Chemistry of Life

Click to see EQs

Essential Question

What does a cell need to survive?

Essential Question

How does the types of foods we eat affect our body?

What is Chemistry?

Chemistry is the study of the...

Drag beakers inwards to reveal

Chemical reactions

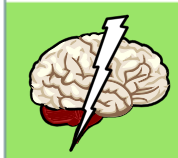
Structure of matter

Properties and composition of substances

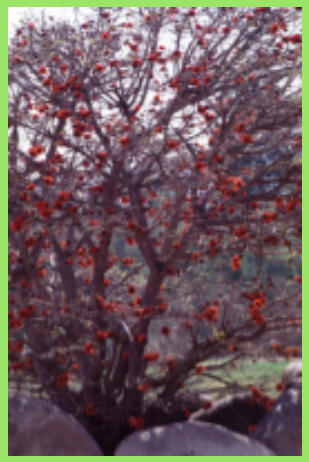
Non-living things

Why Chemistry in Biology?

Brainstorm answers (fill in w/ pen) then click on right side to reveal



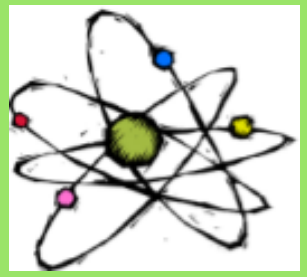
Millions of chemical reactions take place in the bodies' of living things in order to survive. Its important to understand what some of the key chemicals are and how they function in order to understand life's processes.



What is matter?

- Matter is anything that takes up space and has weight
- ALL things are made up matter, living and nonliving

Pull



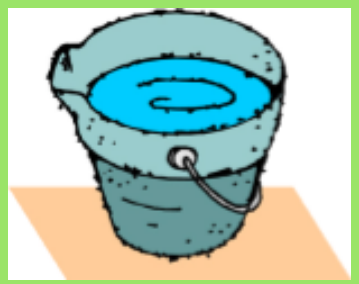


All matter is exists in one of three states:

Click each number to see picture then click below number to show each state

Solid

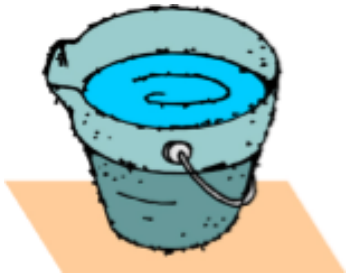
Liquid



Gas

The 3 Physical States

Drag & drop each picture in the box

You have a definite volume AND definite shape.	
You have a definite volume but NO definite shape.	
You NO definite volume and NO definite shape.	

What STATE are you?

Match up each term with description, click box to reveal answer

SOLID

LIQUID

GAS

You have a definite volume but NO definite shape.

You have a definite volume AND definite shape.

You NO definite volume and NO definite shape.

What STATE are you?

Match up each term with description, click box to reveal answer

You have a definite volume but NO definite shape.	You have a definite volume AND definite shape.	You NO definite volume and NO definite shape.
LIQUID	SOLID	GAS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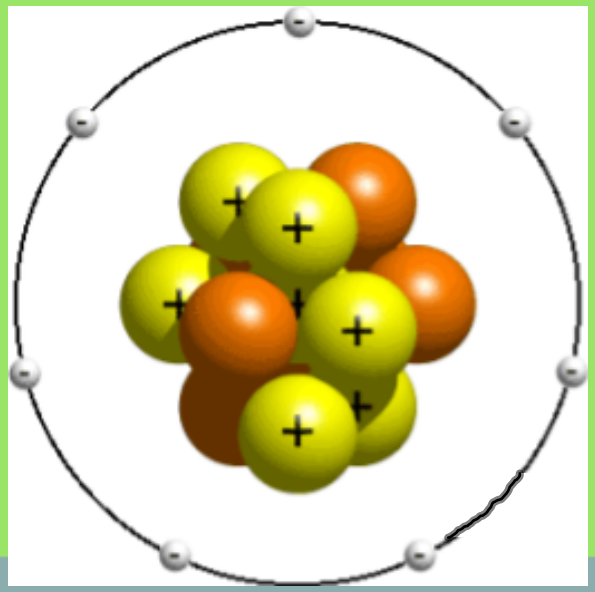
What are ATOMS?

