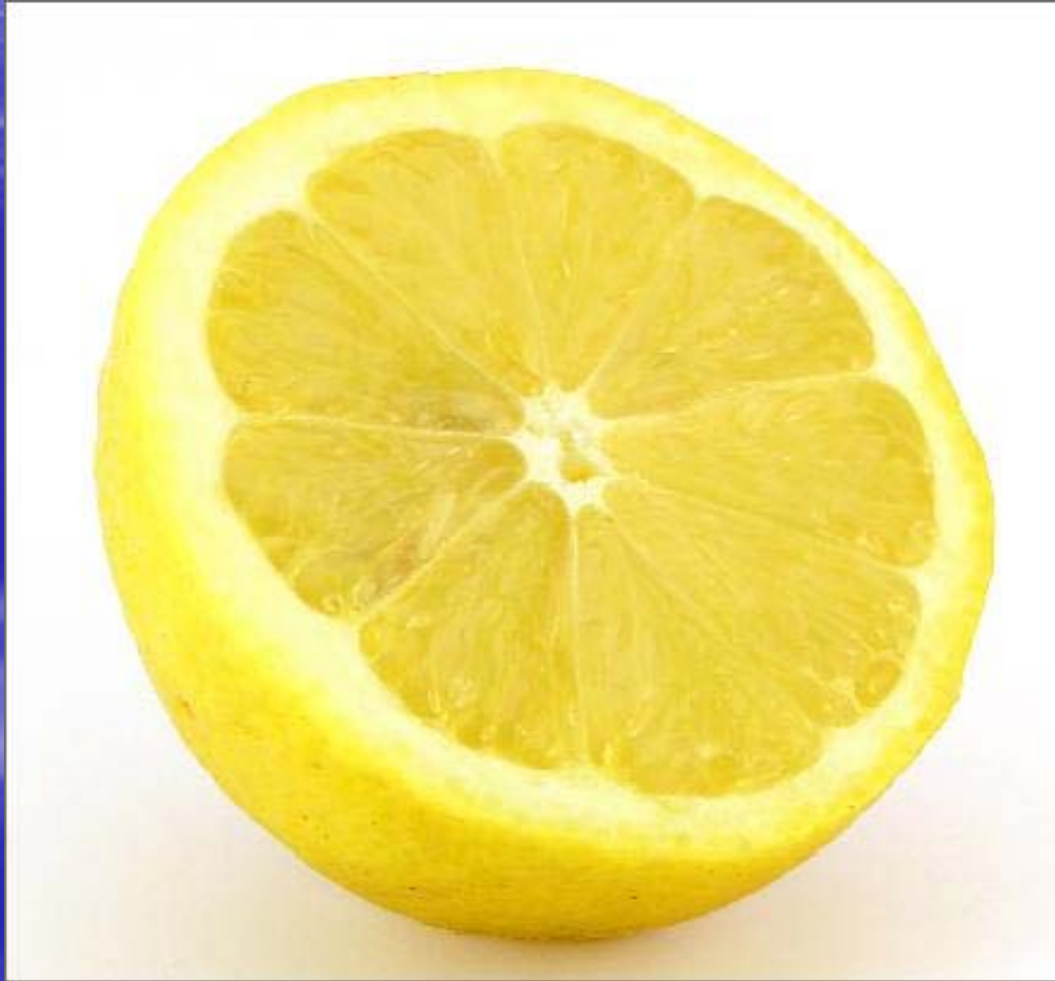
8.0 to 10+
Water From IonWays



The pH Scale is Logarithmic

For example, a soda at pH 3 is 1,000,000 times more acidic than pH 9 water from an IonWays ionizer!!

Acidic pH 2



Acidic pH 4



Neutral pH 7



Base pH of 8



Base pH of 10



pH Lab activity

Skip 6.2

Begin with 6.3
Life Substances

Carbon in Organisms

The carbon atom has 4 electrons in its outer energy level that can bond with other elements.

Sometimes elements share electrons to make it more stable.

