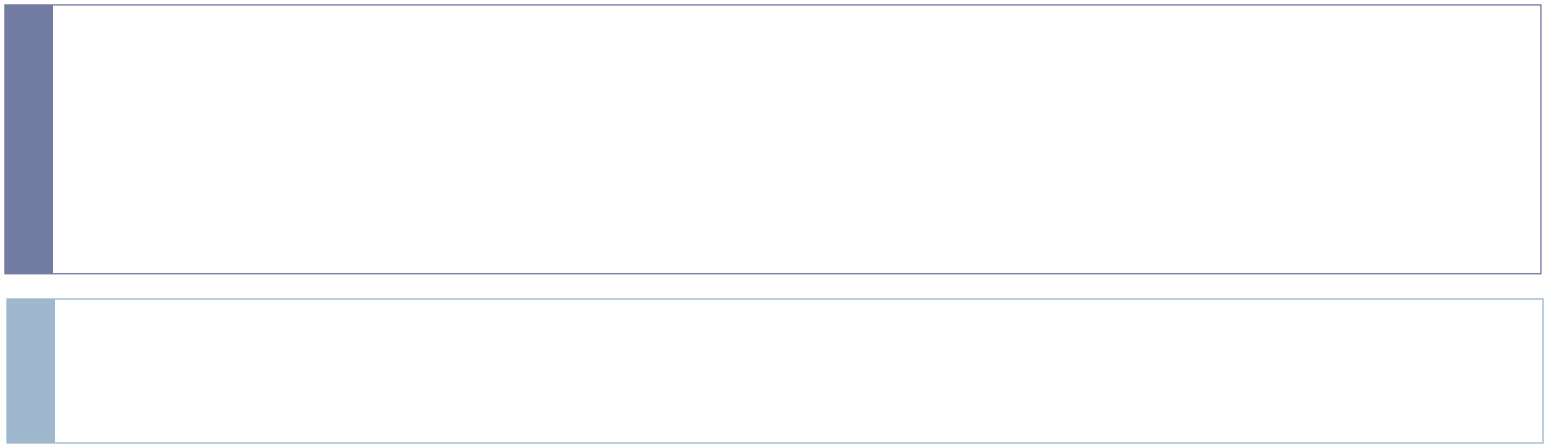
Chapter 3 Chemistry of Life

DO NOW

- TAKE 3 INDEX CARDS AND WRITE YOUR NAME AND SCIENCE NUMBER ON THE TOP.
- BELOW YOUR SCIENCE NUMBER WRITE WEDNESDAY 10/10 ON ONE CARD, THURSDAY ON ANOTHER AND FRIDAY ON THE LAST.
- YOU WILL BE USING THESE CARDS TO SUMMARIZE WHAT THE CLASS IS ABOUT EACH DAY.
- THIS IS YOUR EXIT PASS- YOU MUST HAND THIS IN TO LEAVE THE ROOM!!!

Bellringer-pair share

- What is acidic? Basic?
- List 3 things you think are basic.



Bellringer ON 88

- An atom has 5 protons and 6 neutrons. How many electrons would the element have?
- Is this atom carbon? Explain your answer.
- What would the atomic mass be?

Bellringer ON PP 89

- What property of water causes rain to fall in droplets?
- Is this the same property that causes capillary action?

Bellringer ON PP 90

- A solution contains the same number of H+ (hydronium) and OH- (hydroxide) ions. Is the solution acidic, basic or neutral?
- What would the pH of this solution be?

Bellringer ON PP 91

- What 2 things do all amino acids have in common?

Bellringer

- What 3 things do all nucleotides have in common?

Bellringer

- Why is it difficult for chemical reactions to occur in living organisms without an enzyme? What would happen if there weren't any enzymes?

Homework for

19-Mar	Date Assigned (due the next day unless otherwise specified	Whats happening in class/Being collected this day
Monday		
Tuesday		
Wednesday	PP 88& 89 READ BOOK PAGES 52-54 TO ANSWER	CH 1 NOTES
Thursday	PP 90 READ BOOK PAGES 55-58 TO ANSWER	
Friday	PP 90 READ BOOK PAGES 59-63 TO ANSWER	

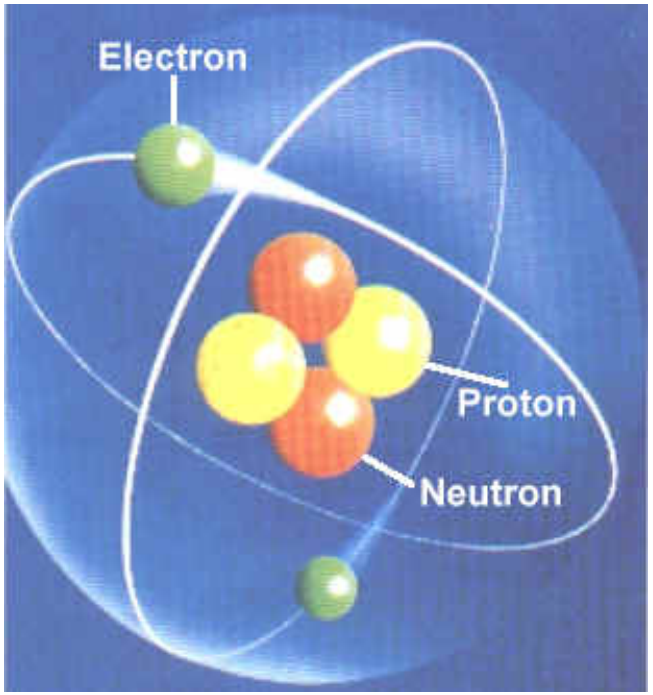
Homework for

Homework for

Homework for

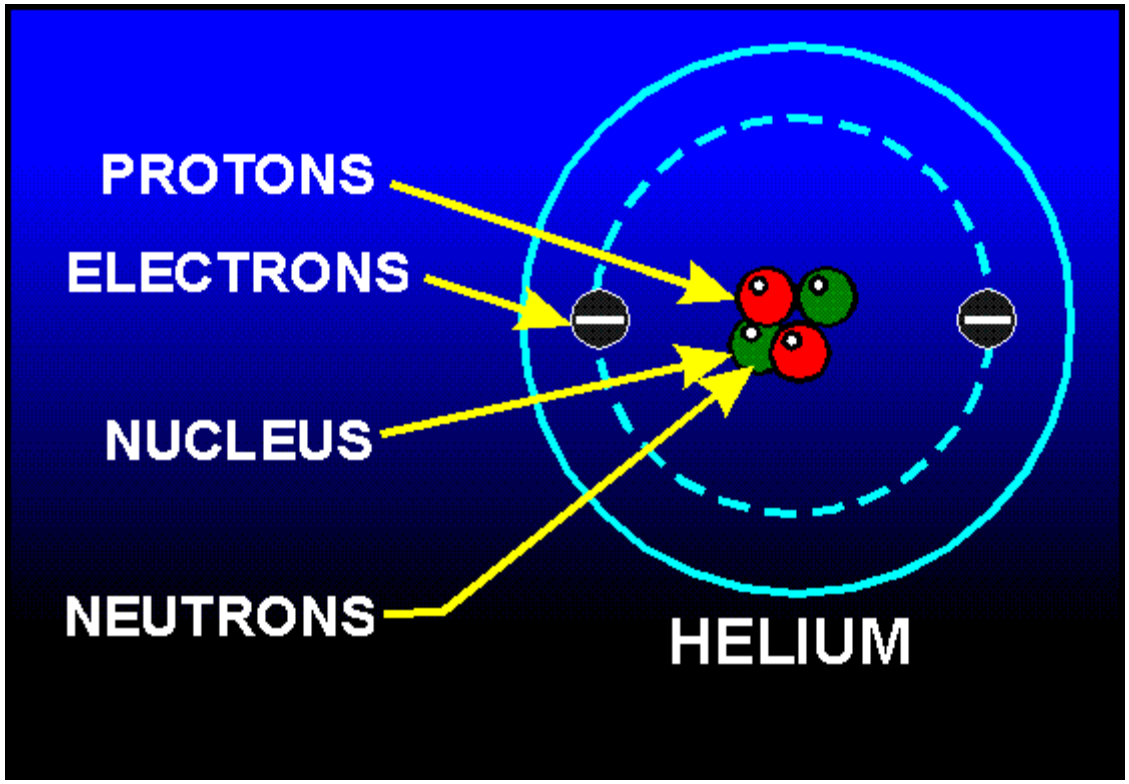
Ch 3 Sec 1

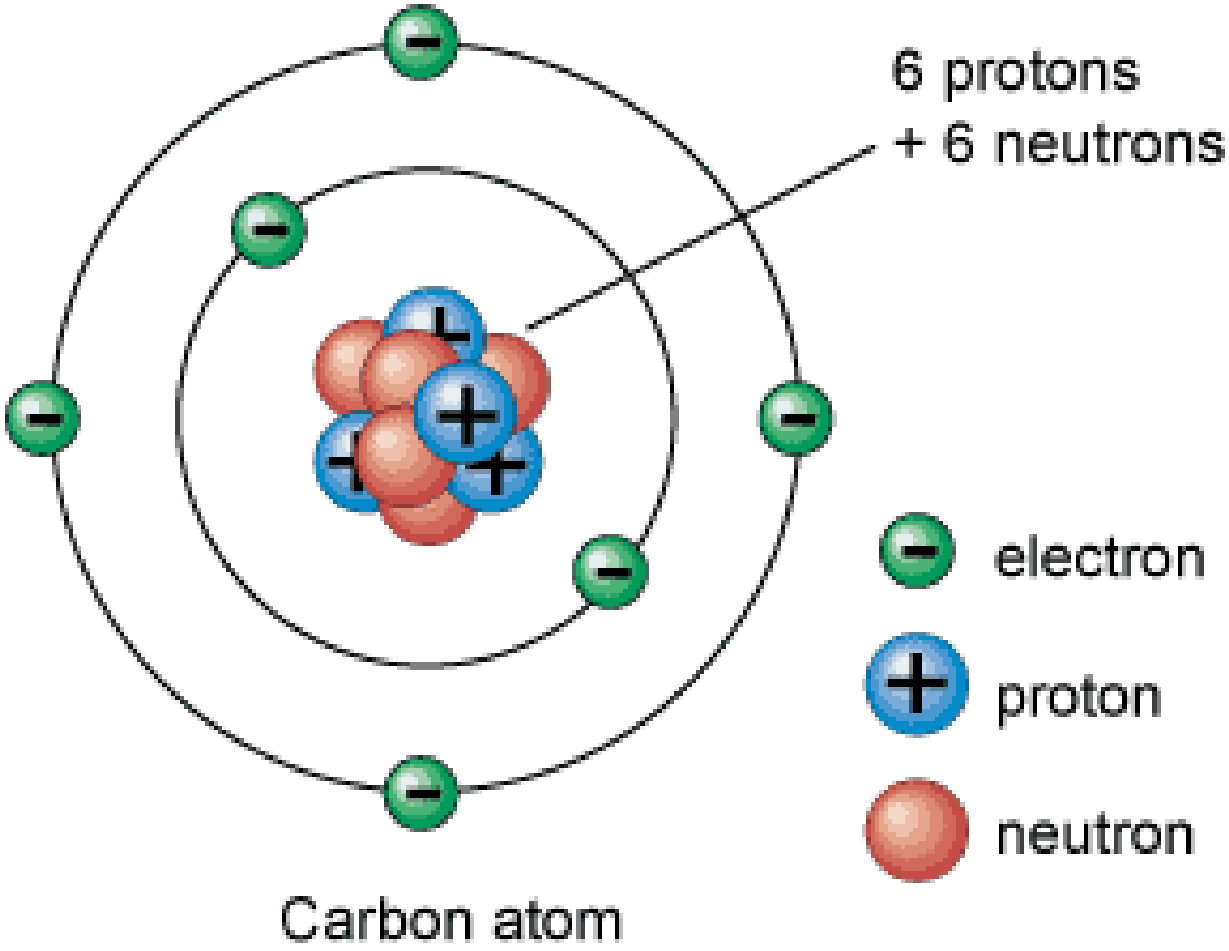
- **ATOMS** -All matter is made up of atoms. An atom is the smallest unit of matter that cannot be broken down by chemical means.



