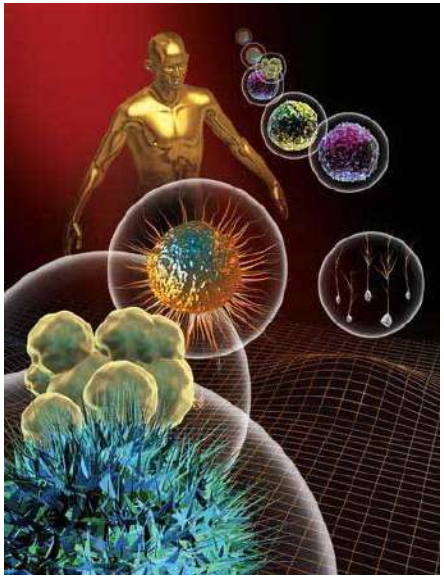
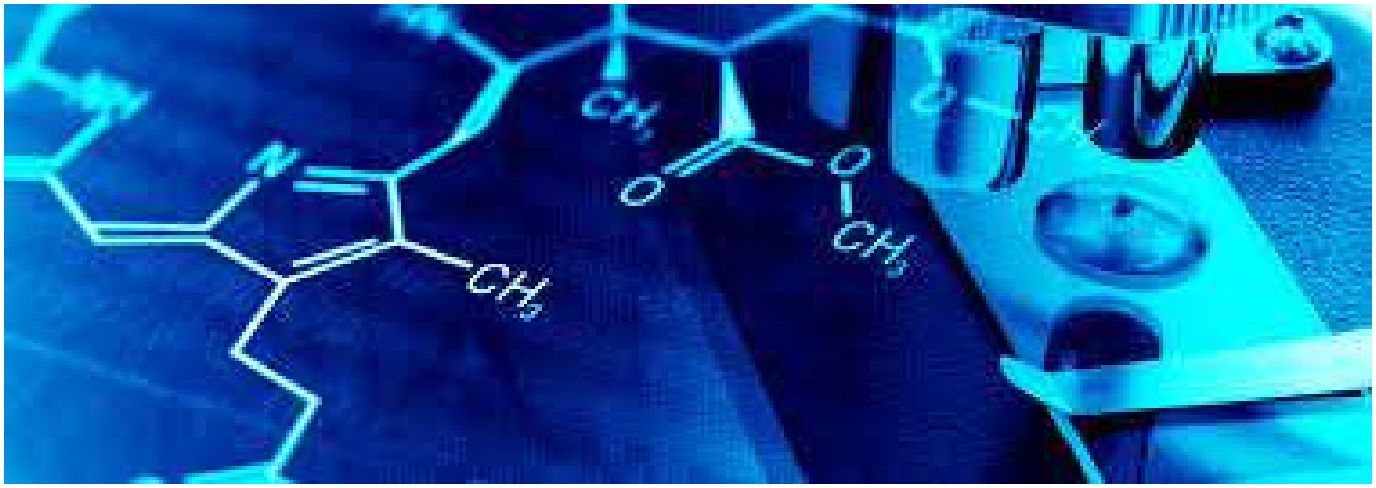
Biochemistry Vocabulary: pg. 28

1. Atom9. Protein
2. Element
3. Compound
4. Molecule10. Amino Acid
5. Ion
6. Solution
7. Acid
8. Base





Biochemistry

"**Bio**": Life
"**Chem**": Chemicals

The Chemistry of Life

Why should we study chemistry in

Biology?

Life depends on chemistry!

https://www.youtube.com/watch?v=tpBAmzQ_pUE

Life depends on chemistry!

When you eat food or inhale oxygen, your body uses these materials in chemical reactions that keep you alive.
Just as buildings are made from bricks, steel, glass, and wood, living things are made from chemical compounds.

Wouldn't you want an architect to understand building materials? Same idea applies to geneticists, ecologists, zoologists, botanists, biologists, and etc.

Water and its Properties!!

https://www.youtube.com/watch?v=aVmU3CLxvgU

WATER: (INORGANIC) MOLECULES

Water is essential (needed) for all living things. It lets cells maintain homeostasis (happy levels).

ABOUT WATER…

- Earth is ¾ water
- Organisms are 50-90 percent water
- Usually remains liquid in normal temperature ranges.
- Slow to heat
- Exhibit cohesion and adhesi
- It's solvent

BONDING & WATER

- ***BONDING*** *is the attraction of positive and negative charges in atoms to form molecules.*

EX: H^+ *=positive charge*

O^{-2} *= negative charge*

H_2O *= molecule; H & O are atoms*

- *Water is a* ***polar*** *molecule.*
- *A* ***polar molecule has a (-) & a (+) end.***

Polarity: *allows for cohesion and adhesion*

Properties of Water:

1. Cohesion

1a. Surface Tension

2. Adhesion

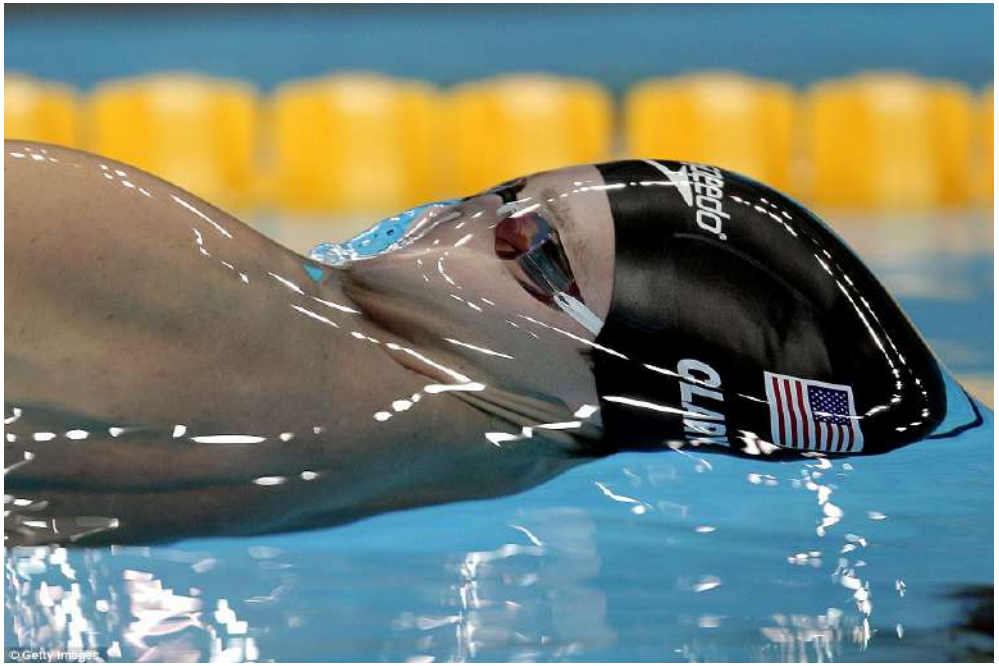
2a. Capillary Action

Cohesion – An attraction between molecules of the same substance.

- *Cohesion is the reason why water forms beads on a smooth surface.*

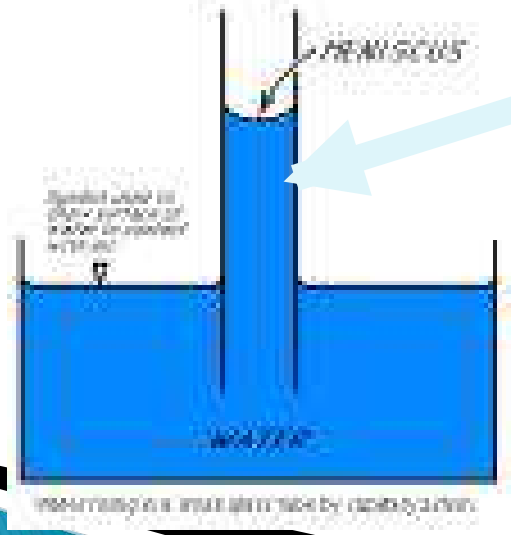
1a. Surface Tension

- The attraction between water molecules that allows it to resist an external force.

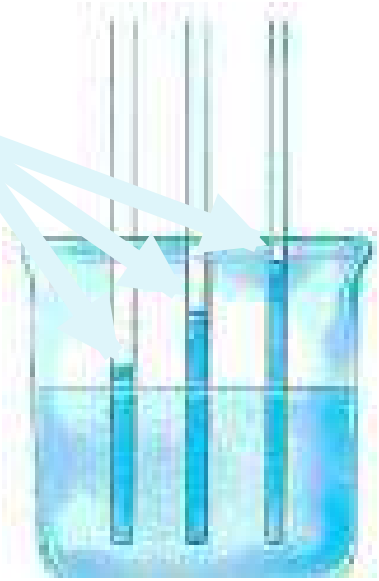


2. Adhesion: an attraction between different substances.

- Adhesion powers a process called *capillary action*
- 2a. Capillary Action: in which water molecules move upward through a narrow tube, such as the stem of a plant.



Capillary Action



Penny Lab!

Properties of Water Pop Quiz!!