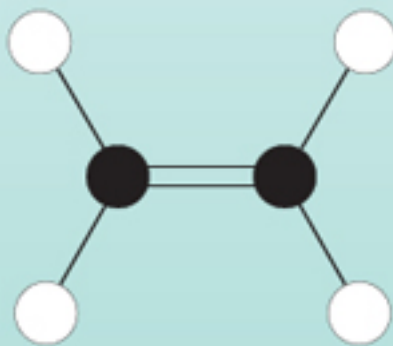
Carbon can combine with other carbon molecules and other elements.

Bars represent the type of bonds which can be formed.

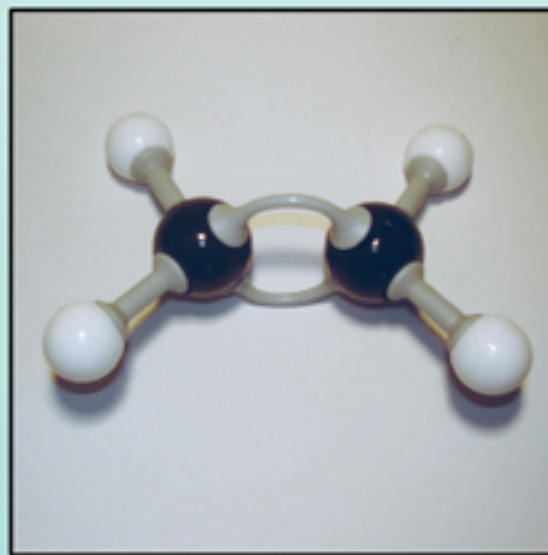
Single



Double Bond Carbon



(a)



(b)

Triple Carbon Bond

Three bars to bond the
element

When bonding they can form
chains, branched chains or
rings.

Marshmallows!!!

(Don't eat them – yukkie!)

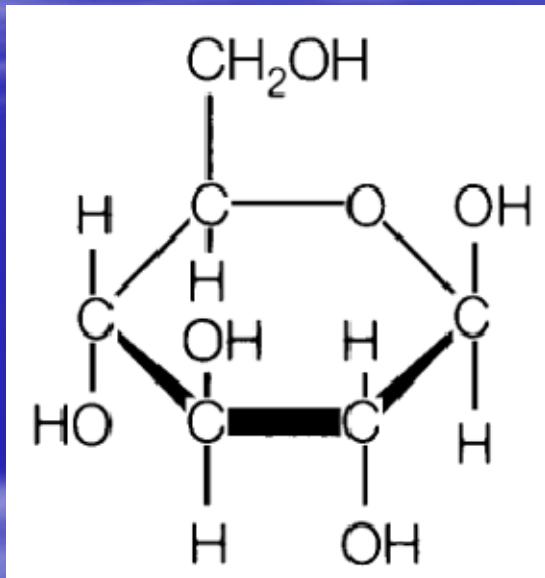
- Use tooth picks and mini marshmallows to make a
 - Single bond
 - Double bond
 - Triple bond



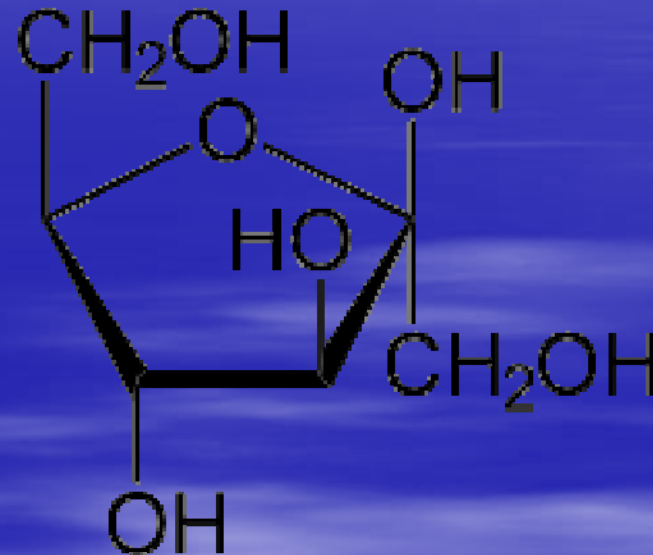
Isomer

- Carbons are so flexible in bonding that they can make huge #'s of different structures.
- Compounds that have the same chemical formulas but have a different structure are called *isomers*.