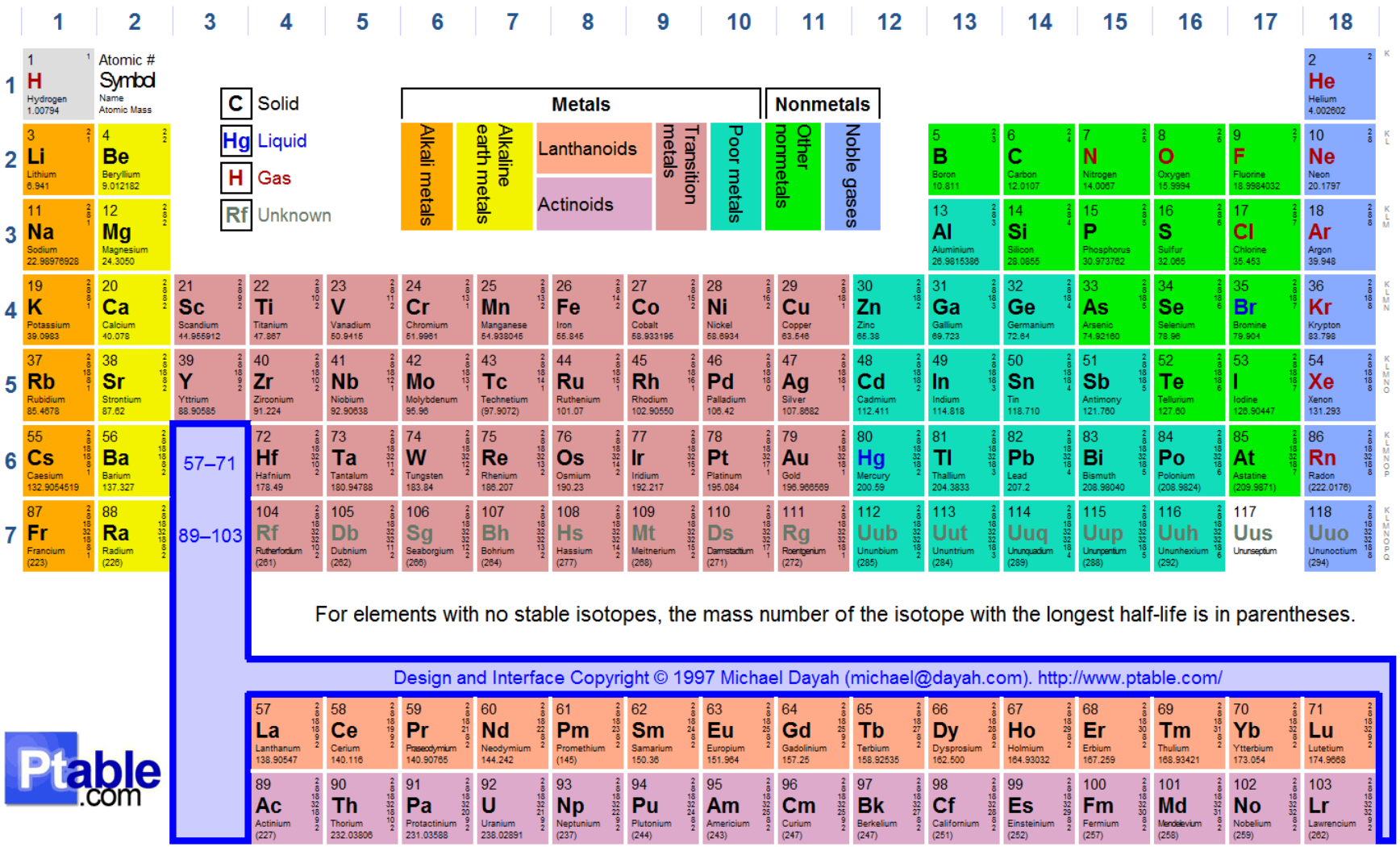
Matter is anything that has mass and takes up space.

- The nucleus of an atom is made up of positively charged protons and uncharged neutrons. Negatively charged electrons have very little mass and move around the nucleus in a large region called the *electron cloud*.
- An element is a substance made up of atoms that have the same number of protons. For example, each atom of the element carbon has six protons.
- Atoms of an element may have different numbers of neutrons. These atoms are called *isotopes* of elements.

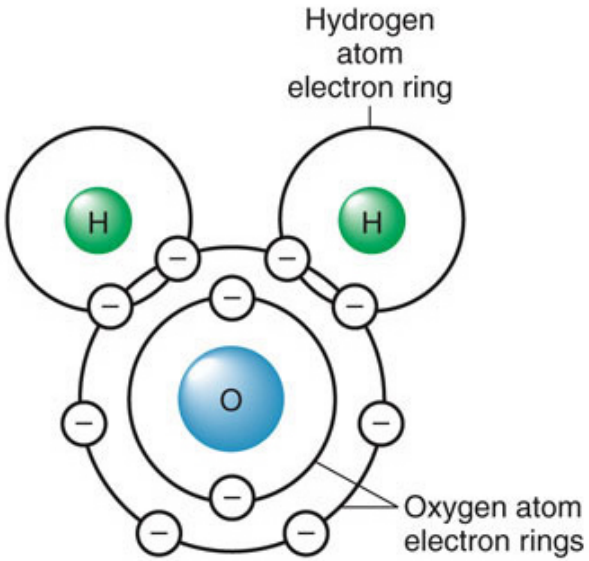

PROTONS
ELECTRONS
NUCLEUS
NEUTRONS
HELIUM

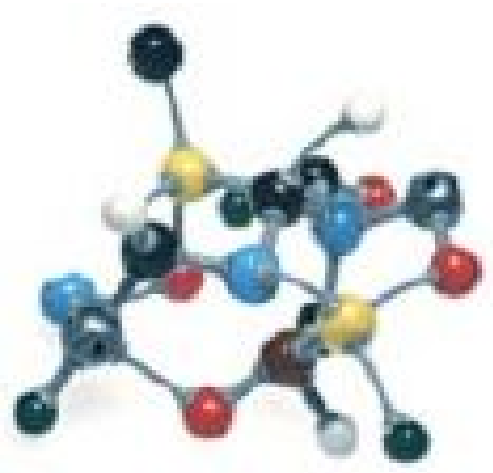

6 protons
+ 6 neutrons
electron
proton
neutron
Carbon atom

Periodic Table of Elements



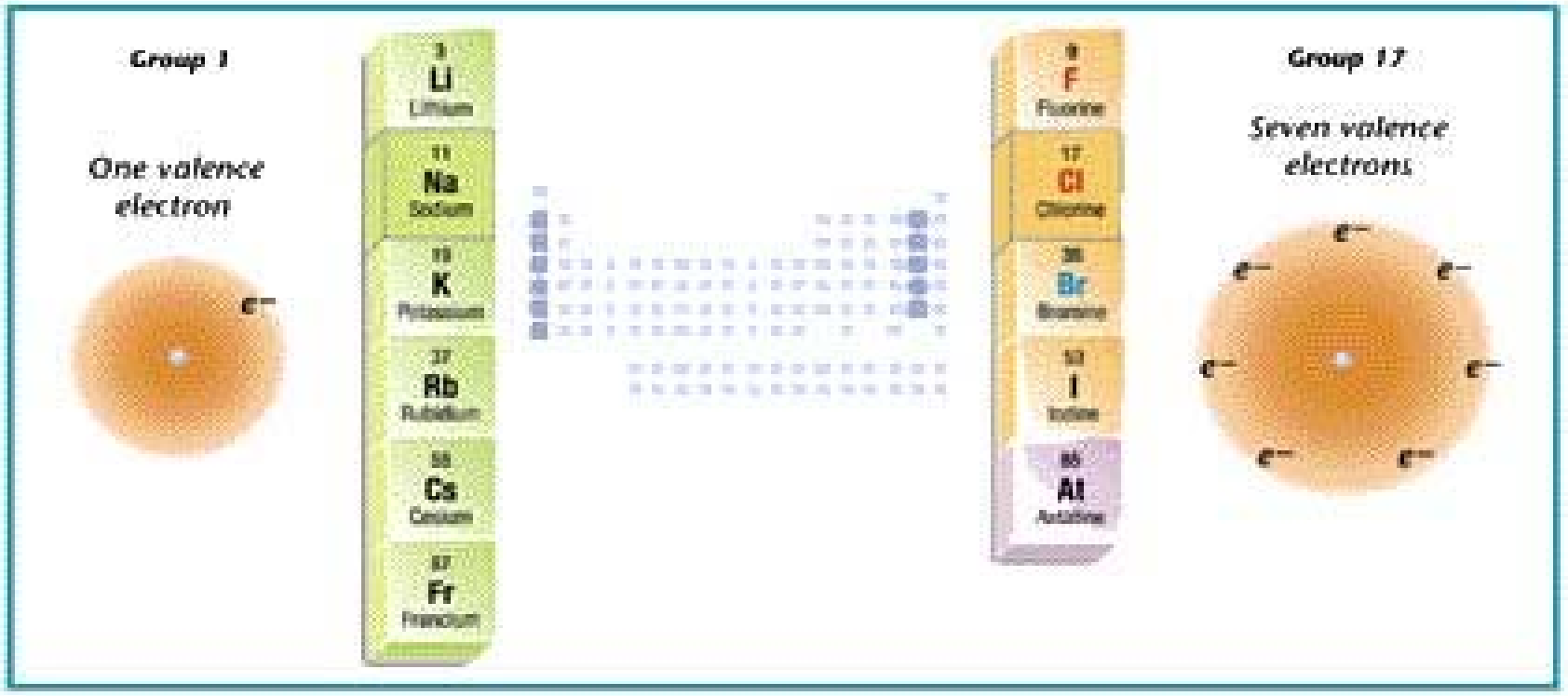
- CHEMICAL BONDS **-**Chemical bonds form between groups of atoms because most atoms become stable when they have **eight** electrons in the valence shell





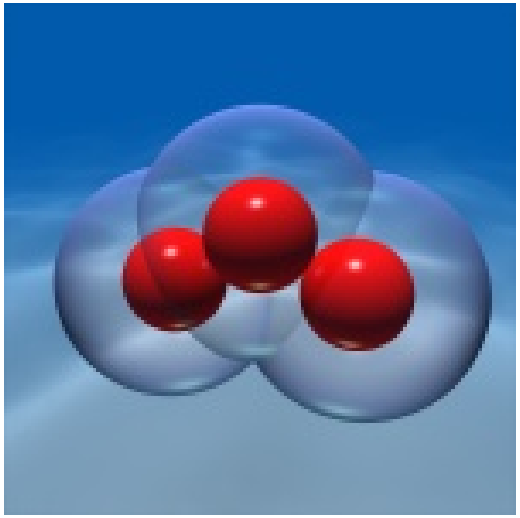
Valence electrons

- Electrons in the outermost level, or shell, are called *valence electrons*.



