Lect 1: Chp 16: Carbon Chemistry 2 pts ec

Chemistry of Living Things

Living things are a lot like laboratories… There's some serious chemistry going on inside. Your body is an incredibly complex chemical machine taking in chemicals & food, and causing countless reactions to occur every second.
_____ is the study of substances & processes occurring in all living organisms.

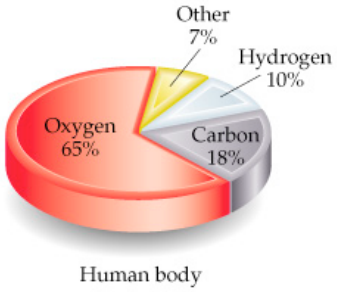
I'm made of what???

Only about _____ elements make up all living things.

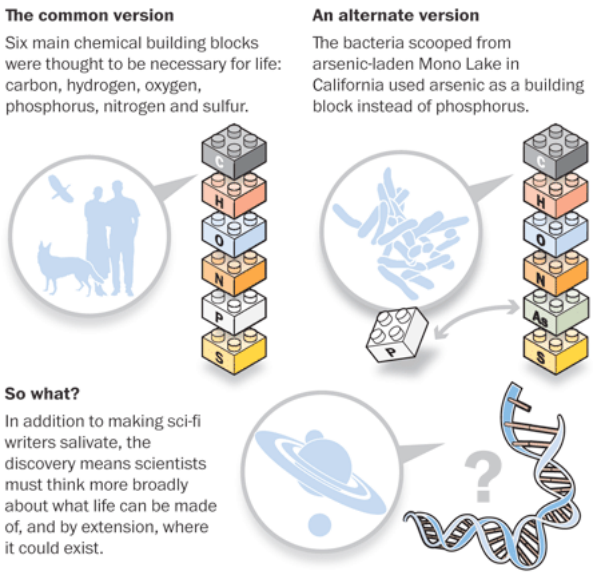
97% of your body's mass is made of 4 elements:

- ✓ _____
- ✓ _____
- ✓ _____
- ✓ _____

Two other major elements are _____ & _____



Human body



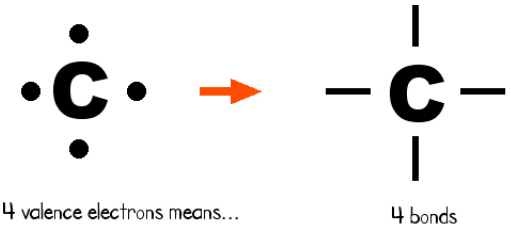
Major Compounds in the Body

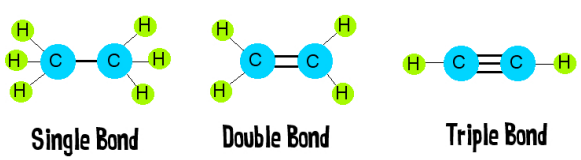
- Also relies on _____ & _____
- Typically consists of _____% water. In other words, 2/3 of your body weight is water. Water is important because many of our body's chemical reactions can only occur in solutions containing water. Blood, sweat, urine… all mostly water!
- Salt is also important because of how it can separate its two ions: Na^+ and Cl^-. Sodium ions regular the amount of water in our cells, while chlorine ions help body digest food.

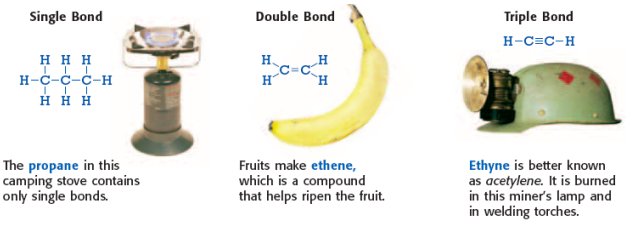
- **The most important element is… _____** It may not be the most abundant element in living things, but it is the most important. Scientists call carbon compounds _____ compounds. Remember: Not ALL substances made of carbon are living.
- _____ & _____ are pure forms of carbon.

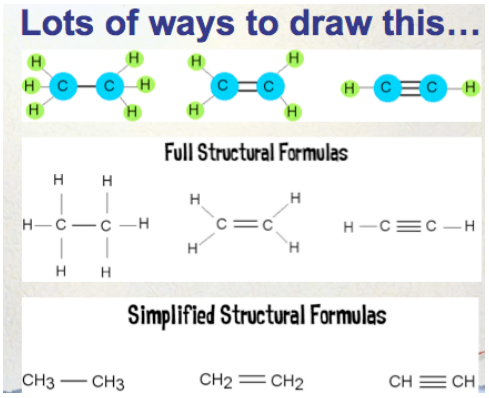
What makes carbon so special?