Please take out a sheet of paper and put your first name, last name, date and period in the TOP RIGHT hand corner

Title your paper Properties of Water Pop Quiz!!

Make sure to answer all questions in **COMPLETE SENTENCES**!!!

Please skip lines between each answer

Good luck!!

Properties of Water Pop Quiz!!

1. Describe how cohesion is different from adhesion

2. Explain what surface tension is

3. List the (3) states of matter water can be found in

4. Describe how evaporation occurs

5. What does it mean for water to be a polar molecule? (think magnets!!)

6. Give (4) specific examples of how biochemistry relates to you

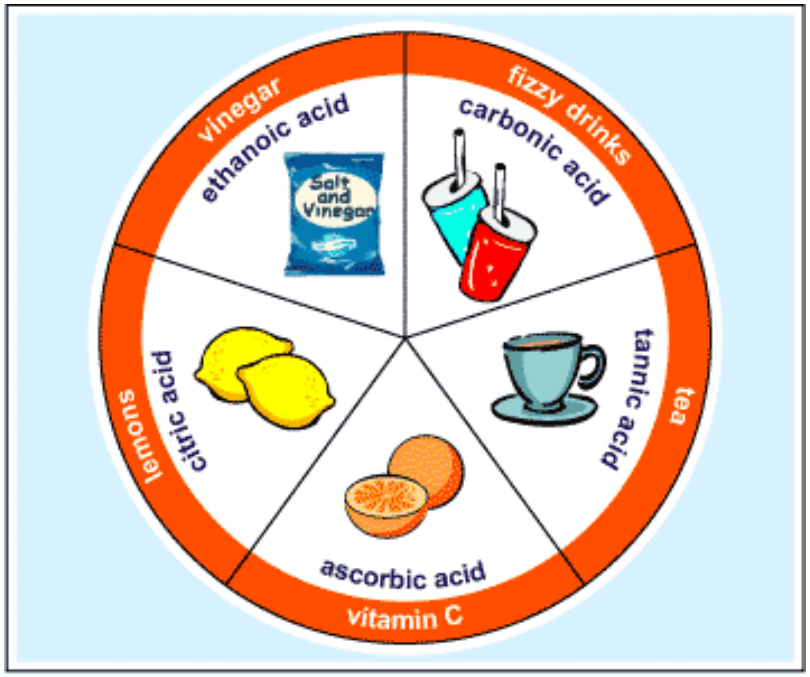
Acids & Bases

What's the difference???

What is an acid?

- An acid is a solution that *has an excess of H+ ions.* It comes from the Latin word acidus that means "sharp" or "sour".
- The more H + ions, the more acidic the solution.

Properties of an Acid



- Tastes Sour
- Conduct Electricity
- Corrosive, which means they break down certain substances. Many acids can corrode fabric, skin,and paper
- Some acids react strongly with metals
- Turns blue litmus paper red

Picture from BBC Revision Bites
http://www.bbc.co.uk/schools/ks3bitesize/science/chemistry/acids_bases_1.shtml

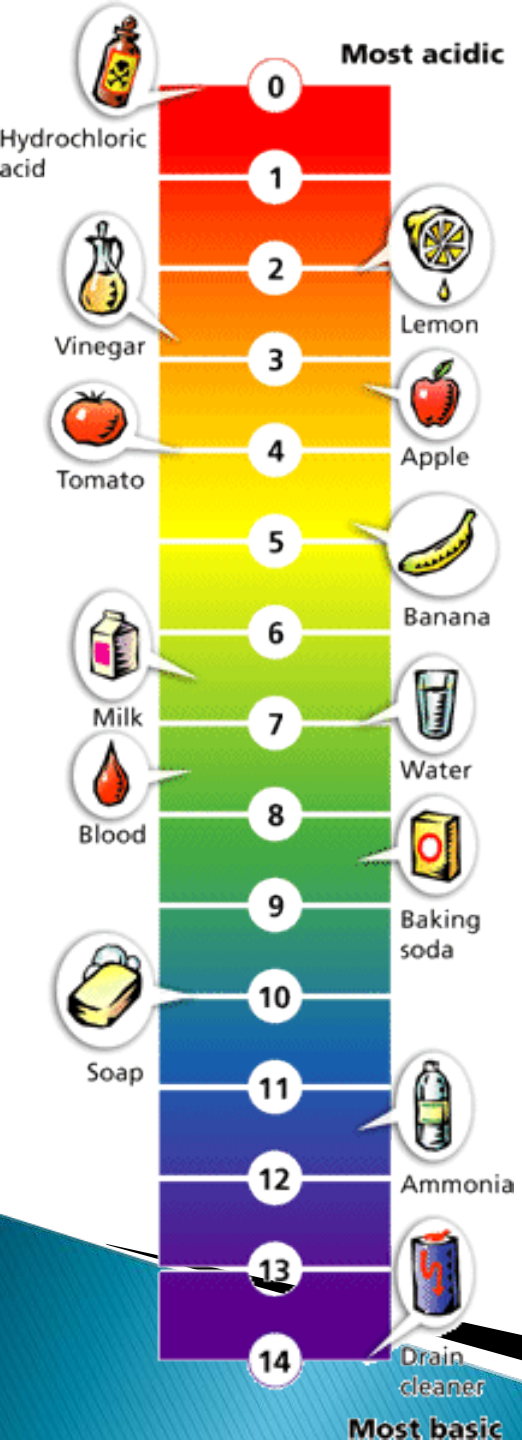
What is a base?

- A base is a solution that has an excess of OH- ions.
- Another word for base is alkali.
- **Bases** are substances that can accept hydrogen ions

Properties of a Base

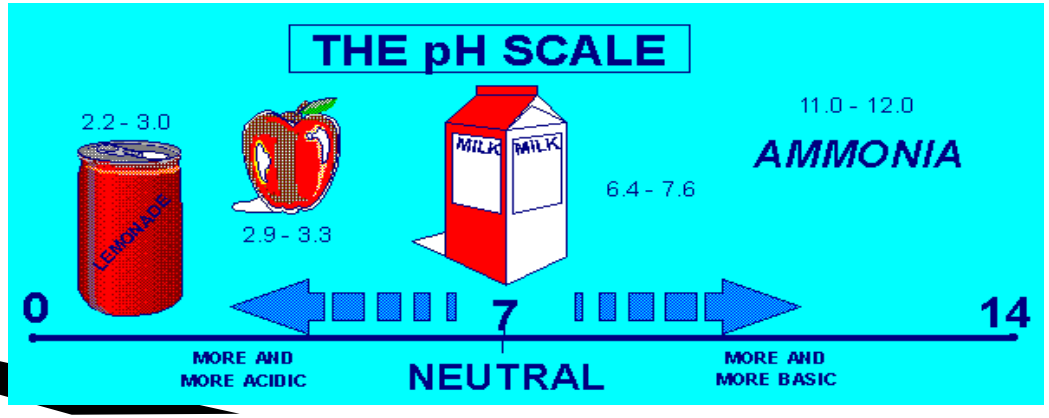
Bases

- Feel Slippery
- Taste Bitter
- Corrosive
- Can conduct electricity. (Think alkaline batteries.)
- Do not react with metals.
- Turns red litmus paper blue.



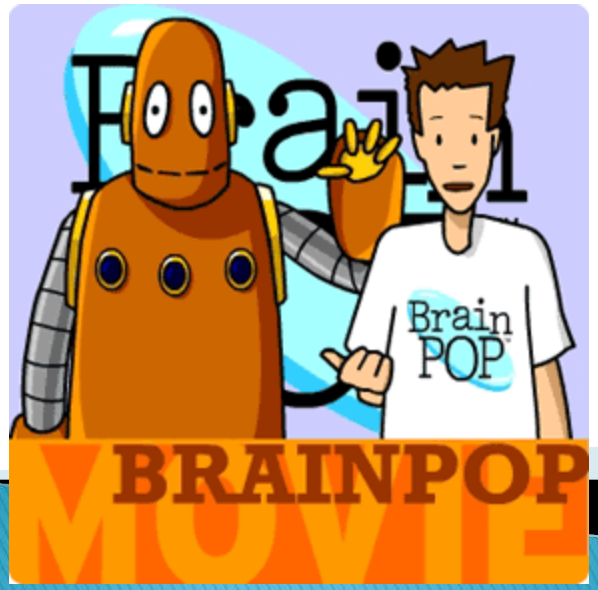
pH Scale
pH = Potential Hydrogen

- pH is a measure of how acidic or basic a solution is.
- The pH scale ranges from 0 to 14.
- Acidic solutions have pH values below 7
- A solution with a pH of 0 is very acidic.
- A solution with a pH of 7 is neutral / homeostasis.
- Pure water has a pH of 7.
- Basic solutions have pH values above 7.



BrainPop! Acids & Base

http://www.brainpop.com/science/matterandchemistry/acidsandbases/



Biochemistry!!

Tuesday 8/25/2015

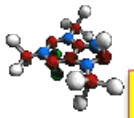
- **AGENDA**
- **Notes**: What is Biochemistry, Levels of Organization and the Atom
- **Video**: Bill Nye "Atoms" with Worksheet

- **Homework/Assignments**
- No Homework!!