Types of bonds-

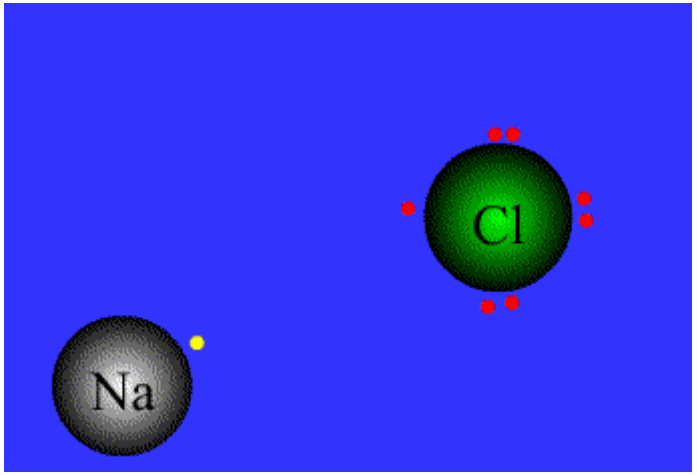
- **Covalent-** sharing valence electrons forms a covalent bond.
- A molecule is a group of atoms held together by covalent bonds.
- A water molecule, H_2O, forms when an oxygen atom forms covalent bonds with two hydrogen atoms.



Covalent bond

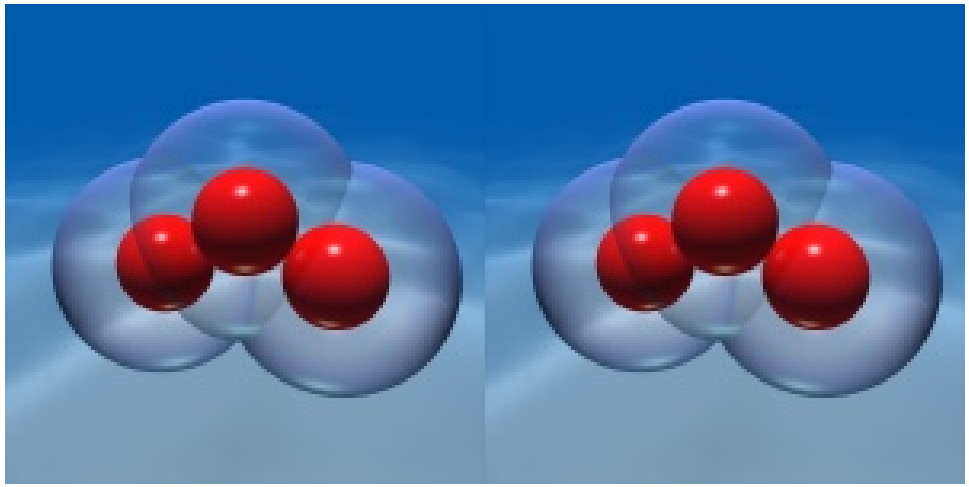
Types of bonds-

- Ionic-Atoms can achieve a stable valence level by losing or gaining electrons, resulting in a positive or negative charge. An ion is an atom or group of atoms that has an electric charge because it has gained or lost electrons. The attractive force between oppositely charged ions is an ionic bond.

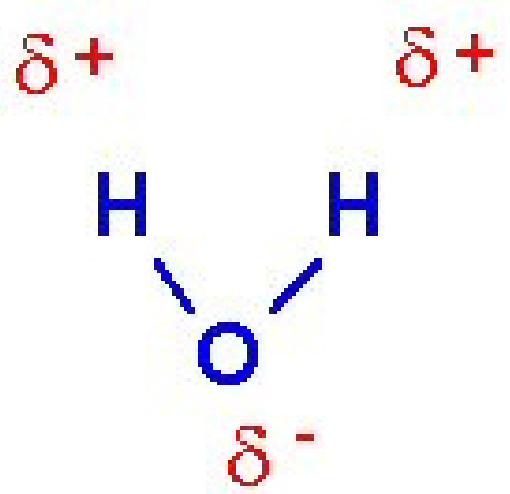


Types of bonds-

- Hydrogen Bonding- when a hydrogen is bound to a highly electronegative atom, there is a slight positive charge on the hydrogen. This makes the molecule POLAR

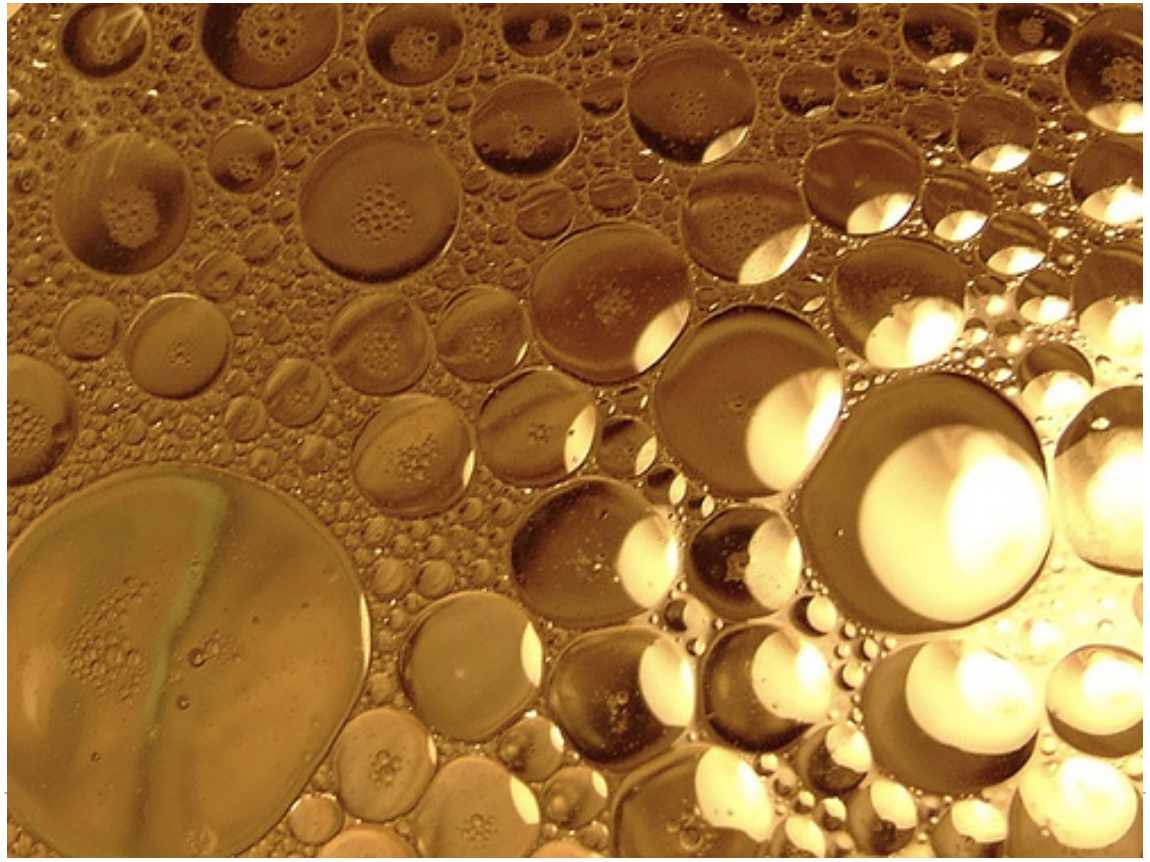


- **POLARITY** – some bonds may have charges that are not distributed equally. Molecules with partial charges on opposite ends are said to be polar



- In some covalent bonds, the shared electrons are attracted more strongly to one atom than to the other. As a result, one end of the molecule has a partial negative charge, while the opposite end has a partial positive charge.
- The partially charged ends of polar molecules attract opposite charges. Because of this behavior, polar molecules can dissolve other polar molecules and ionic compounds.

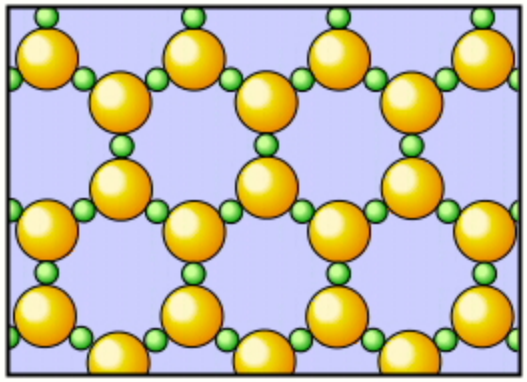
- Nonpolar substances, such as oil, grease, and wax, do not dissolve well in water



- When bonded to an oxygen, nitrogen, or fluorine atom, a hydrogen atom has a partial charge nearly as great as a proton's charge. It attracts the negative pole of other nearby molecules. This attraction, called a **hydrogen bond**, is stronger than attractions between other molecules, but not as strong as covalent bonds.

- **PROPERTIES OF WATER** -Most of the unique properties of water result because water molecules form hydrogen bonds with each other.

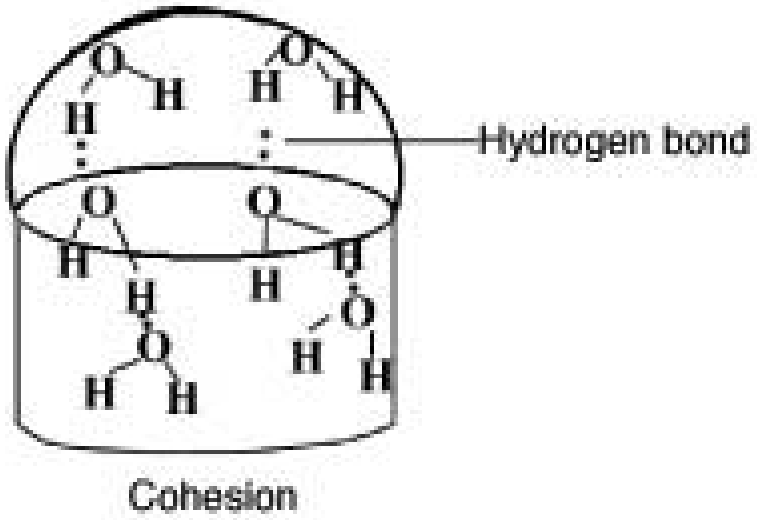
- When water freezes, the crystal structure formed due to hydrogen bonding makes ice less dense than liquid water.
- Water can absorb a large amount of heat without changing temperature. This property can help organisms maintain a constant internal temperature.