Drag white box down to reveal

1. All matter is made up of an atom/atoms
2. Atoms are the smallest unit of matter



All atoms have a nucleus

Pull arrow

Nucleus is made of protons & neutrons

Pull arrow

Electrons orbit the nucleus

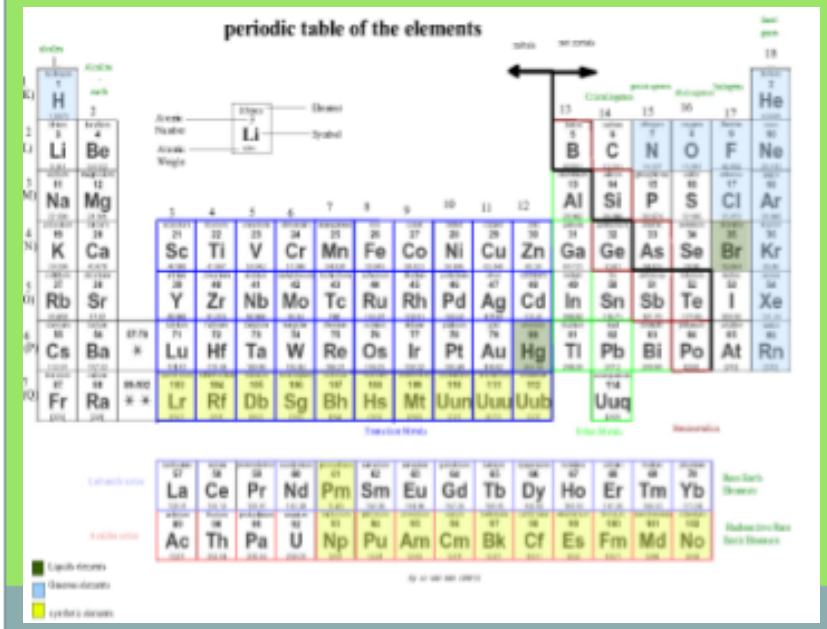
Pull arrow

What are ELEMENTS?

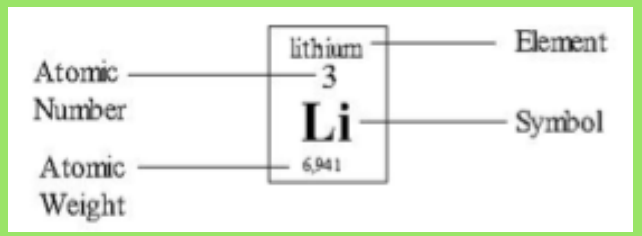
Drag white box down to reveal

1. Made up of the same kind of atom(s)

2. A pure substance that cannot be chemically broken down



Elements are represented by an abbreviated chemical symbol, as shown on the *Periodic Table of Elements.*



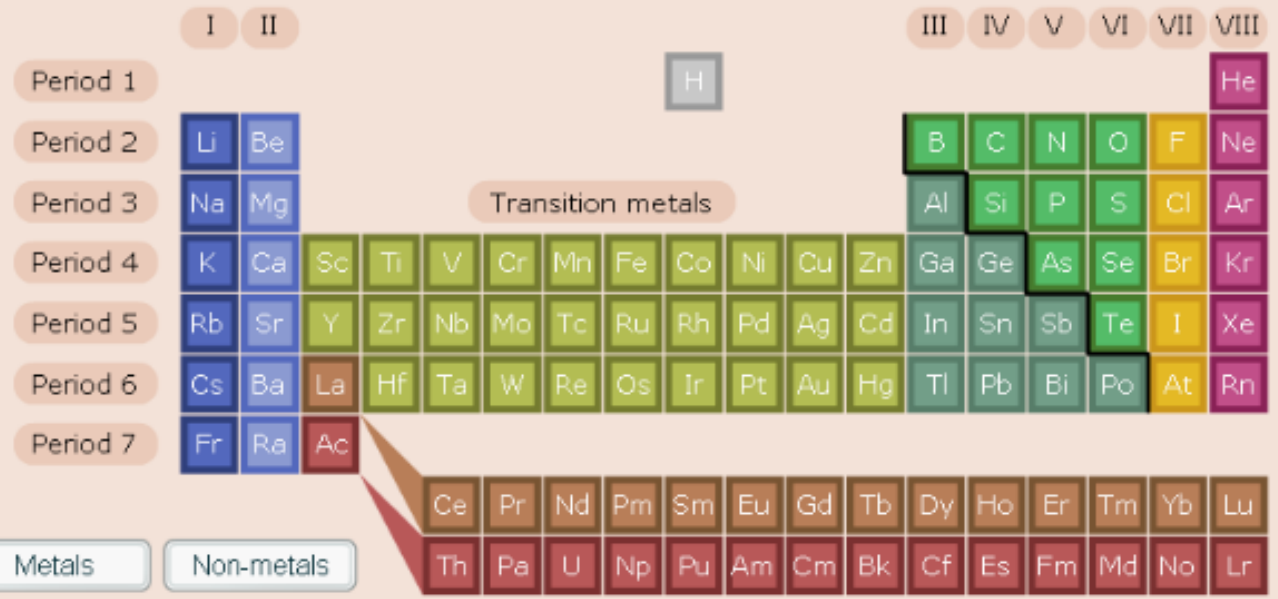
Drag arrow down to show example

The Periodic Table represents elements in such a way as to highlight their similarities and differences.