- It has a "central" role in all living organisms.
- It has _____ electrons
- It makes _____ bonds
- It bonds to itself over & over

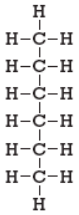




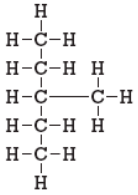




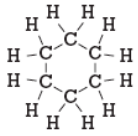
3 Types of Carbon Backbones



Straight chain
Carbon atoms are connected one after another.



Branched chain
The chain of carbon atoms branches when a carbon atom bonds to more than two other carbon atoms.



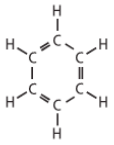
Ring
The chain of carbon atoms forms a ring.

Carbon forms _____ _____

One carbon chain may contain hundreds of carbon atoms. Notice how the CH_2 units repeat. A very large carbon-based molecule made of repeating units is called a _____. Polymers can be *thousands* of atoms long.

Carbon forms _____

One of the most important carbon rings is _____. Many compounds are based on Benzene. They often have very strong smells or aromas, so they are called _____ compounds. An example of one aromatic compound is a molecule called vanillin.


Benzene Ring

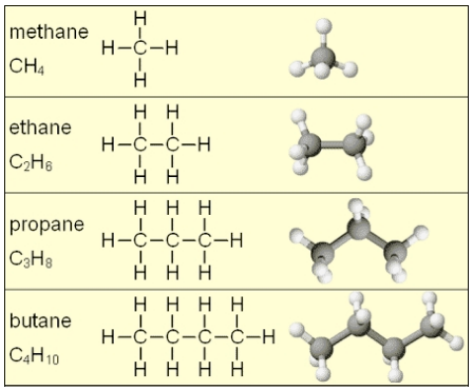

Simplified Benzene Ring

Silicon is similar to carbon. Why are there no life forms based on silicon?

Silicon is unsuitable because, although it is a valence IV element like carbon, (4 electrons to share) the Silicon - Silicon covalent bond is not strong enough for it to form long stable chains. So, it cannot form molecules of the complexity needed to make up cells like carbon can!

The _____make up a series of **straight chained hydrocarbons**, and are the foundation for how hydrocarbons are named. The first four members of the series are gases at room temperature and are called:

_____CH_4
_____C_2H_6
_____C_3H_8
_____C_4H_{10}



Alkanes with increasing numbers of carbon atoms have names are based on the Greek word for the number of carbon atoms in the chain of each molecule. So you can get, for example,
pentane (5)
hexane (6),
heptane (7)
octane (8)

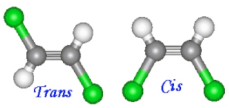
Lots of carbon compounds seem to be isomers.
What is an isomer?

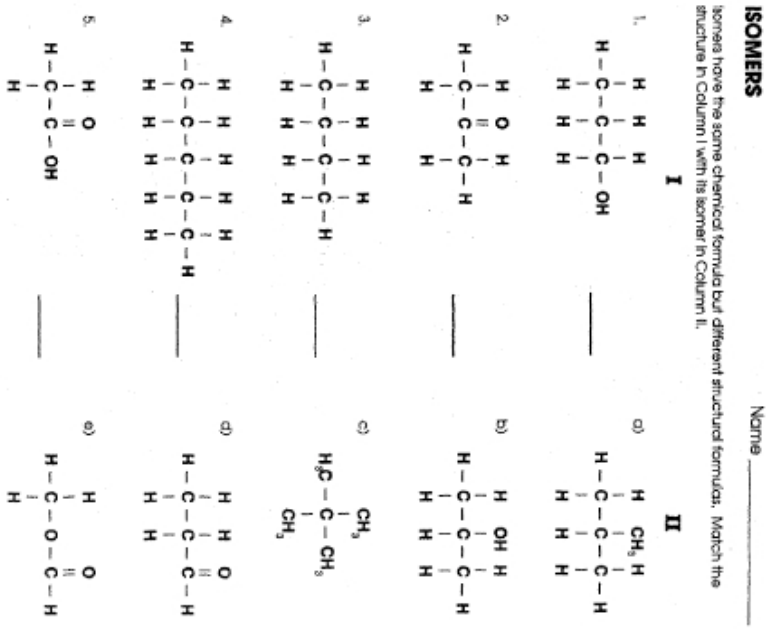
In organic chemistry, there are many examples of different compounds which have the same molecular formula as each other

But different arrangements _____ of the atoms in their molecules.