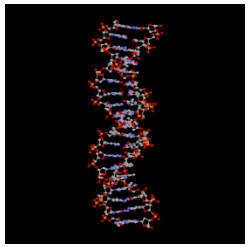
KEEP CALM AND STUDY BIOCHEMISTRY

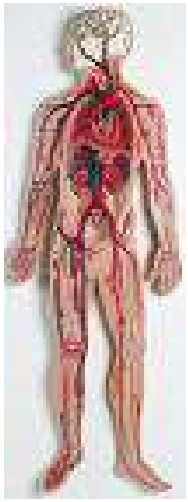
Levels of organization

smallest to LARGEST



1. Atom (oxygen)
2. Molecule (amino acid)
3. Macromolecule (DNA)
4. Organelle (Nucleus)
5. Cell (Nerve Cell)
6. Tissue (Muscle)
7. Organ (heart)
8. Organ system (circulatory system)
9. Organism (human)



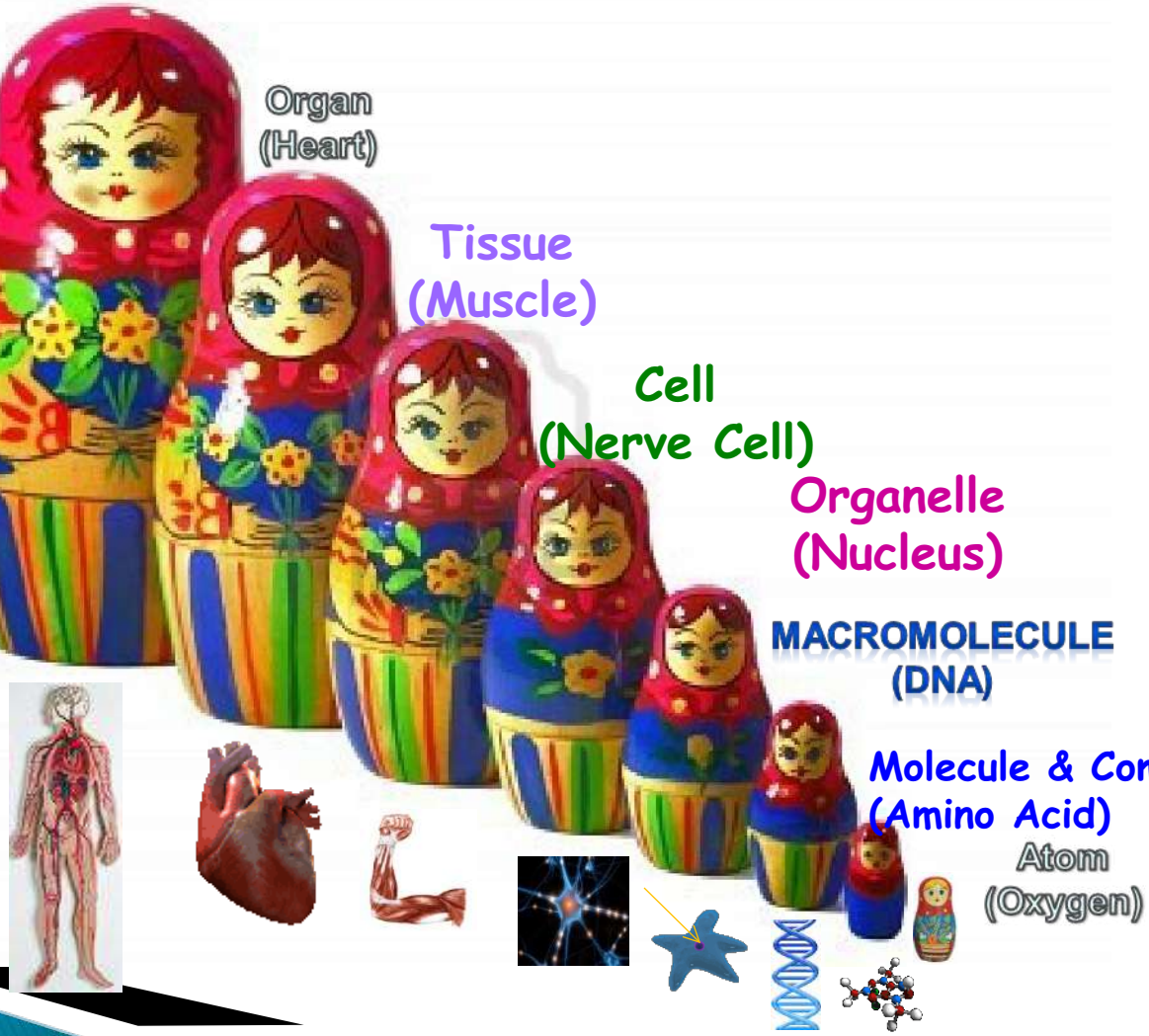


http://www.coldwater.k12.mi.us/nicholsk/courses/chs/ana/levelorg.htm

Levels of Organization of Life

Organism
(You & me)

Organ System
(Circulatory System)



Levels of Organization: ANALOGY

In your science notebook!

Think of a "Levels of Organization" analogy in our everyday life

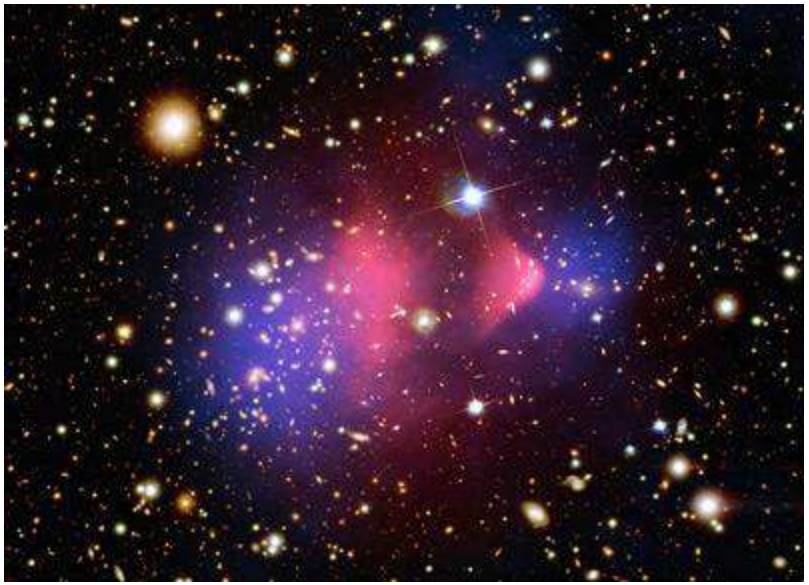
Organize your analogy from smallest to LARGEST! *9 levels*

Example: SCHOOLS

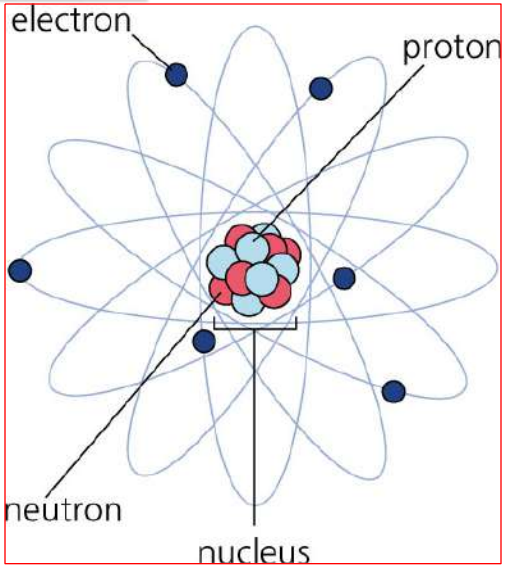
Student, class, teacher, faculty, administration, Chandler High School, Chandler School District, Arizona schools, U.S schools

Matter vs. Energy

- **Matter**—anything that occupies *space* & has *mass* (weight)
- **Energy**—the ability to do *work*
  - Chemical
  - Electrical
  - Mechanical
  - Radiant



Composition of Matter



- Atoms—building blocks of elements

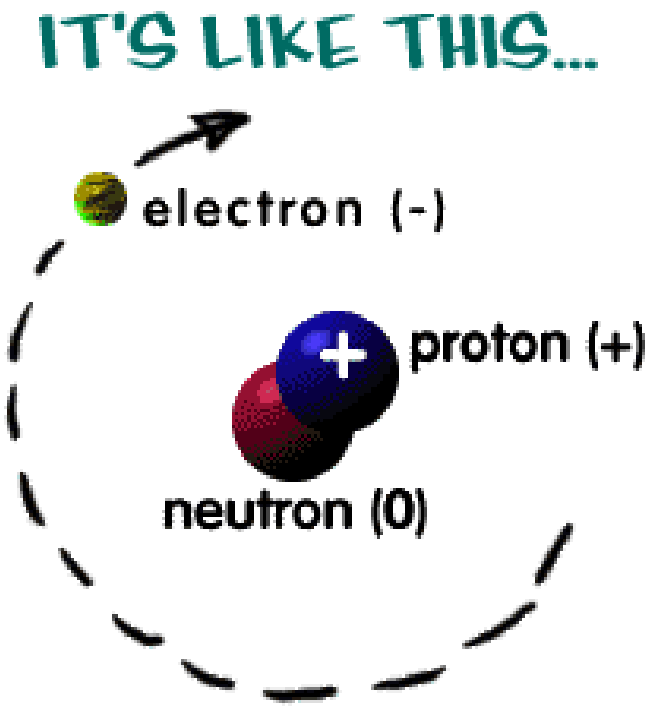
- Elements—fundamental units of matter
  - 96% of human body is made from 4 elements
    - Carbon (C)
    - Oxygen (O)
    - Hydrogen (H)
    - Nitrogen (N)

Atoms

The study of chemistry begins with the basic unit of matter…the ATOM!!