INSTRUCTIONS

Explore the Periodic Table below by clicking on the elements.
You can use the '- Select Element -' drop-down menu to quickly jump straight to an element. More information can be found out about periods (rows) and groups (columns) by clicking on the relevant button along the left-hand side or along the top of the table.

There is also a game you can play to test your knowledge.



- Select Element -

Instructions

Find the Elements

Unlock the Code

It's ELEMENTAL My Dear Watson...

Identify the element associated with each symbol

Click on circle to reveal answer

Ca

Fe

Cl

Mg

Br

H

C

Na

It's ELEMENTAL My Dear Watson...

Identify the element associated with each symbol

Click on circle to reveal answer

Calcium	Iron	Chlorine	Magnesium
Bromine	Hydrogen	Carbon	Sodium

What are MOLECULES?

Drag white box down to reveal

1. Atoms of the same element combine to form a molecule

2. Smallest unit of a compound

Click picture to reveal

How many of each atom does the following moelcule have?

$C_6H_{12}O_6$

Carbon=6

Pull arrow

Hydrogen=12

Pull arrow

Oxygen=6

Pull arrow

What's a COMPOUND?

A compound is made up of several molecules.

Molecule example: O_2, N_2, CO_2

-VS-

Compound example: $6CO_2$

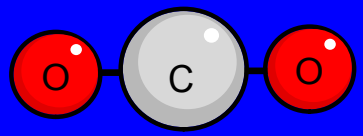
Like parts to a whole, molecules make up a compound

Click & drag "!"

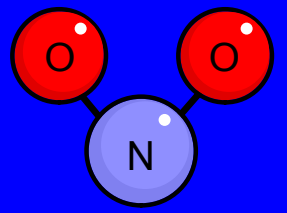
How many atoms of each element in each molecule?

Click on each box to reveal answer

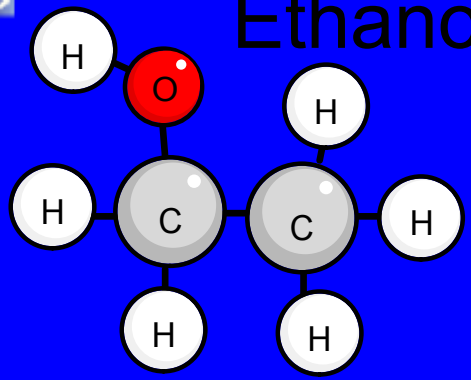
CO_2



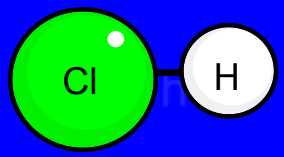
NO_2



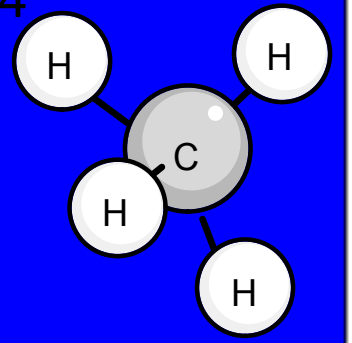
Ethanol



HCl



CH_4



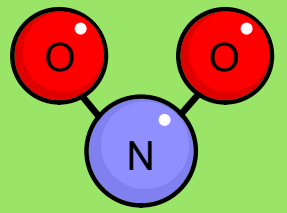
How many atoms of each element in each molecule?