Glucose

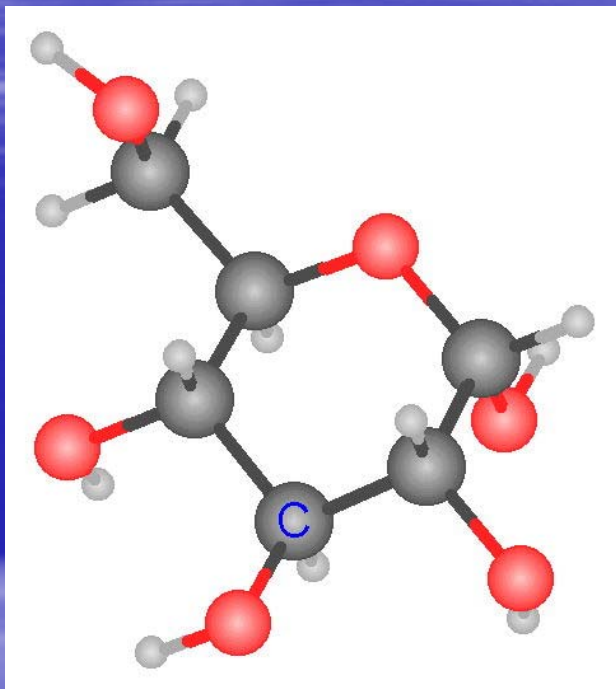


Fructose

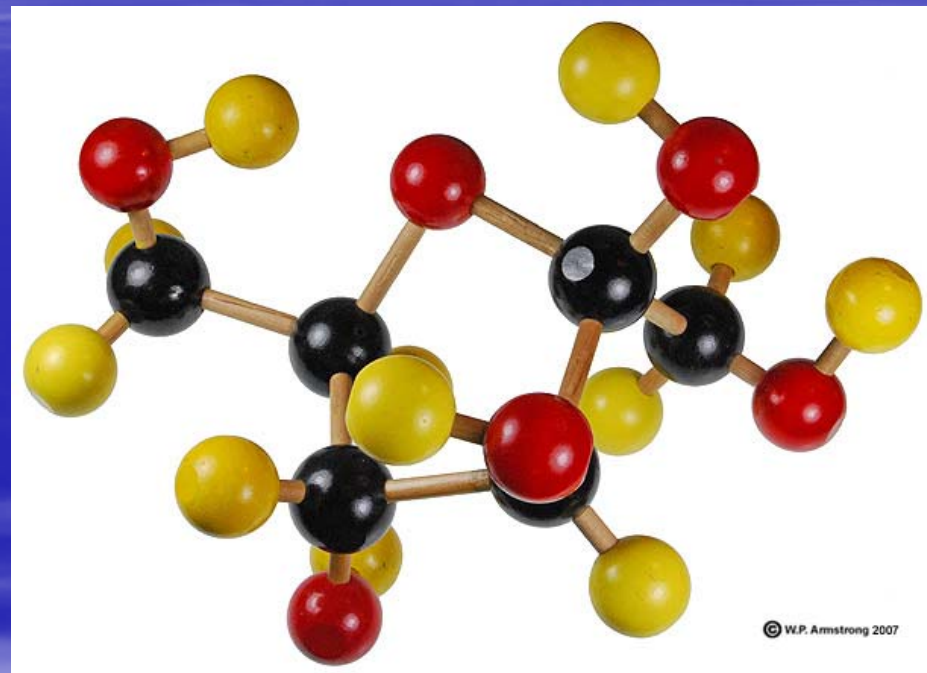


Formula: C₆ H₁₂ O₆

Glucose



Fructose



Formula: C₆ H₁₂ O₆

Carbon compounds vary greatly in size. There can be 1- thousands of carbon atoms in a compound.

These **organic compounds** are called biomolecules

Proteins are examples of biomolecules.

Polymer

Cells build these biomolecules by bonding small molecules together. These chains of molecules are called **polymers**.

Condensation is a chemical reaction that can form polymers.

Many ***polymers*** are formed by condensation (when water is added) and can be broken by hydrolysis (when water is taken away).

*Movie Clip

Carbohydrate

Carbohydrates are used in humans and animals to provide energy for the body.

We get this by eating food.

A “carb” is a biomolecule which is made of carbon, hydrogen and oxygen.