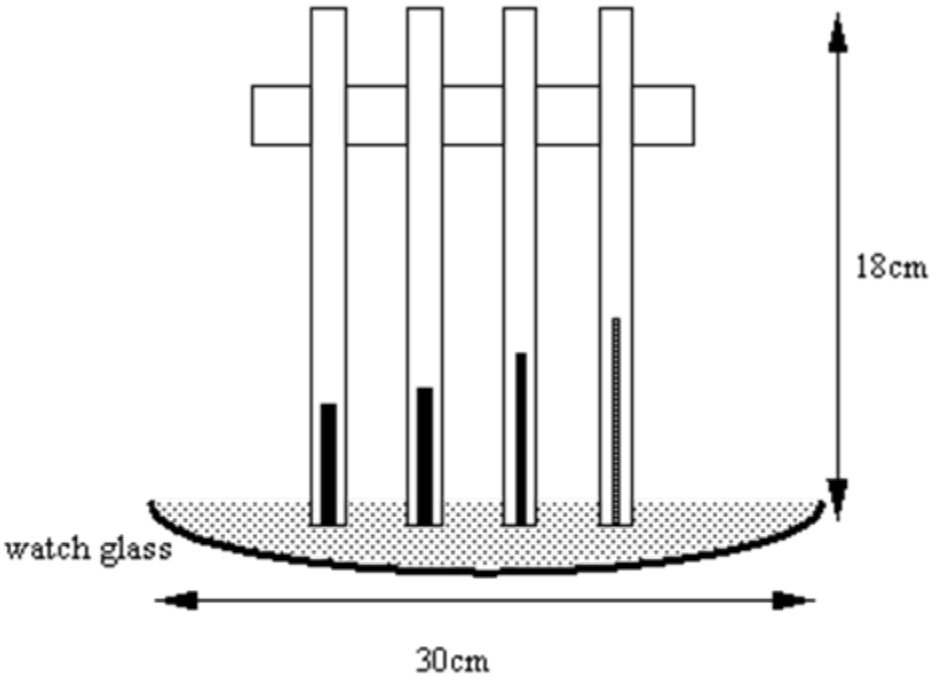
Ordered Molecular Structure of Frozen Water

Cohesion Adhesion

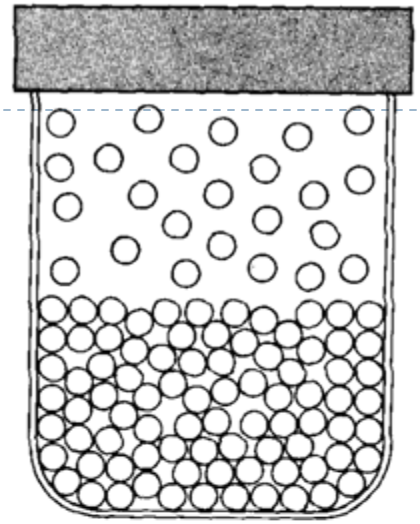
- The attraction of particles of the same substance, such as water, is called **cohesion**. Cohesion keeps water from evaporating easily; thus, water is a liquid at ordinary temperatures.
- .



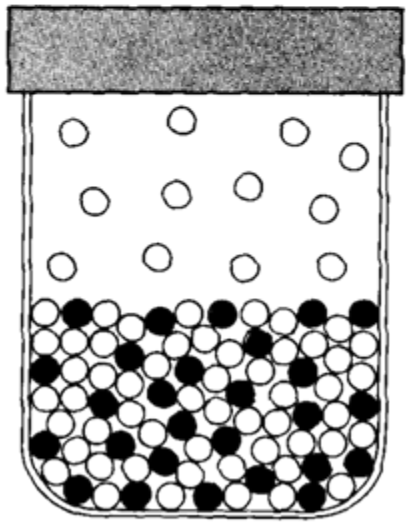
- Water molecules also stick to other polar molecules. This attraction between particles of different substances is called **adhesion**



- **SOLUTIONS** - A solution is a mixture in which ions or molecules of one or more substances are evenly distributed in another substance.

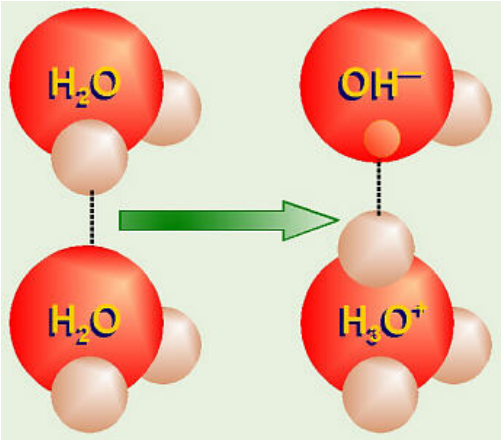


Pure solvent



Solution with a nonvolatile solute

- Many substances are transported throughout living things as solutions of water. Dissolved substances can move more easily within and between cells.
- Some water molecules break apart to form **hydronium**(H+) and **hydroxide**(OH-) ions. In pure water, hydronium and hydroxide ions are present in equal numbers.



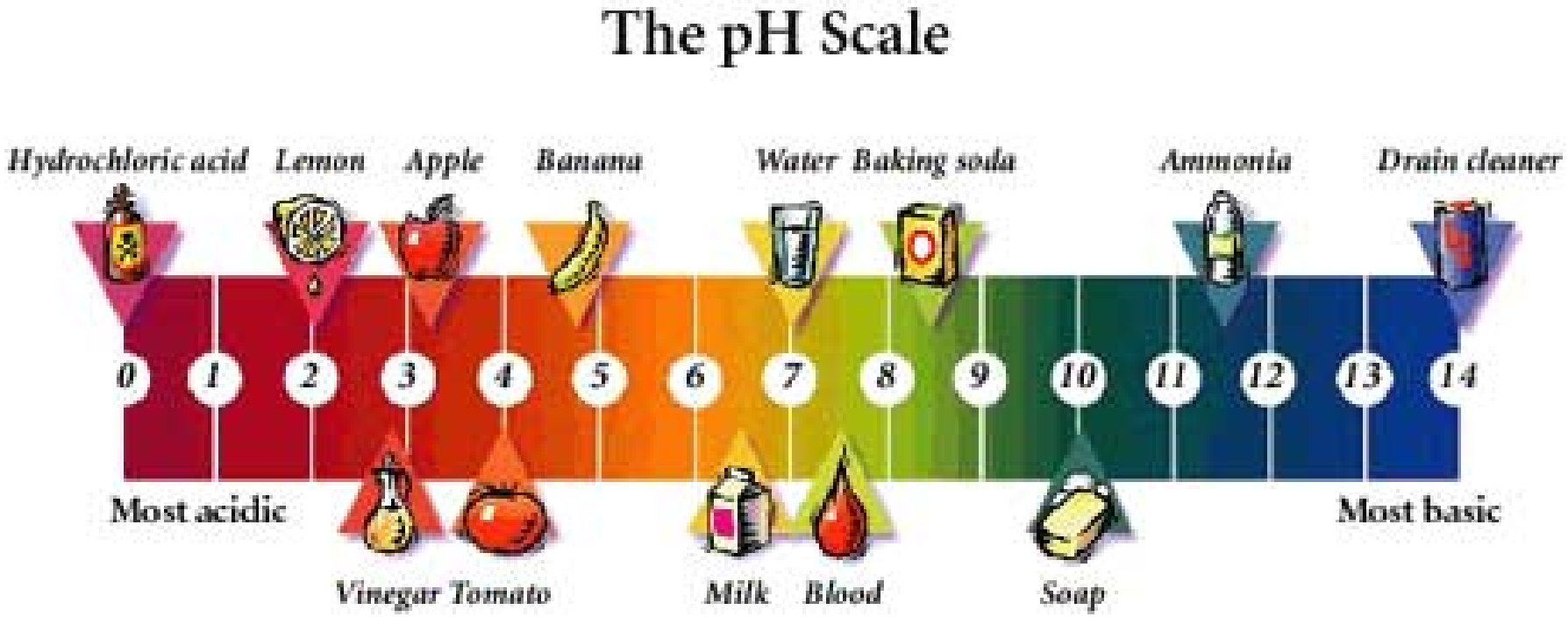
- **ACIDS/BASES**- Acids and bases are compounds that change the balance of these ions.
- Acids are compounds that form extra hydronium(H+) ions when dissolved in water.
- Bases are compounds that form extra hydroxide(OH-) ions when dissolved in water.
- When acids and bases are mixed, the extra hydronium and hydroxide ions react to form water.