Atoms are composed of 3 main particles: (subatomic particles)

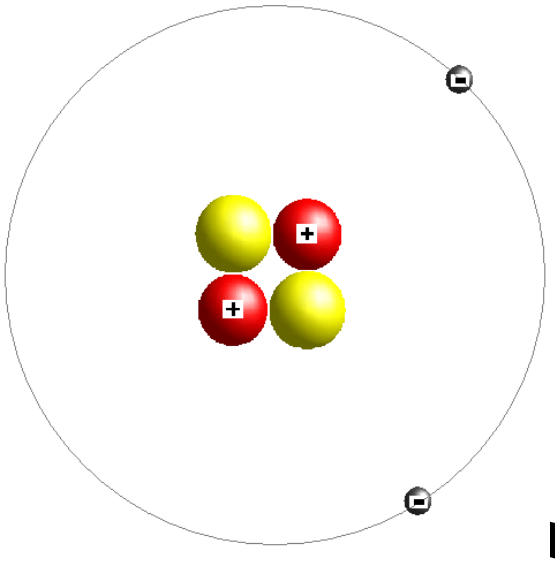
Protons (+)
Neutrons
Electrons (-)



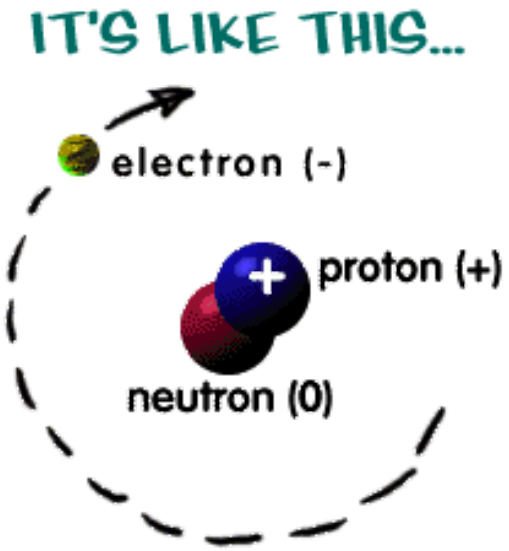
Protons and Neutrons

Strong forces bind **protons and neutrons** together to form the **nucleus**, which is at the center of the atom.

Both particles have about the same mass.



Helium atom



Electrons

Electrons are negatively charged with about 1/1840 the mass of a proton.

(Smaller than protons and neutrons)

They are in constant motion in the space surrounding the nucleus.

Atoms

Atoms have equal numbers of electrons and protons.

Because these subatomic particles have equal but opposite charges, atoms are neutral.

Bill Nye: ATOMS ☺

- http://www.schooltube.com/video/52bb23430c9c4e0ebb74/Bill%20Nye%20-%20Atoms

Molecules & Compounds

- **Molecule**—2 or more *like* atoms combined chemically
  - Example: O_2 (Oxygen)
  - **Macromolecule**—very large molecule
    - Example: DNA
- **Compound**—2 or more *different* atoms combined chemically
  - Example: H_2O (Water)

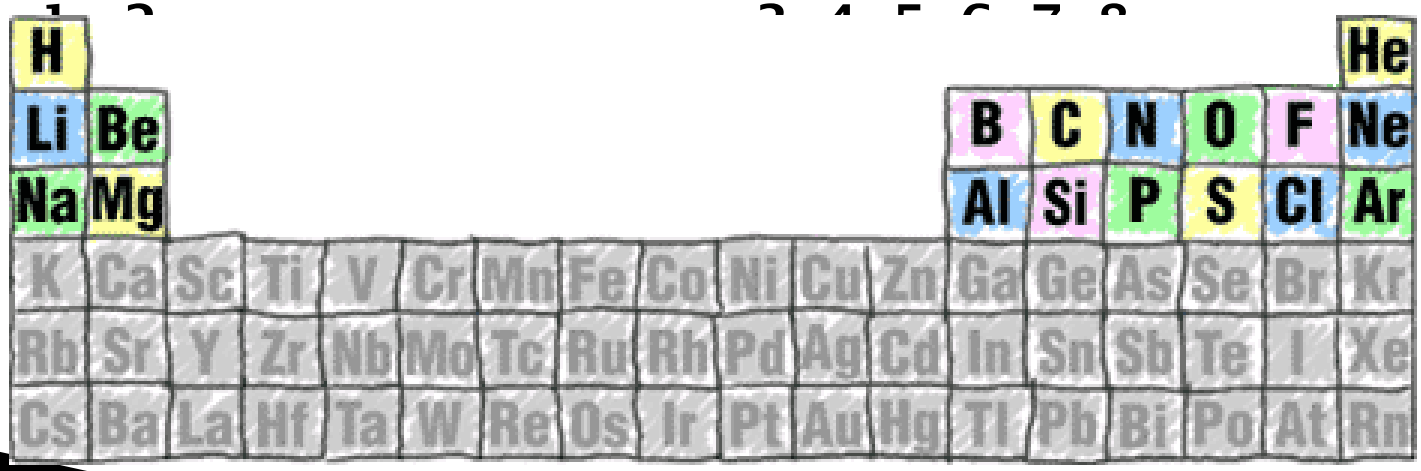
Sodium (silvery metal) | Chlorine (poisonous gas) | Sodium chloride (table salt)

Figure 2.4

Elements

Elements are the building blocks of all matter.
Elements cannot be decomposed into simpler matter.
Elements are made up of compounds

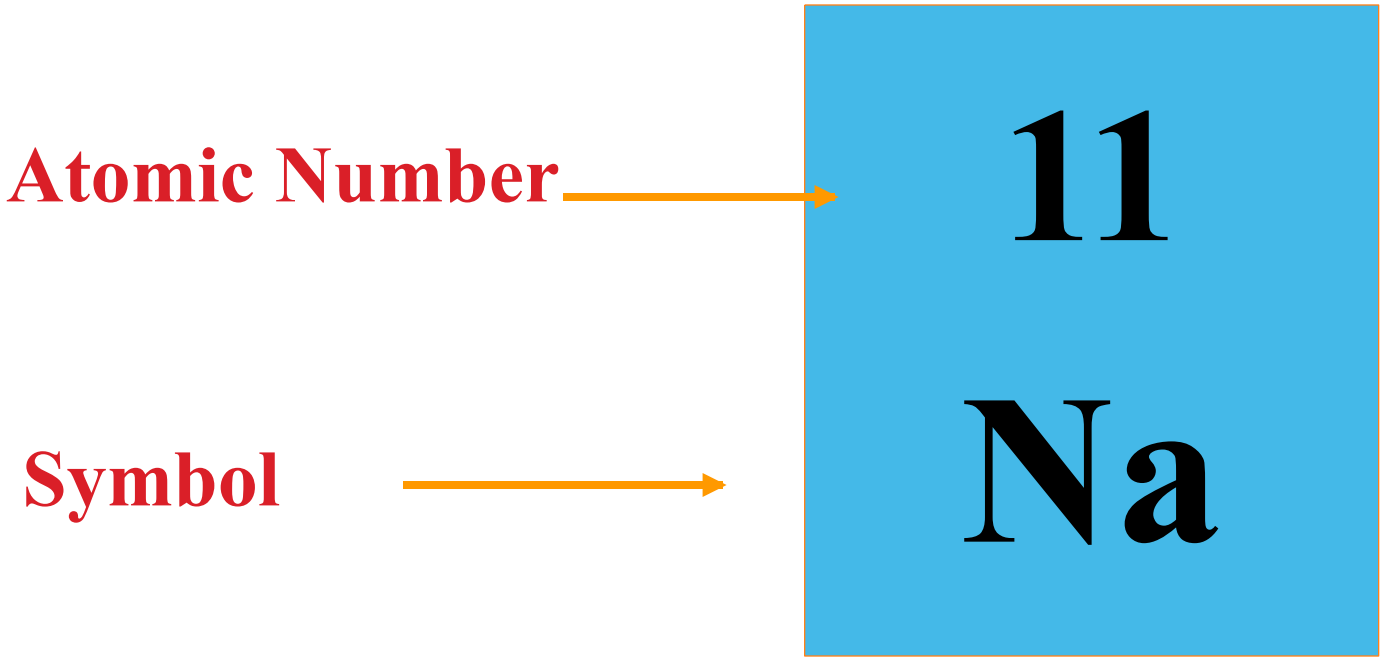
Group Number:



Atomic Number

Counts the number of protons in an atom

Atomic Number on the Periodic Table



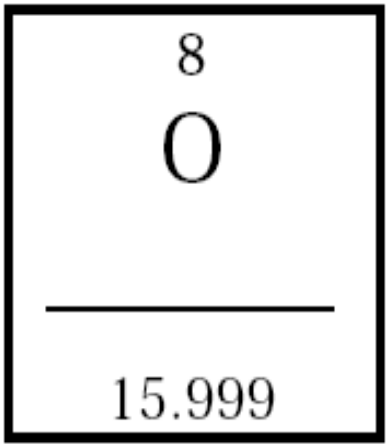
All atoms of an element have the same number of protons

11 protons → **11**

Sodium → **Na**

Atomic Mass

Mass of an atom.
Approximately equal to the number of protons and neutrons
Find number of neutrons by subtracting the number of protons from the mass.