Monosaccharide

Examples are simple sugars:

Fructose

Glucose

When glucose and fructose are lined together by condensation sucrose is formed which is a disaccharide (table sugar)



The largest carb molecules are called polysaccharides – polymers made of many monosaccharide sub units.

Examples this are:

Starches



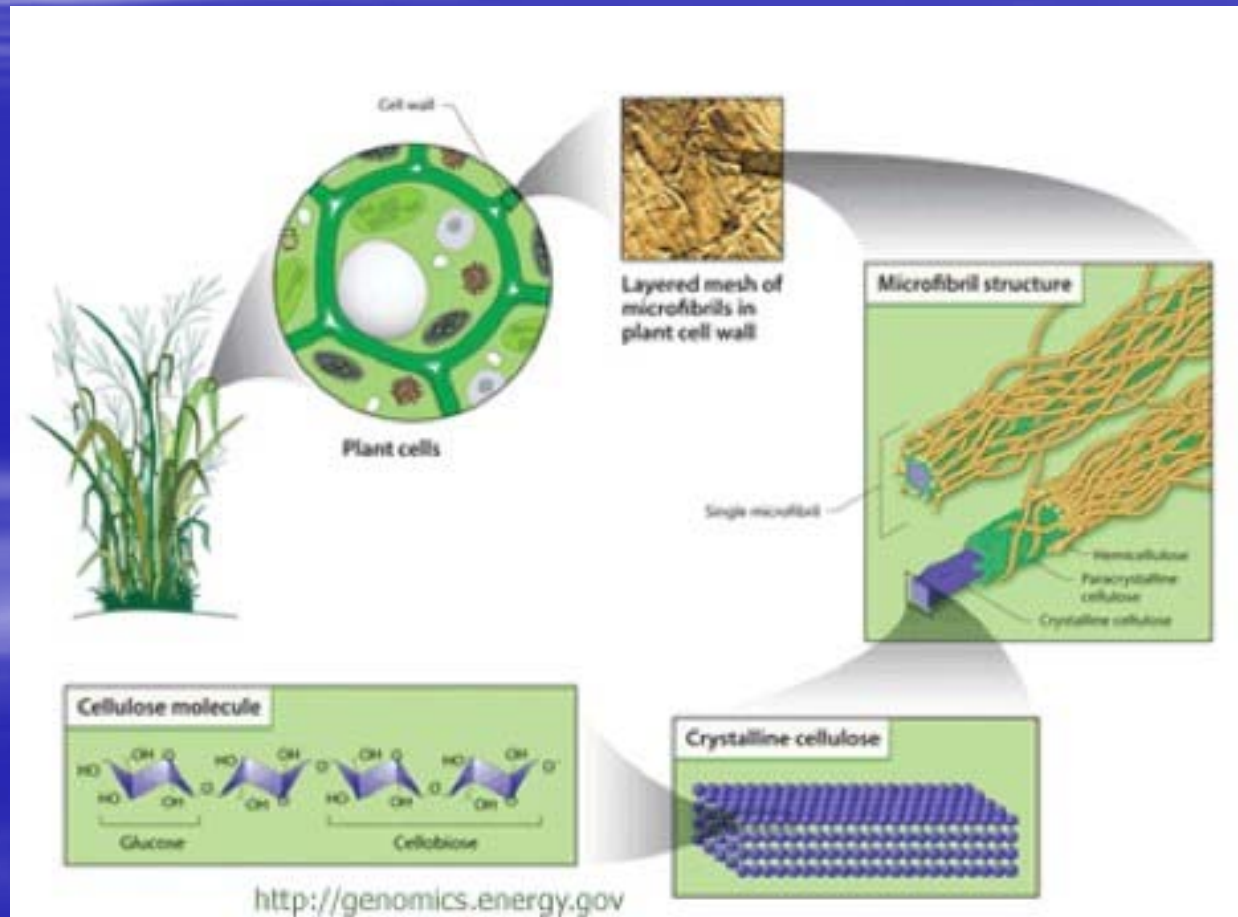
Glycogen

- Stored in the liver – form of energy



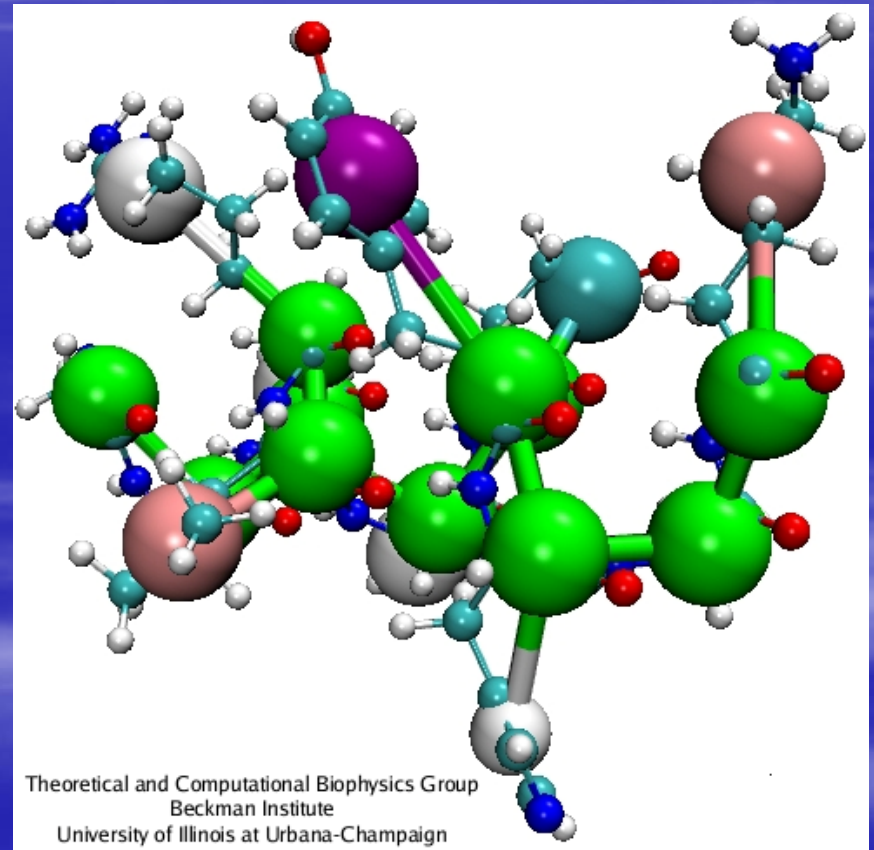
Cellulose

- Found in plants



Lipids

- Are fats, oils, waxes and steroids
- Large biomolecules that are made of carbon, hydrogen with a little bit of oxygen