pH

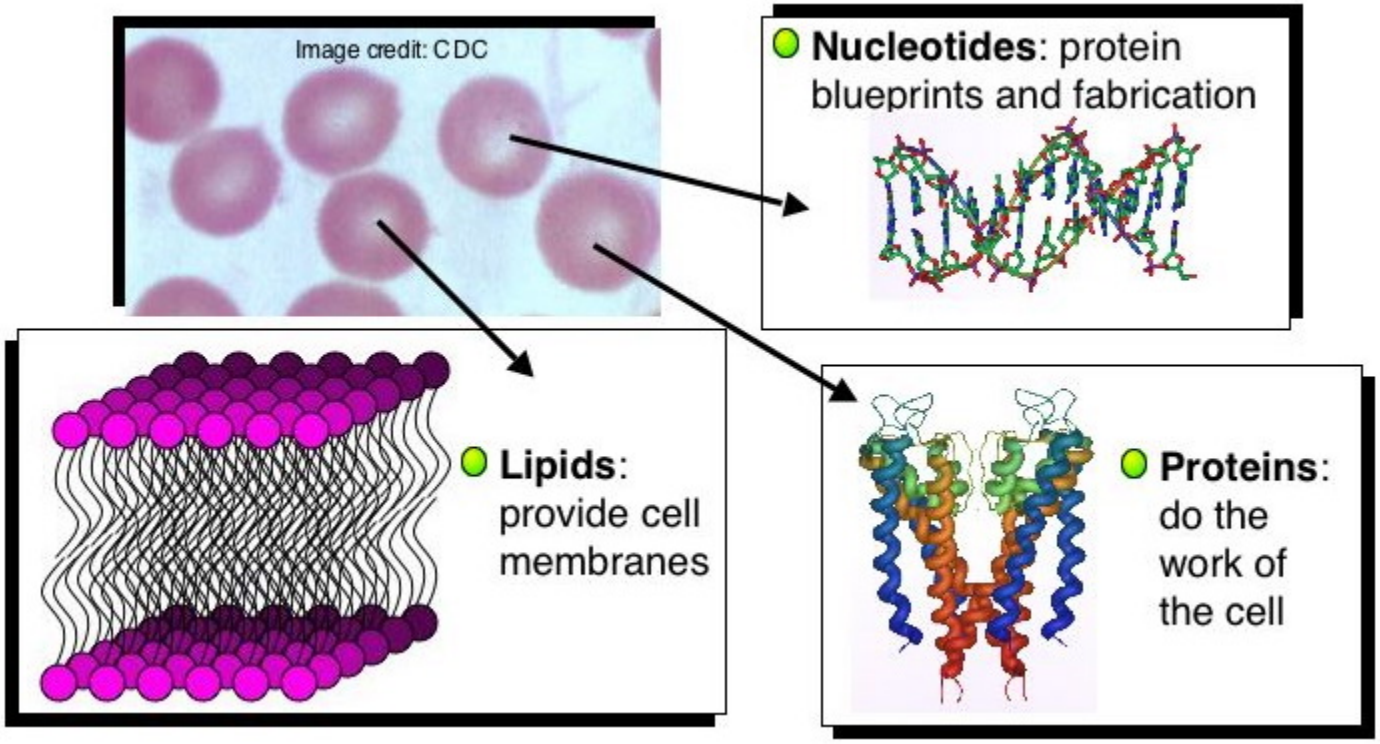
- **pH** is a measure of how acidic or basic a solution is.
- Each one-point increase in pH represents a 10-fold decrease in hydronium ion concentration. (logorathmic scale)
- Pure water has a pH of 7. Acidic solutions have a pH below 7, and basic solutions have a pH above 7.
- The pH of solutions in living things must be stable. For a stable pH to be maintained, the solutions in living things contain buffers.
- A buffer is a substance that reacts to prevent pH changes in a solution.

Acids

Bases

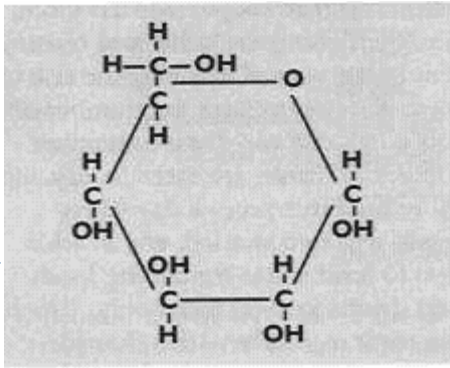

The pH Scale
Hydrochloric acid
Lemon
Apple
Banana
Water
Baking soda
Ammonia
Drain cleaner
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Most acidic
Most basic
Vinegar
Tomato
Milk
Blood
Soap

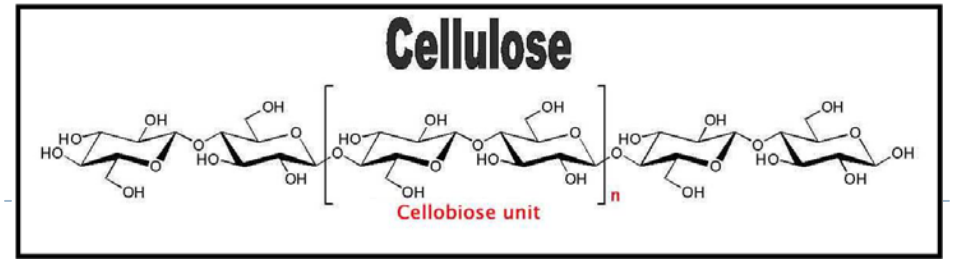
- **BUILDING BLOCKS OF CELLS** – biomolecules contain carbon (also called organic). They include carbohydrates, proteins, lipids and nucleic acids



Carbohydrates

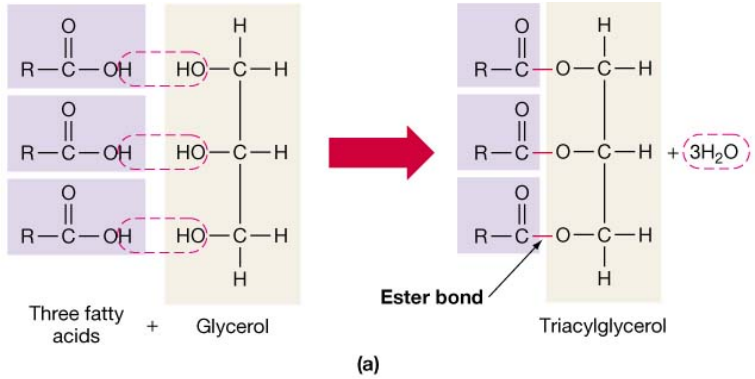
- **CARBOHYDRATES** - Carbohydrates are molecules made of sugars. A sugar contains carbon, hydrogen, and oxygen in a ratio of 1:2:1.
- Carbohydrates are a major source of energy
- Chitin and cellulose are complex carbohydrates that provide support.
- Chitin is found in the shells of insects and the cell walls of mushrooms.
- Cellulose is found in the cell walls of plants.



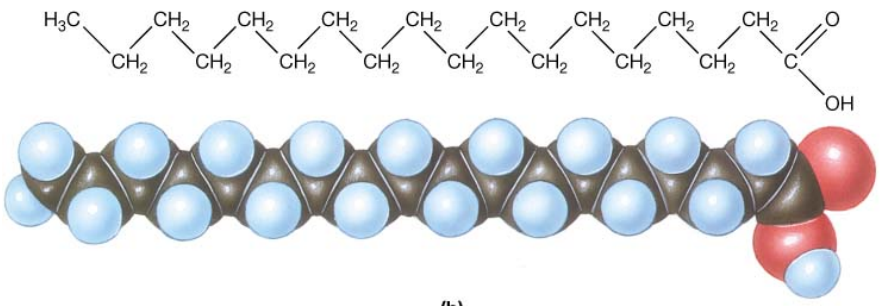


Lipids

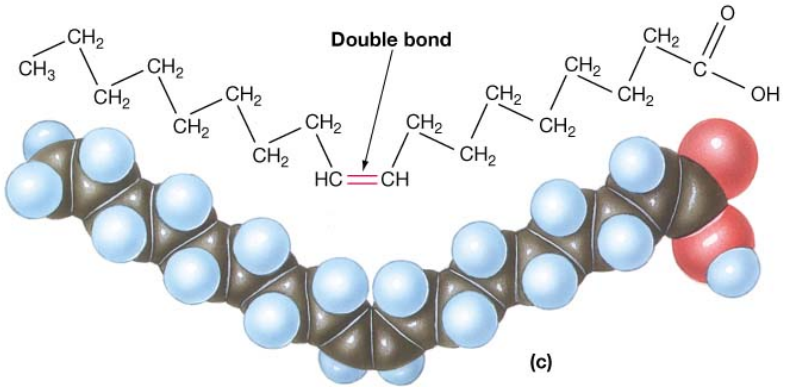
- **LIPIDS** - Lipids are another class of biomolecules, which includes fats, phospholipids, steroids, and waxes.
- Lipids consist of chains of carbon atoms bonded to each other and to hydrogen atoms. This structure makes lipids repel water.
- The main purpose of fats is to store energy. Fats can store energy even more efficiently than carbohydrates.
- The cell's boundary(cell membrane) is made of phospholipids. The structure of cell membranes depends on how this molecule interacts with water.


Three fatty acids
+
Glycerol
Ester bond
Triacylglycerol
+ 3H2O

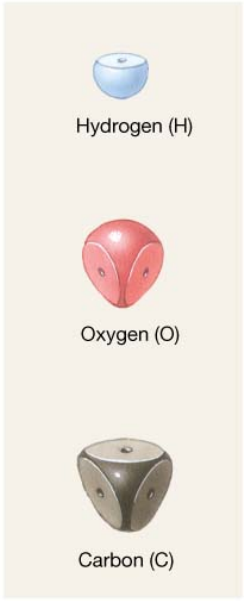
(a)



(b)

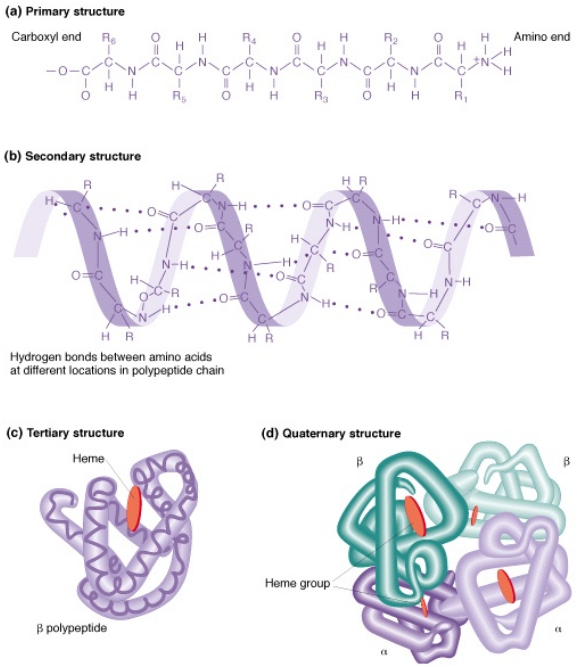

Double bond

(c)

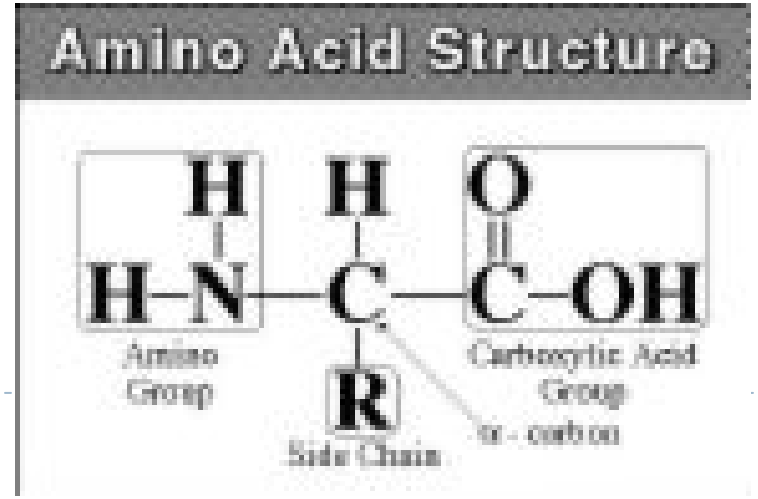

Hydrogen (H)
Oxygen (O)
Carbon (C)