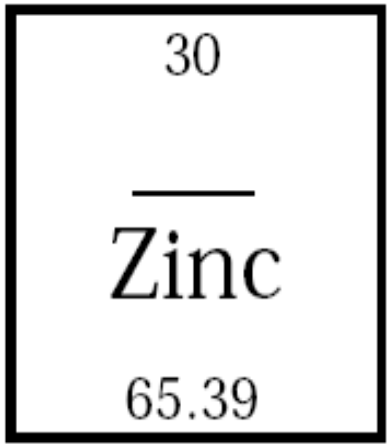
Atomic # = _____

Atomic Mass = _____

# of Protons = _____

# of Neutrons = _____

# of Electrons = _____



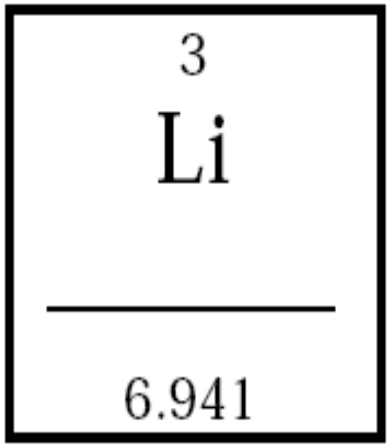
Atomic # = _____

Atomic Mass = _____

# of Protons = _____

# of Neutrons = _____

# of Electrons = _____



Atomic # = _____

Atomic Mass = _____

# of Protons = _____

# of Neutrons = _____

# of Electrons = _____

Review:

An element's **atomic number** tells how many **protons** are in its atoms.
An element's **mass number** tells how many **protons and neutrons** are in its atoms.

Learning Check 1

State the number of protons for atoms of each of the following:

A. Nitrogen

1) 5 protons 2) 7 protons 3) 14 protons

2) 7 protons

B. Sulfur

1) 32 protons 2) 16 protons 3) 6 protons

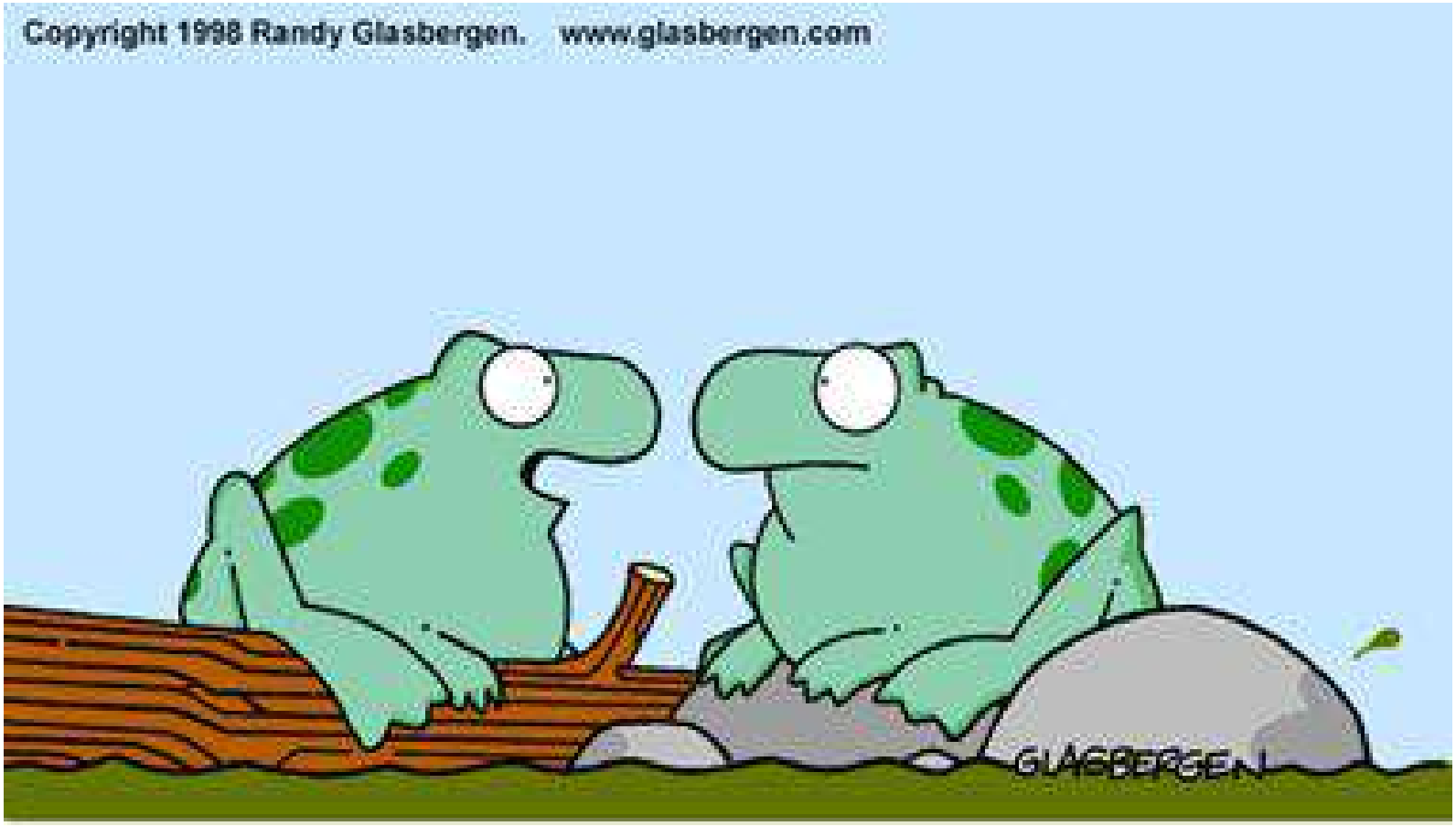
2) 16 protons

C. Barium

1) 137 protons 2) 81 protons 3) 56 protons

3) 56 protons

Organic Compounds

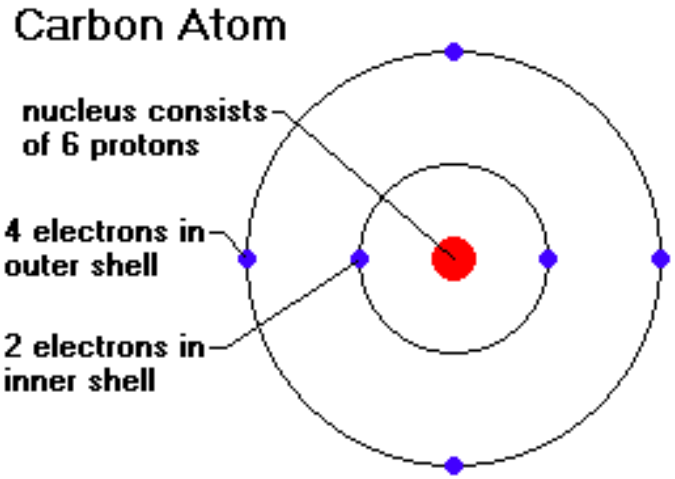


"Looks aren't everything. It's what's inside you that really matters. A biology teacher told me that."