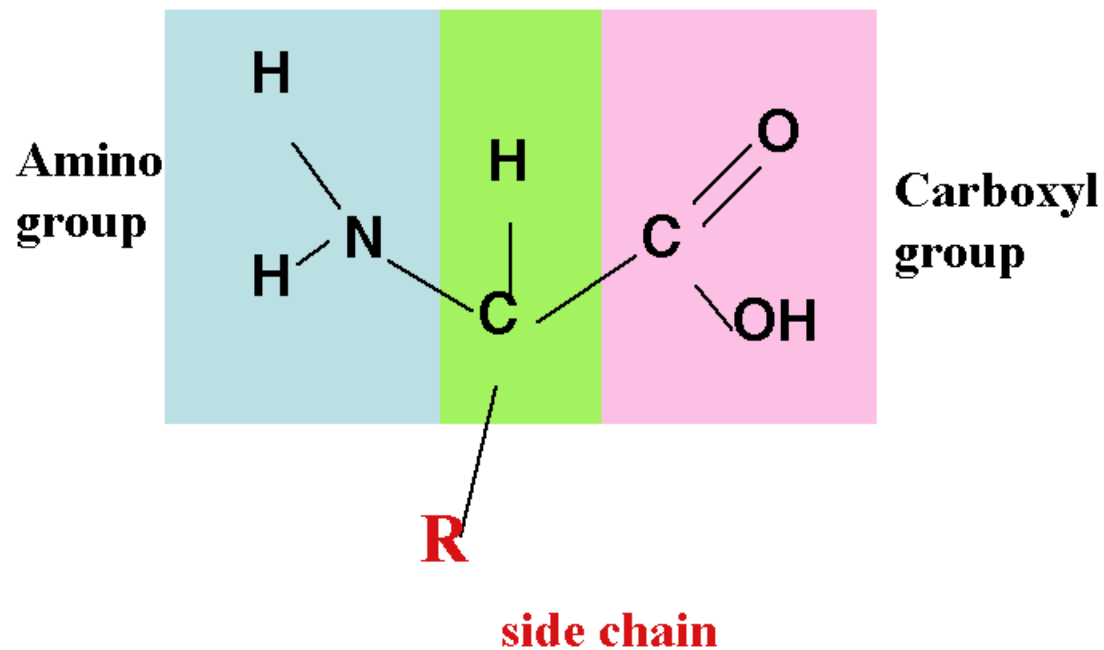


- Lipids are insoluble in water – example is olive oil, bacon grease.
- **Saturated** – each carbon is bonded to the other carbons by a **single** bond
- **Unsaturated** – there is a **double** bond present
- Cells use lipids to store energy

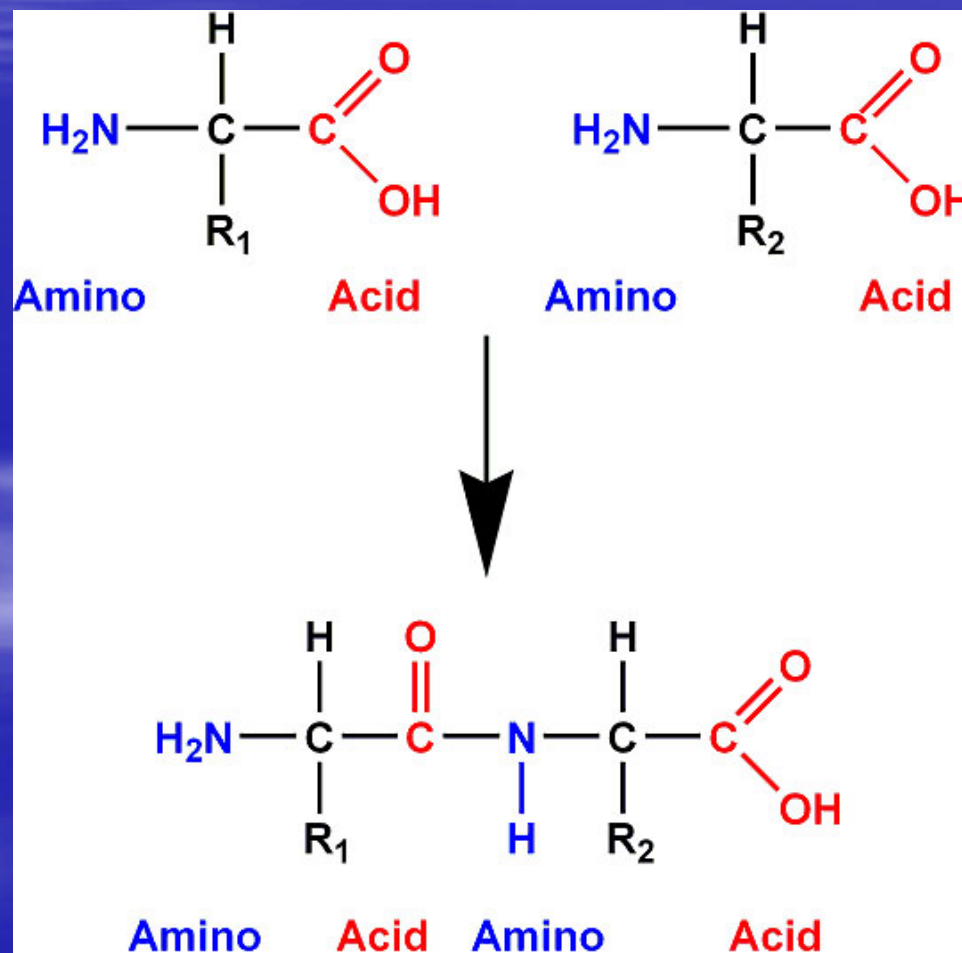
Proteins (Meat)

- A protein is a large complex polymer made of carbon, hydrogen, oxygen, and nitrogen.
- Read page 160- Structures of proteins 163.