Proteins

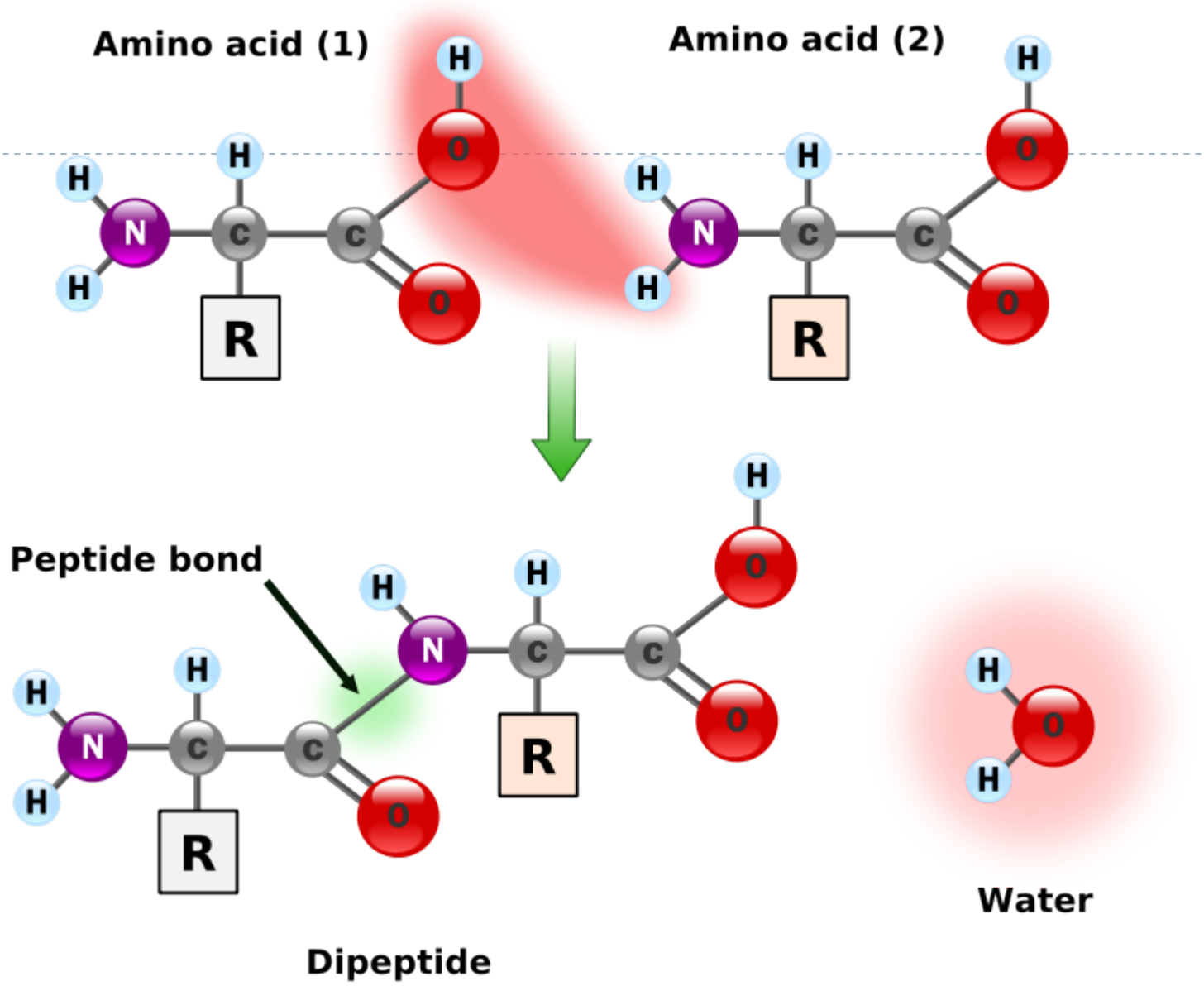
- **PROTEINS** -Proteins are chains of amino acids that twist and fold into certain shapes that determine what the proteins do. Proteins may be involved in structure, support, movement, communication, transportation, and carrying out chemical reactions.



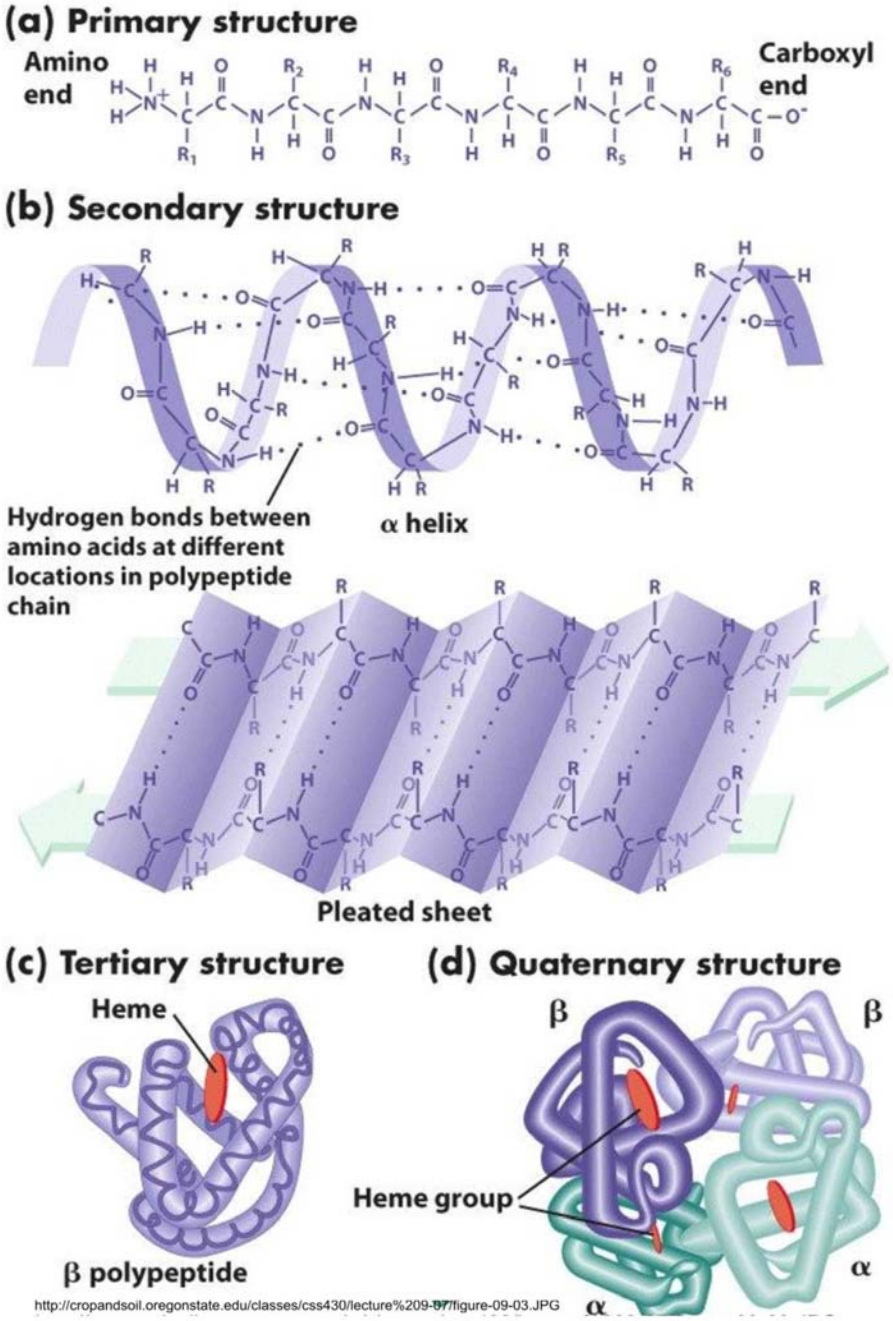
- A protein is a molecule made up of amino acids, building blocks that link to form proteins.
- Every amino acid has an amino group and a carboxyl group. Units of amino acids can form links called peptide bonds.
- The side group gives an amino acid its unique properties. Twenty different amino acids are found in proteins.



- For each type of protein, there are different levels of structure
- amino acids are arranged in a specific order, the protein's primary structure. 1
- The interactions of the various side groups may form coils and folds, the protein's secondary structure. 2
- The overall shape of a single chain of amino acids is the protein's tertiary structure. 3
- The quaternary structure is the overall shape that results from combining the chains to form proteins. 4


Amino acid (1)
Amino acid (2)
Peptide bond
Dipeptide
Water

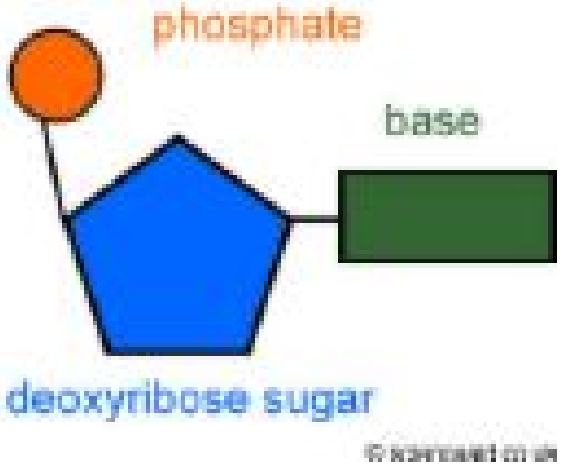
The 4 levels of protein structure



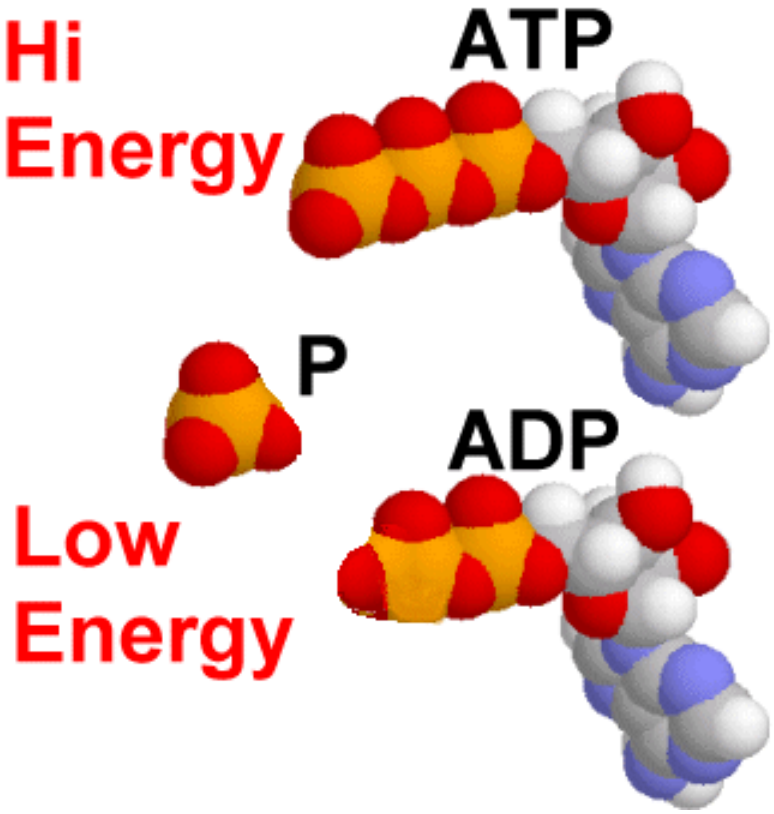
http://cropandsoil.oregonstate.edu/classes/css430/lecture%209-97/figure-09-03.JPG

Nucleic Acids

- **NUCLEIC ACIDS** - A nucleic acid is a long chain of nucleotide units. A nucleotide is a molecule made up of three parts: a sugar, a base, and a phosphate group.