These are called _____

Isomers





Other organic compounds

Take a cheeseburger.... hamburger, covered with American (yellow) cheese on a hamburger bun... yummy! Now, if you made this cheeseburger with Swiss cheese and put it on slices of rye bread, you'd end up with a "cheeseburger" but one that tasted totally different ... you would notice that the substitutions affected the taste... Chemists make similar changes to organic compounds... these changes produce compounds called _____
A substituted hydrocarbon has had one or more of its hydrogen atoms or groups of atoms replaced by atoms or groups of atoms of other elements.

_____
alcohol is the name of a family of compounds formed when a hydroxyl (-OH) group _____ one or more hydrogen atoms in a hydrocarbon. (ex: thanolis produced by sugar fermenting in corn, grains & fruits) Structure challenge:
Isopropyl alcohol: The -OH is on the middle carbon of the 3 carbon chain
Propyl alcohol: Has the carbon on the end

Alcohols

Characterized by the **hydroxyl group**

-OH

Alcohols

Nomenclature:

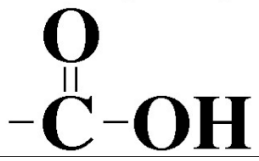
CH_3OH

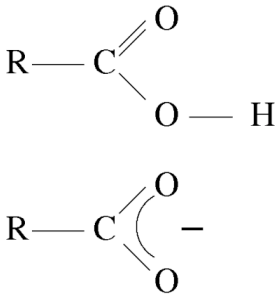
methanol (methyl alcohol)

_____
a carboxylic acid is formed when a _____ group is replaced by a carboxyl (-COOH) group. (The simplest carboxylic acid is methanic acid or formic acid which is made by ants and is injected into your skin when they bite you)
R means: Repeating Hydrocarbons, or lots of CH_2
The R is where the long chain of hydrocarbons would be attached

Carboxylic Acids

Characterized by the **Carboxyl Group**





_____
In this group, Nitrogen forms bonds with the carbon and hydrogen. The amine group _____ **replaces the hydrogen** in the hydrocarbon. Methylamine is the simplest amine. ex: Novocain in the dentist's office, caffeine in soft drinks... are all hydrocarbons substituted with nitrogen Example: Ethylmethylamine: $CH_3\ NHCH_2\ CH_3$

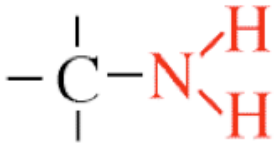
Amines

Characterized by Nitrogen joined to at least one alkyl group.

$-NH_2$

Amino Group

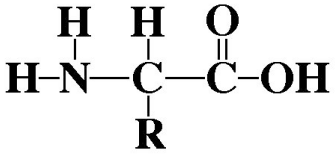
Amino



_____
Amino acids have both:
_____(the acid) and

_____(the amino)
as the substituted hydrocarbons- replacing more than 1 hydrogen

Amino Acid Structure

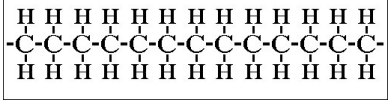


R means: Repeating Hydrocarbons

_____
Milk, blood muscle, cassette tapes & athletic shoes are all made of organic compounds with _____ called Polymers. Polymers are made up of smaller organic compounds that are linked together to form new bonds. Polymers are also found in the biological compounds that make up living things. Cotton is a natural polymer. The word "polymer" comes from the Greek **poly**, meaning "many" and **meros,** meaning "parts".

Addition Polymerization

The simplest and most widely used addition polymer is polyethylene



Chemistry & Your Body

FACTS:

- You are made of about 65% _____
- You are also made of molecules consisting mostly of _____, _____, _____, _____, _____, & _____.
- You are also made up of MANY different kinds of molecules, including small ones like _____ & _____ very large ones like _____, _____, _____, and _____.

GOAL: Find out how many pounds of the major elements are in your body.

Step 1: Estimate your weight in pounds.

I weigh approximately _____ pounds (lbs).

Step 2: If all of the water was removed from your body, you would be made of following percentages of elements.

Element	% found in body	% as a decimal	Amount of Element in Body (pounds)
Carbon	53%	0.53	
Oxygen	21%		
Nitrogen	9%		
Hydrogen	8%		
Calcium	4%		
Phosphorous	3%		
Sulfur & Sodium	1%		
All other elements	1%		

Step 3: Determine how many pounds of each element make up your body's mass, less water. Then, fill out the data table. To do this, convert each 5 into decimals. Then, multiply your weight by each decimal.

Example: If Bob weighs 150 lbs, he'd have 150 x 0.53, or 79.5 lbs of carbon in his body.

Video 1.Let's review bonding & Lewis Structures _____

Video 2. Diamonds & Graphite

Video3. Covalent Bonding Review

Video 4. Molecular Geometry