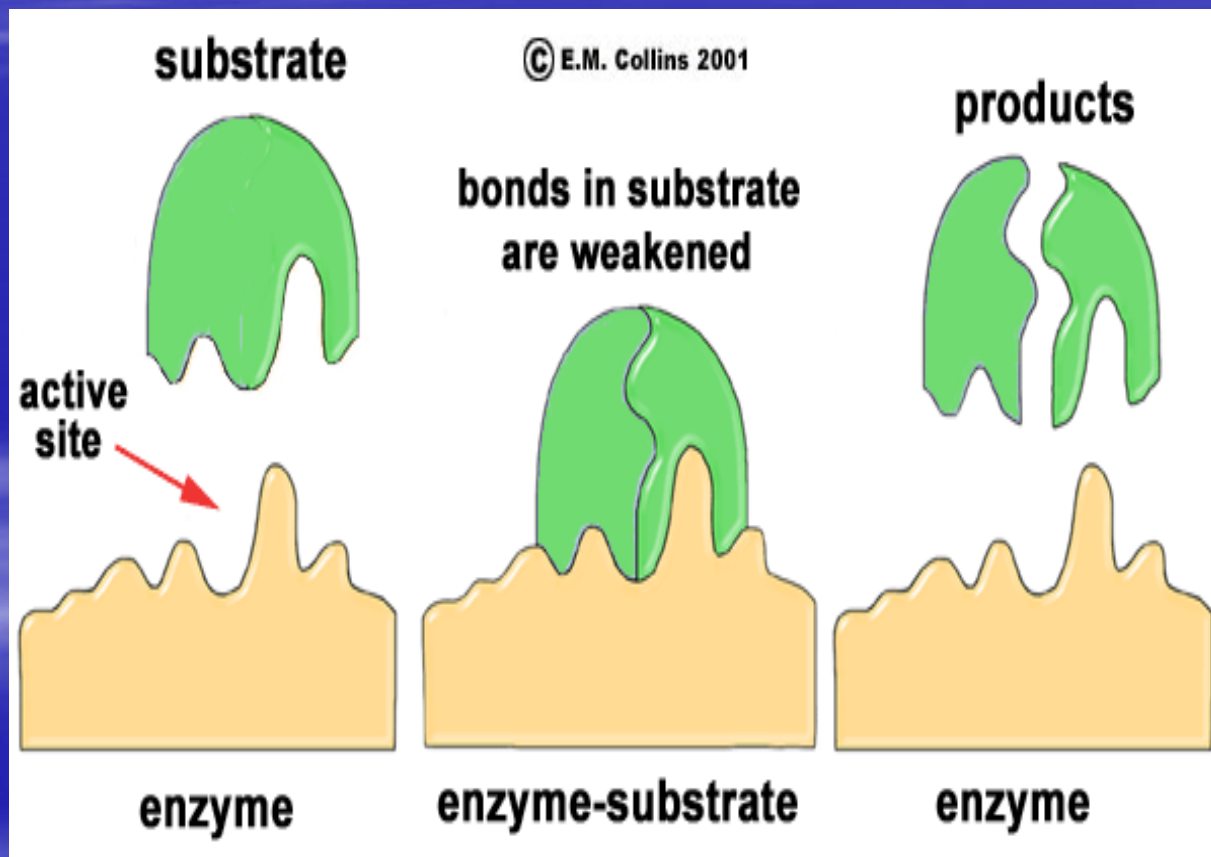
Amino acids - Basic building blocks for proteins (muscle)