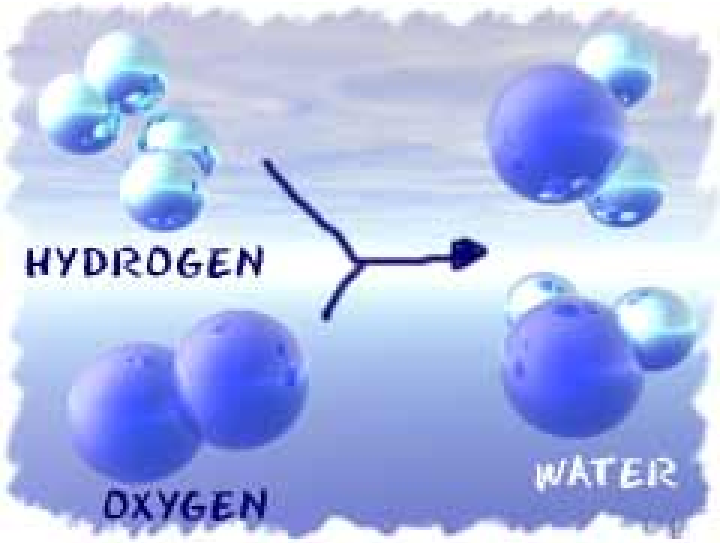
- Nucleotides of deoxyribonucleic acid, or DNA, contain the sugar deoxyribose. DNA molecules act as "instructions" for the processes of an organism's life
- Nucleotides of ribonucleic acid, or RNA, contain the sugar ribose. RNA also interacts with DNA to help decode the information.
- Adenosine triphosphate, or ATP, is a nucleotide that has three phosphate groups and supplies energy to cells. Energy is released in the reaction that breaks off the third phosphate group.


Hi
Energy
ATP
P
ADP
Low
Energy

CHANGING MATTER

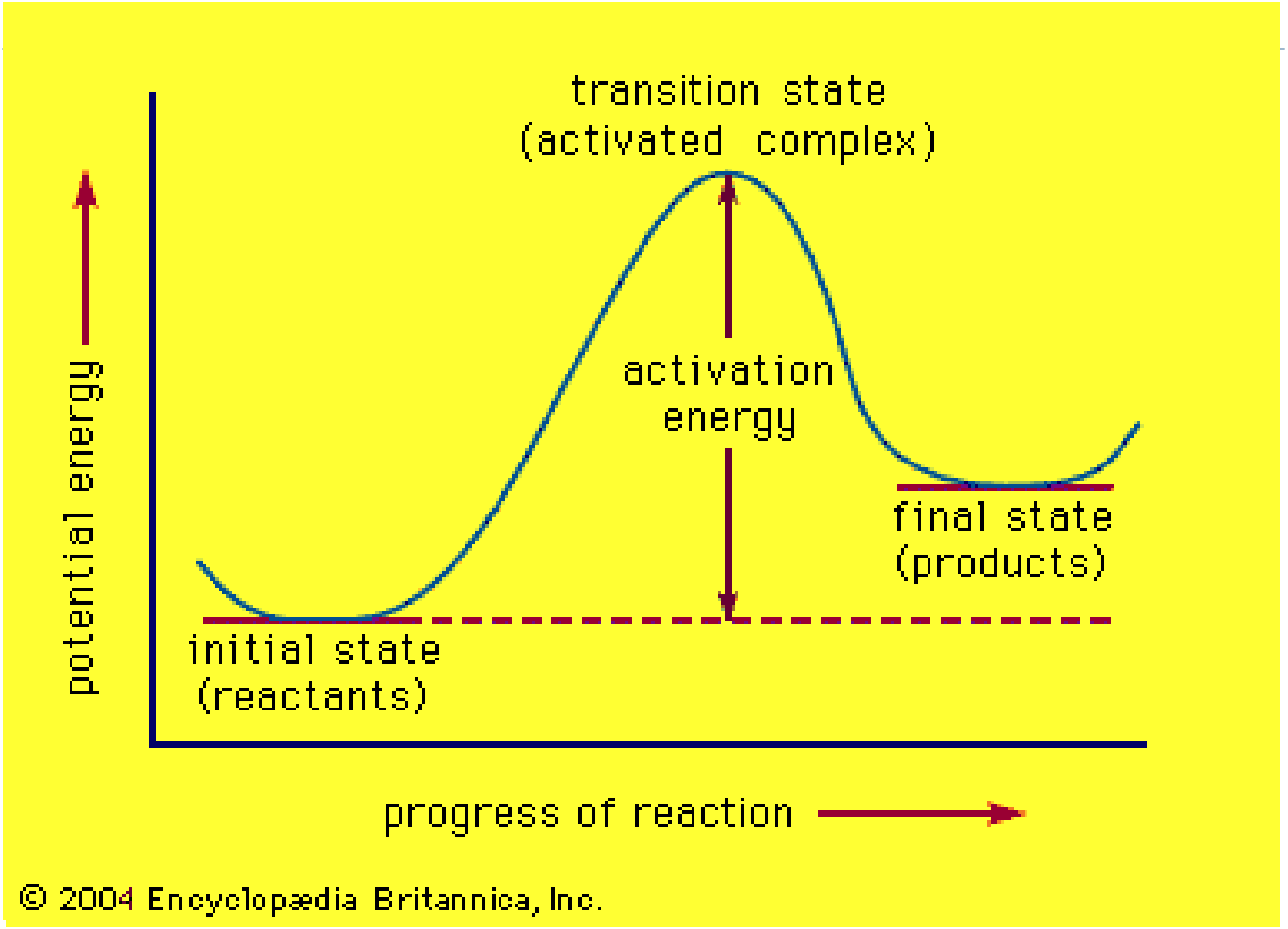
- A physical change occurs when only the form or shape of the matter changes.
- A chemical change occurs when a substance changes into a different substance.
- Matter is neither created nor destroyed in any change. This observation is called the *law of conservation of mass.* Every change in matter requires a change in energy.
- Energy may change from one form to another, but the total amount of energy does not change. This observation is called the *law of conservation of energy.*

- **CHEMICAL REACTIONS** -Chemical reactions can only occur when the activation energy is available and the correct atoms are aligned.



Activation energy

- Changing a substance requires a chemical reaction. During this process, bonds between atoms are broken, and new ones are formed.
- A **reactant** is a substance that is changed in a chemical reaction.
- A **product** is a new substance that is formed.
- Chemical reactions can only occur under the right conditions. The **activation energy** of a reaction is the minimum kinetic energy required to start a chemical reaction. Even if enough energy is available, the product still may not form. The correct atoms must be brought together in the proper orientation.


transition state
(activated complex)
activation
energy
final state
(products)
initial state
(reactants)
potential energy
progress of reaction
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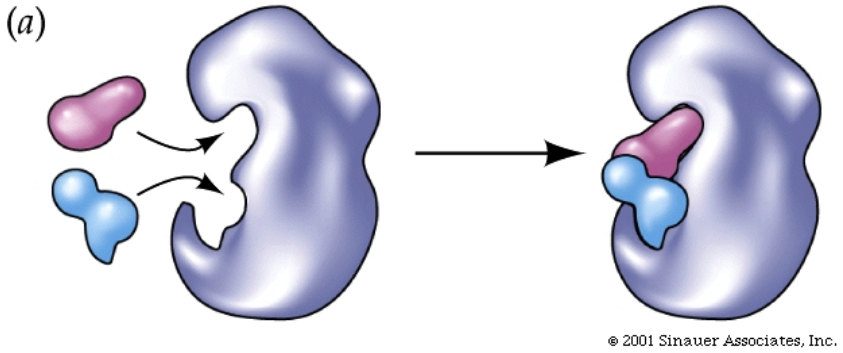
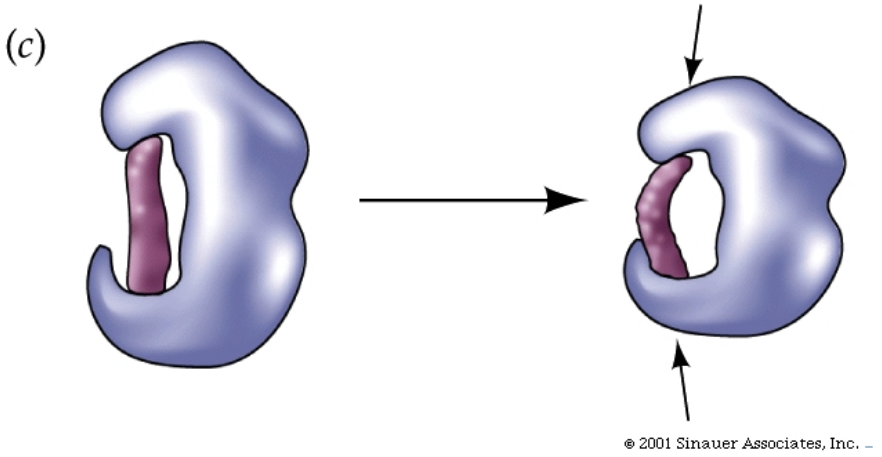
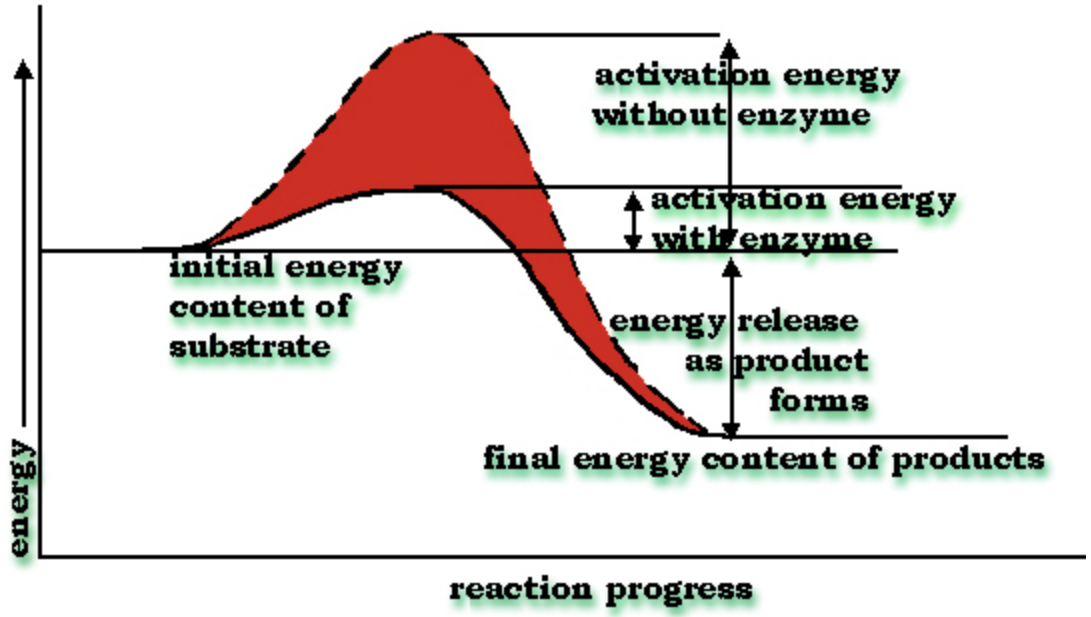
- **BIOLOGICAL REACTIONS** - By assisting in necessary biochemical reactions, enzymes help organisms maintain homeostasis.