Organic Compounds

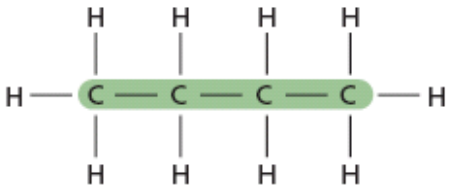
Make up most of living organisms
Contain bonds between two or more **carbon** atoms
C can easily bond with up to 4 other elements

4 valence electrons = 4 covalent bonds

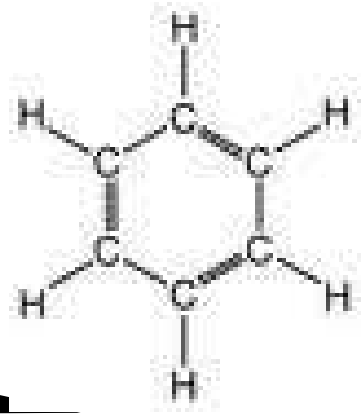


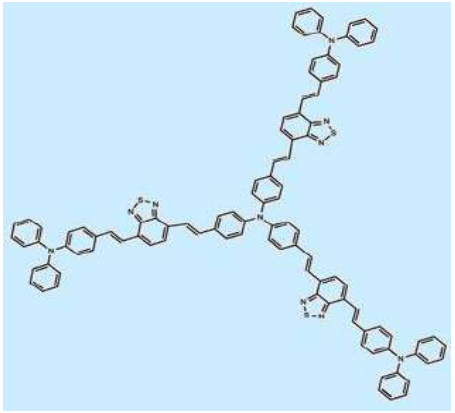
Organic Compounds

Carbon atom is versatile, can be "backbone" of long chains or rings
Organic molecules can be extremely large and complex; these are called **macromolecules**

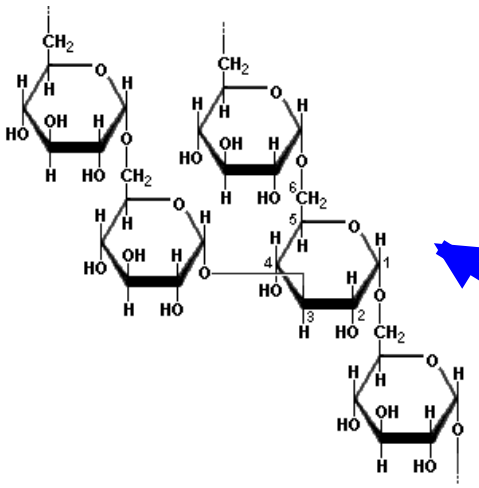


Straight carbon chain

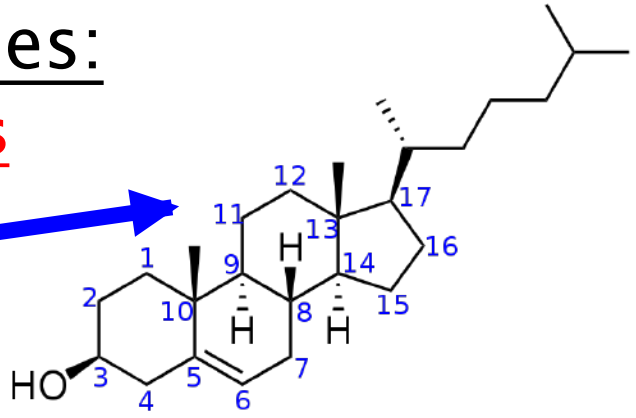


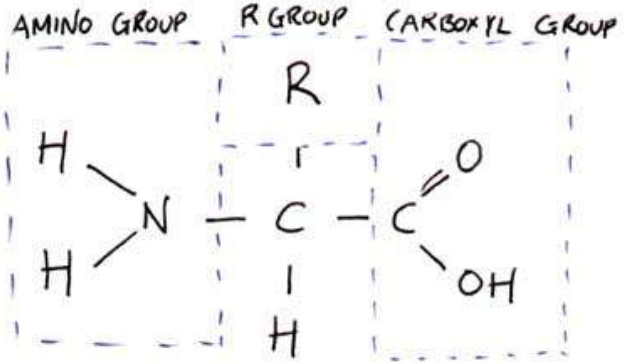


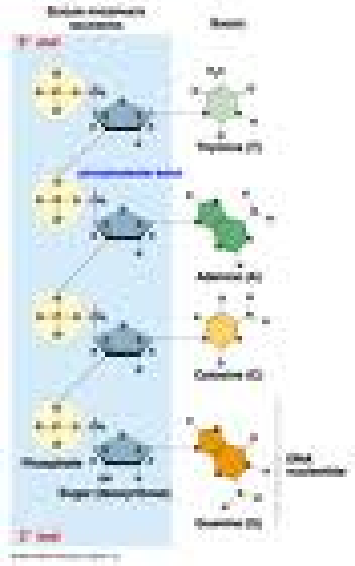
Organic Compounds



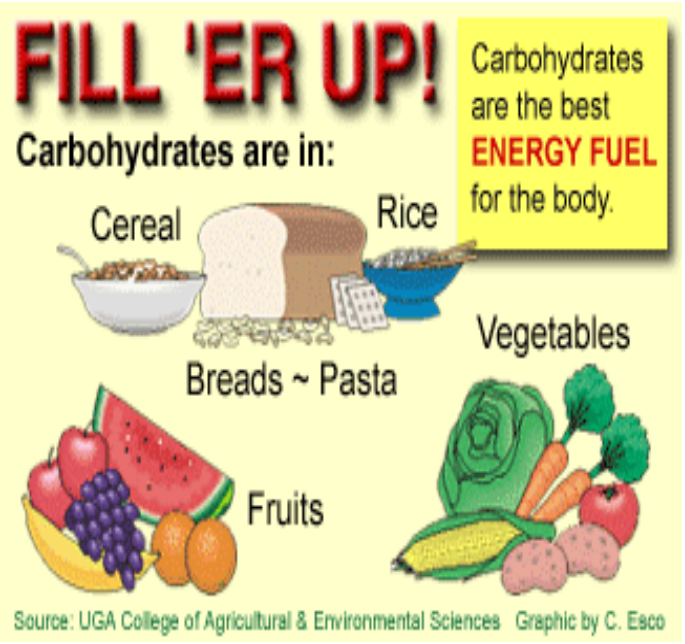
- Four main types of organic macromolecules:
  - Carbohydrates
  - Lipids
  - Proteins
  - Nucleic Acids







Carbohydrates



Made of C, H, & O

Main energy source for living things

Breakdown of sugars supplies immediate energy for cell activities

Extra sugar is stored as complex carbs called starches

Carbohydrates

- Single sugar molecules are called monosaccharides

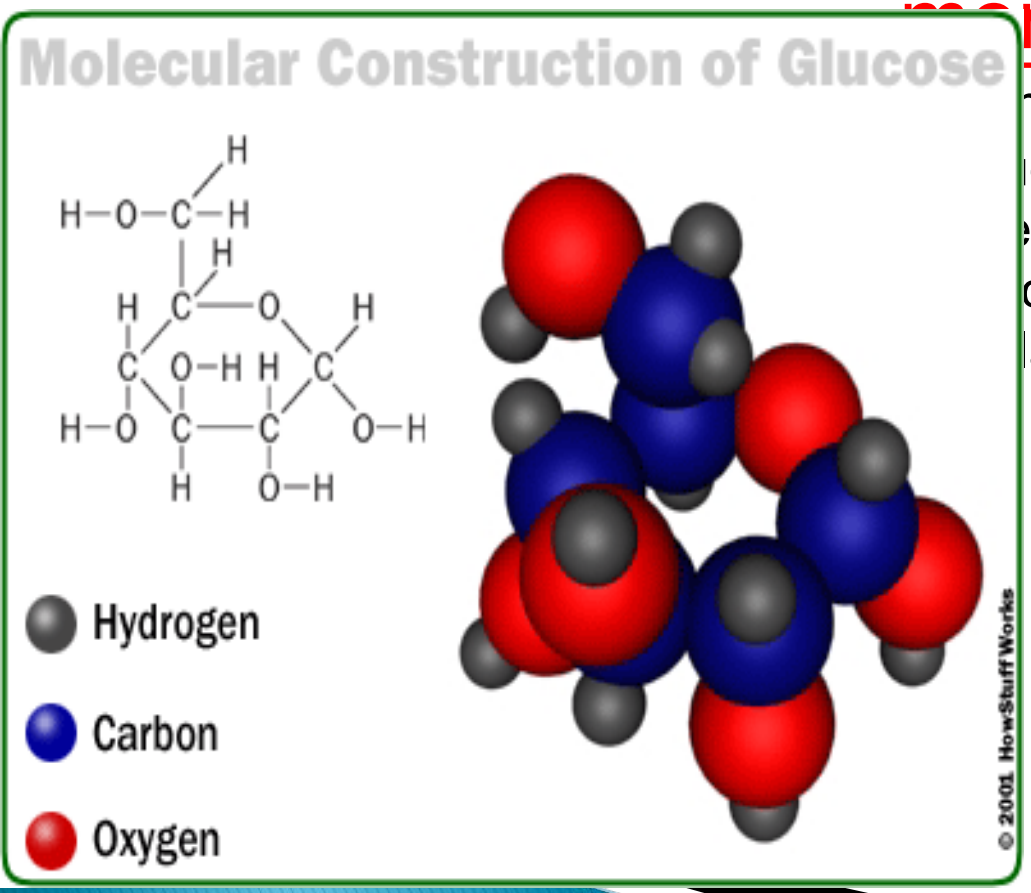
nples:

cose – in many plant and animal

s, most common monosaccharide

ctose – in many fruits

lactose – component of milk

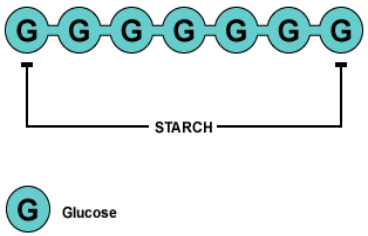


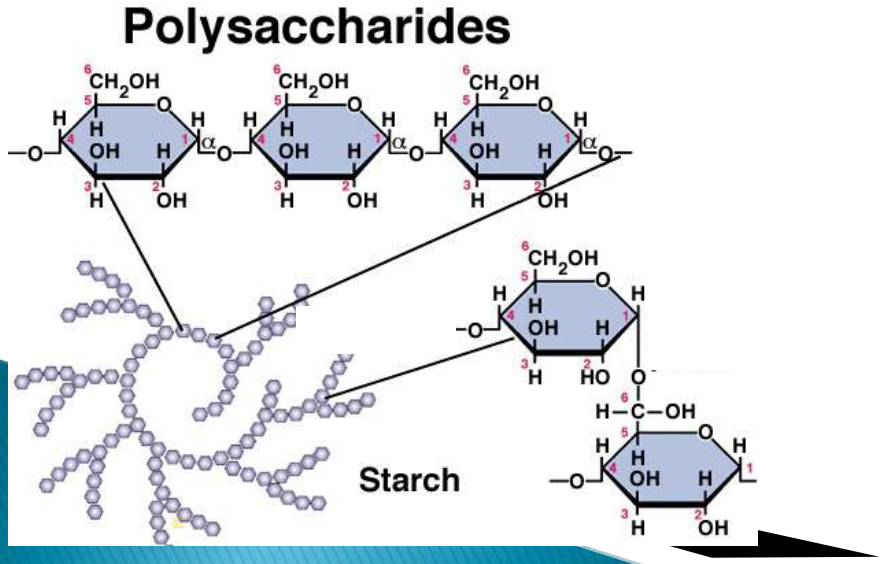
Carbohydrates

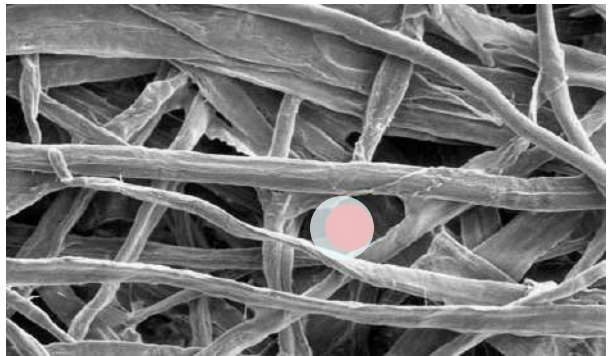
- Large molecules of many monosaccharide are polysaccharides

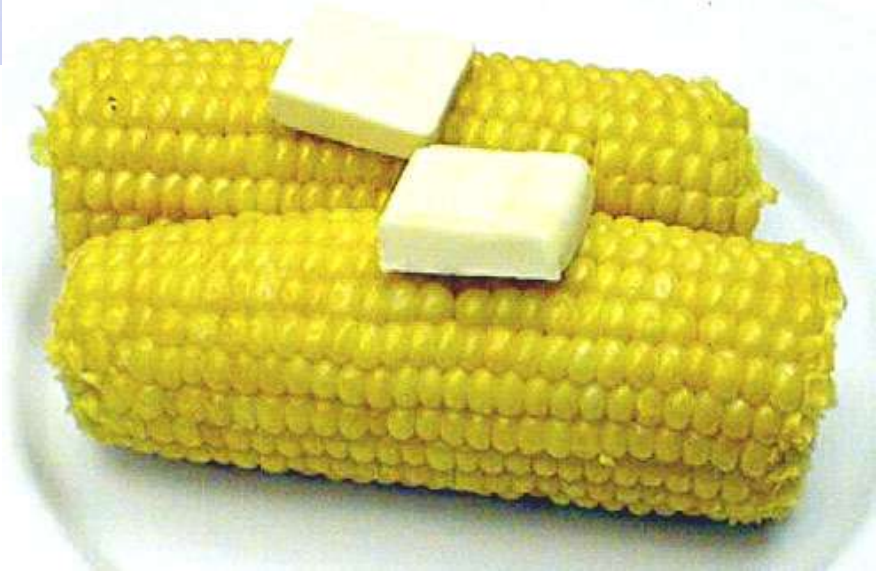
Examples:

- glycogen – animals use to store excess sugar
- plant starch – plants use to store excess sugar
- cellulose – fibers that give plants their rigidity & strength







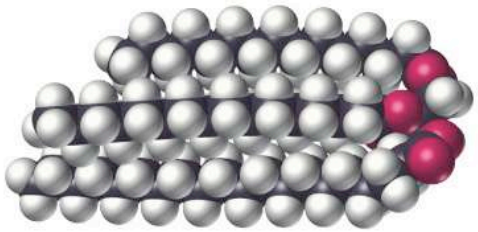


Lipids

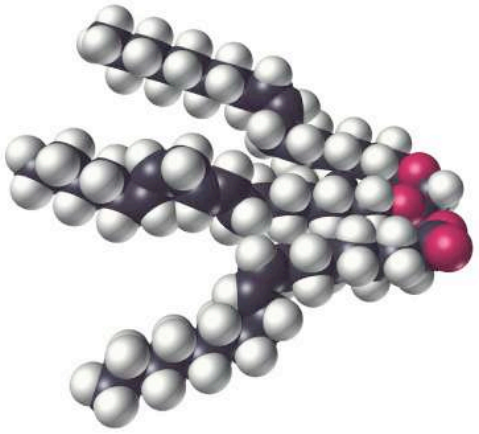
Store more energy than CHOs because the chains are longer

Ex: Fats, oils, waxes

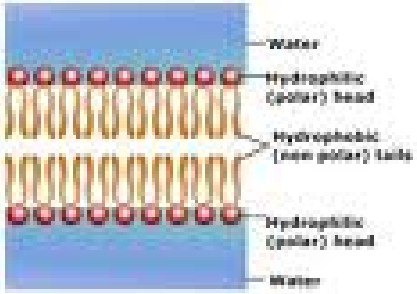
Won't dissolve in water



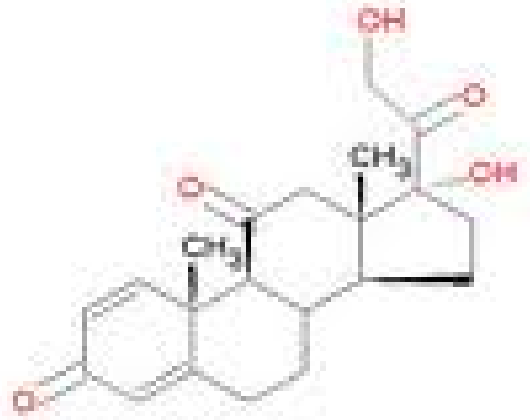
A fat



An oil



- Important parts of biological membranes and waterproof coverings
- Steroids are lipids that act as chemical messengers



Lipids

- Many lipids are made from a glycerol combined with fatty acids
  - If all carbons have *single bonds*, lipid is saturated
    - Ex: butter, lard, animal fat (usually solid at room temperature)
  - If any carbons have *double or triple bonds*, lipid is unsaturated
    - Ex: vegetable oil, fish oil, peanut oil (usually liquid at room temperature)


EXTRA VIRGIN
OLIVE OIL
POMPEIAN


Crisco
All-Vegetable


Crisco

Proteins

Contain C, H, O, ***plus nitrogen***

Formed from amino acids joined together

More than 20 amino acids can be joined in any order or number to make countless proteins (think of how many words can be made from 26 letters!)

Proteins

- Chains are folded and twisted giving each protein a unique shape
- Van der Waals forces and hydrogen bonds help maintain protein's shape
- Shape of protein is important to its function!

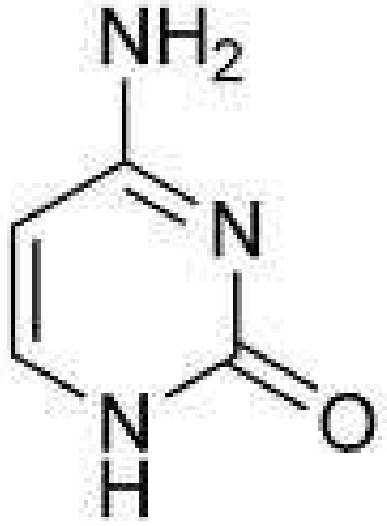
Proteins

- Provide structure
  - Ex: Collagen- makes up your skin, muscles & bones
- Aid chemical activities in your body
  - Ex: Enzymes- work to speed up rxns in your body
- Transport substances into or out of cells
- Help fight diseases