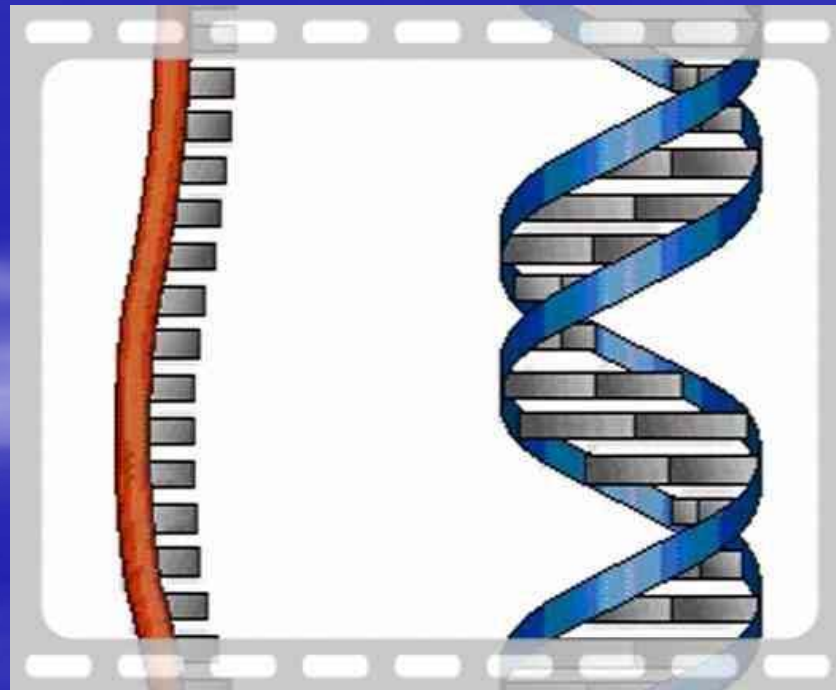
Peptide Bond – The covalent bond formed between the amino acids.

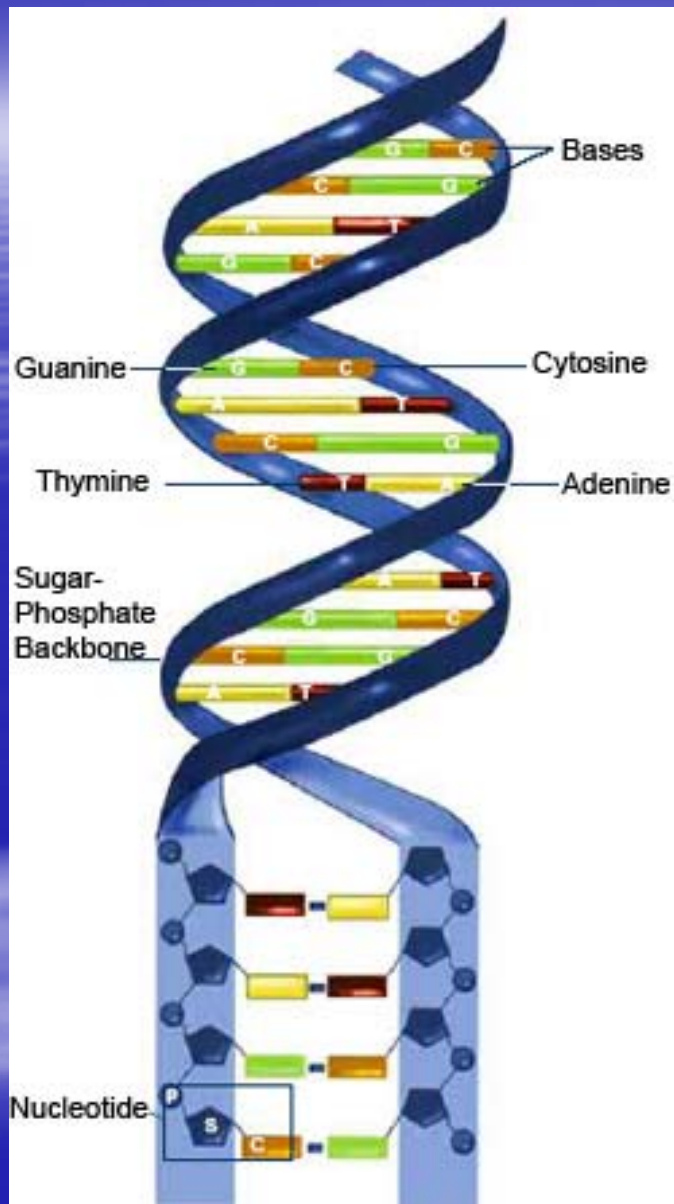


Enzyme – a protein that changes the rate of a chemical reaction



Nucleic Acid – a complex biomolecule that stores cellular information in a form of a code





Nucleotide —
subunits of nucleic acid formed from a simple sugar, phosphate group and a nitrogenous base