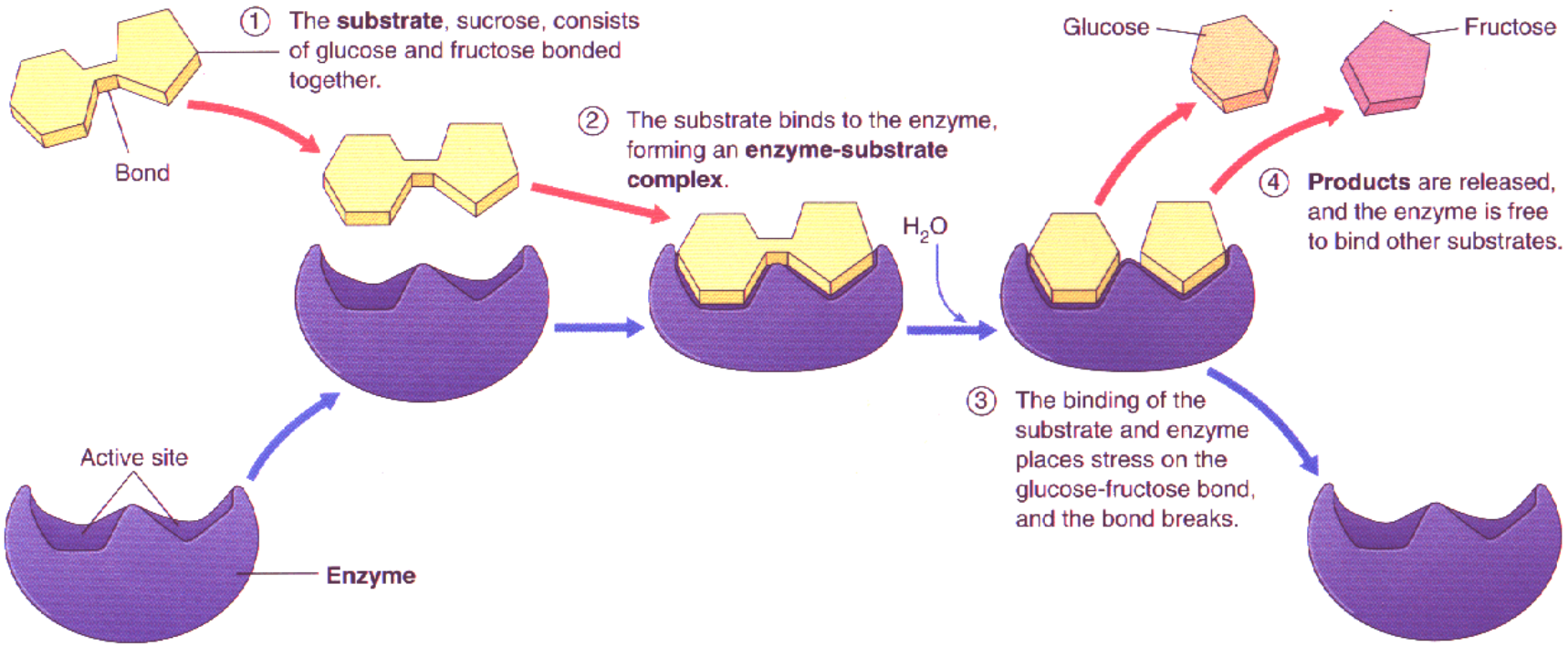


Enzymes

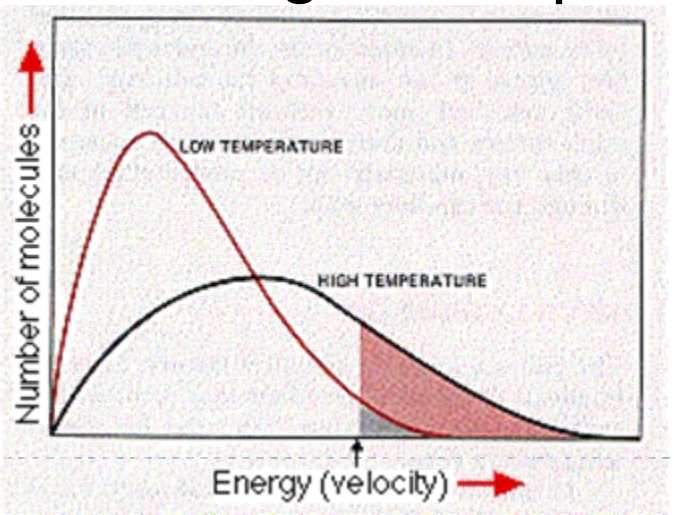
- In living things, chemical reactions occur between large, complex biomolecules. Many of these reactions require large activation energies.

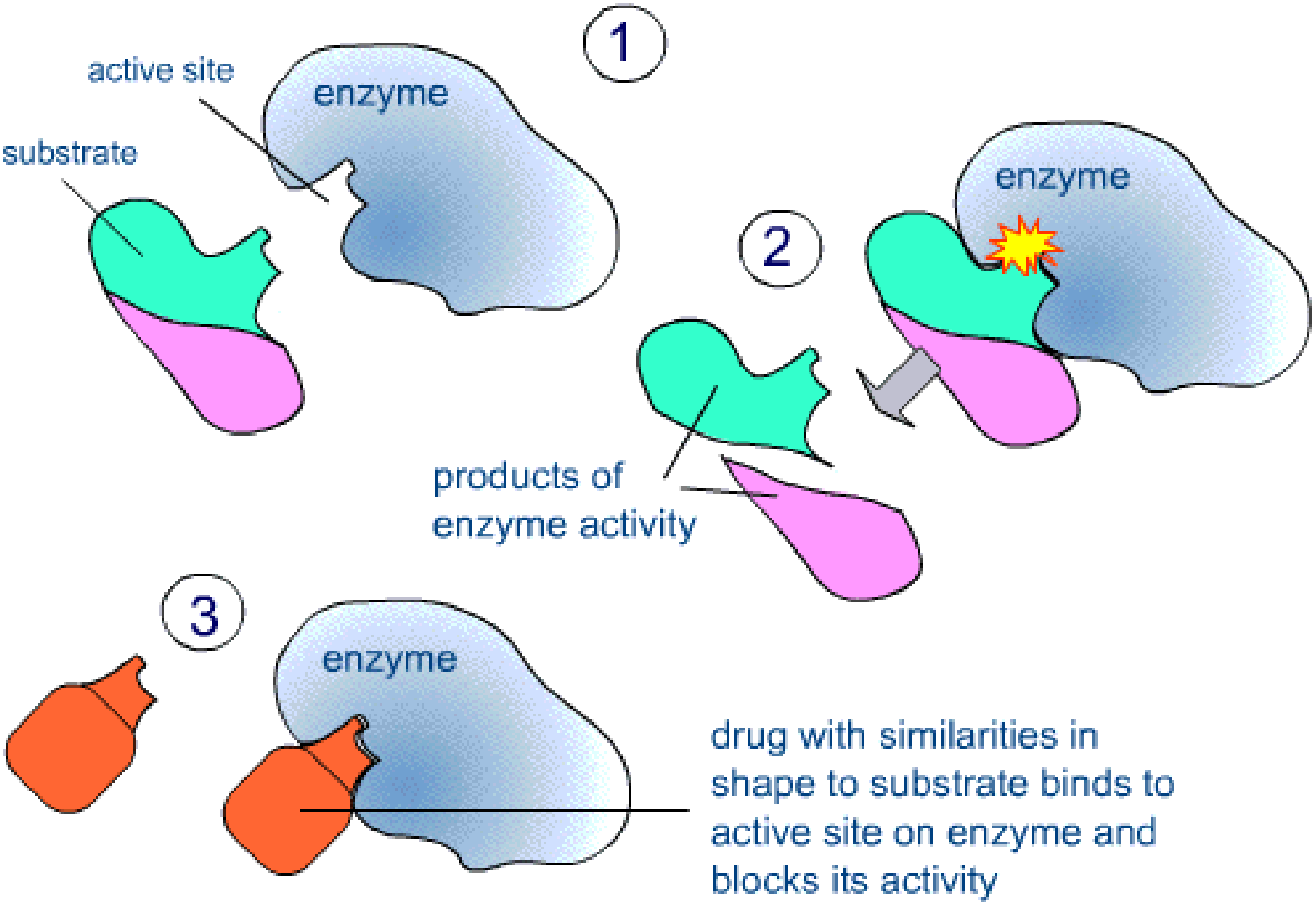


- An enzyme is a molecule that increases the speed of biochemical reactions.
- Enzymes hold molecules close together and in the correct orientation. An enzyme lowers the activation energy of a reaction.
- Each enzyme has an active site, the region where the reaction takes place.


① The **substrate**, sucrose, consists of glucose and fructose bonded together.
Bond
② The substrate binds to the enzyme, forming an **enzyme-substrate complex**.
H_2O
Glucose
Fructose
④ **Products** are released, and the enzyme is free to bind other substrates.
③ The binding of the substrate and enzyme places stress on the glucose-fructose bond, and the bond breaks.
Active site
Enzyme

- The shape of the active site determines which reactants, or substrates, will bind to it. Each different enzyme acts only on specific substrates.
- Binding of the substrates causes the enzyme's shape to change. This change causes some bonds in the substrates to break and new bonds to form.
- Most enzymes need a certain range of temperatures and pH.




1
active site
enzyme
substrate
2
enzyme
products of
enzyme activity
3
enzyme
drug with similarities in
shape to substrate binds to
active site on enzyme and
blocks its activity

Bellringer

- Describe what happens to an electron in :
  - A non-polar covalent bond
  - A polar covalent bond
  - An ionic bond
  - A hydrogen bond

Non polar covalent= e- shared equally

Polar covalent= e- pulled closer to one, giving "stronger atom" a partial negative charge

Ionic- one atom takes e-, giving it a full negative charge

Hydrogen bond- the polar covalent bonds of water cause partial negative and positive charges to attract each other

Homework for 10/26

- Read and understand Cabbage Lab on packet pages 66-68
- Complete review sheet
- Test on Chapter 3 Wednesday 10/28