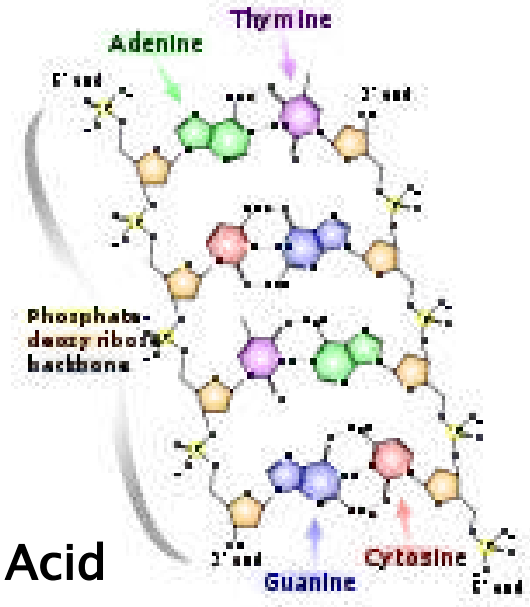
Nucleic Acids

Contain C, H, O, N ***plus phosphorus***

Formed by bonding of ind units called nucleotides



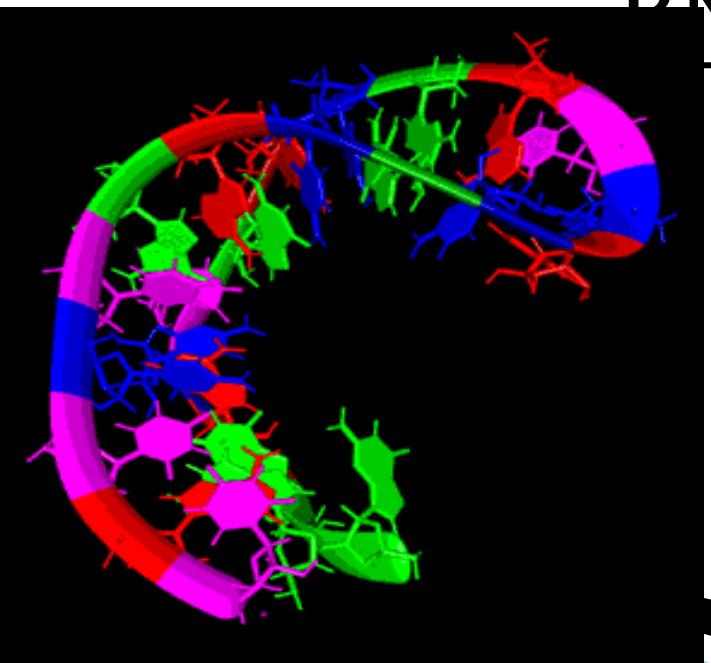
nucleotide

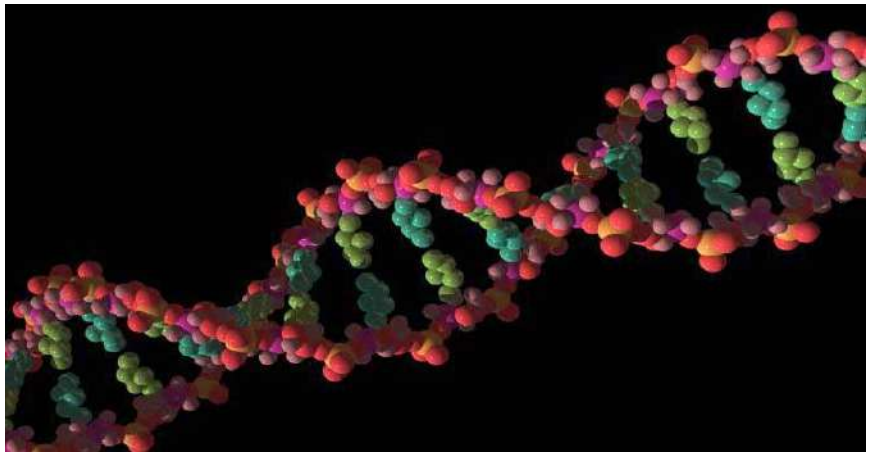


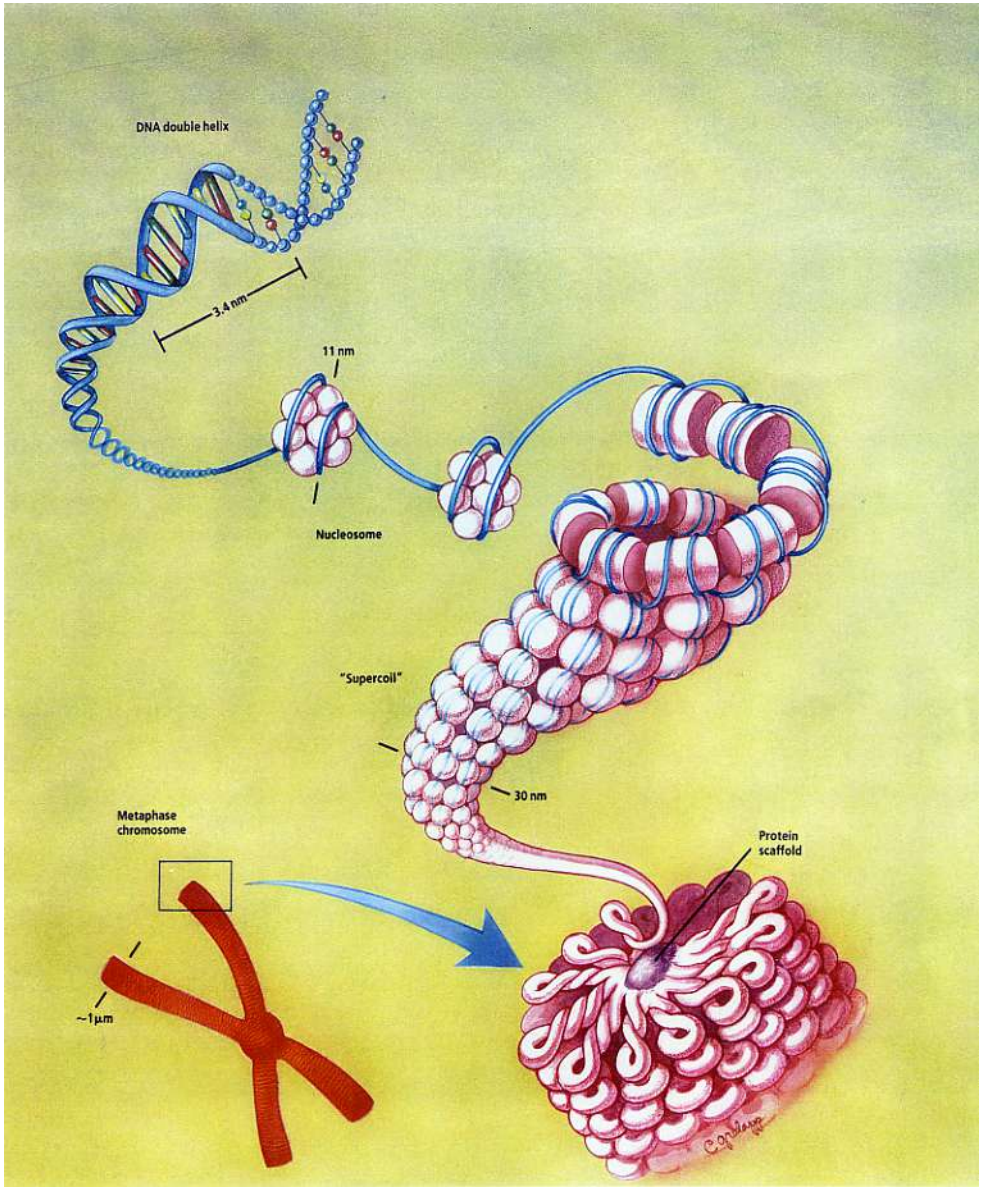
Nucleic Acid

Nucleic Acids

- Store and transmit hereditary information
  - Ex: DNA (deoxyribonucleic acid)
    RNA (ribonucleic acid)






DNA double helix
3.4 nm
11 nm
Nucleosome
"Supercoil"
30 nm
Metaphase chromosome
Protein scaffold
~1 µm

Biochemistry Unit Summary

- Using your notes and all worksheets, you are to write a summary over the unit in your notebook
- The summary needs to be at least **3** paragraphs **(5-7 sentences each)**
- **Topics to be discussed in your summary**: Properties of water, pH (acids and bases), Levels of Organization, Atoms, Elements, Compounds, Molecules and Macromolecules
- Lastly, you are to explain how Biochemistry relates to you as an organism

Biochemistry Word Splash

With the word chosen, you must represent that word through pictures…while still spelling out the word.

For example…

Biochemistry
Surface Tension
Macromolecule
Molecules
Energy
pH Scale
Acids & Bases
Cohesion
Adhesion
Matter

Be creative and include **color** in each of your letters

When you've finished, cut out your word and paste it onto the **"Biochemistry Splash Wall"**

Elephant Toothpaste

Step 1: Clean out your bottle (quickly, NO SOAP)
Step 2: Put on your goggles & aprons *EVERYONE!*
Step 3: Add ½ cup of Hydrogen Peroxide into your bottle. (Use the funnel)
Step 4: Add 8 drops of food coloring
Step 5: In the small cup, combine warm water (3 tablespoons—about **44 mL**) and 1 tablespoon of yeast. Mix for 30 seconds.

Elephant Toothpaste

Step 6: Add 1 tablespoon (about 14 mL) of dish soap into the bottle& swish the bottle around(DON'T SHAKE)

Step 7: Pour in yeast-water mixture into the bottle. Watch the magic ☺

Biochemistry Notebook Checks

1. **Brain Pop Acids and Bases Worksheet**
2. **Levels of Organization Analogy**
3. **Chemical Terms Graphic Organizer**
4. **Bill Nye Atoms**
5. **Notes Taken**
6. **Organized**
7. **Macromolecules Foldable**