Click on each box to reveal answer

CO_2

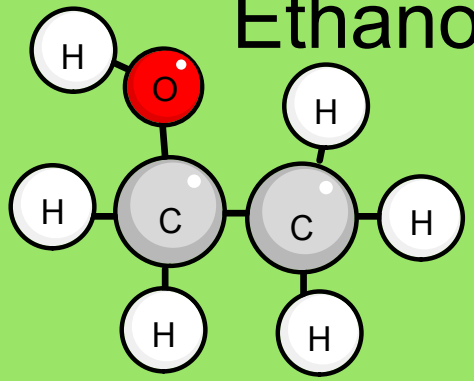
Carbon: 1
Oxygen: 2

NO_2



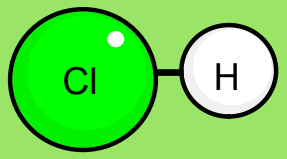
Nitrogen: 1
Oxygen: 2

Ethanol



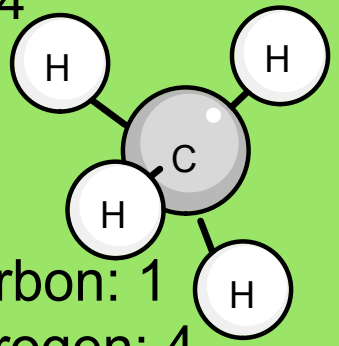
Carbon: 2
Oxygen: 1
Hydrogen: 6

HCl



Chlorine: 1
Hydrogen: 1

CH_4



Carbon: 1
Hydrogen: 4

So...how do atoms stick together?

Click on boxes to reveal

?

?

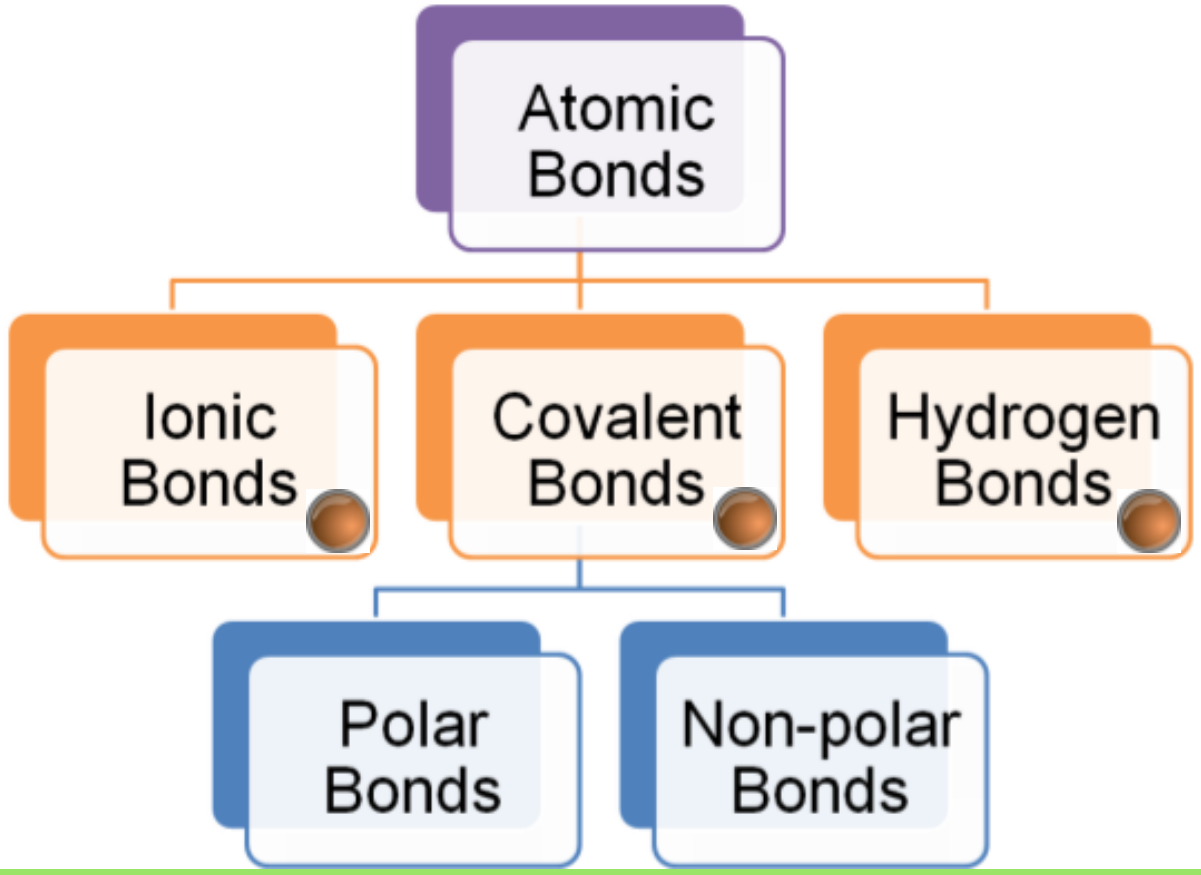
?

Pull arrow

... BONDS...
James
BONDS!!

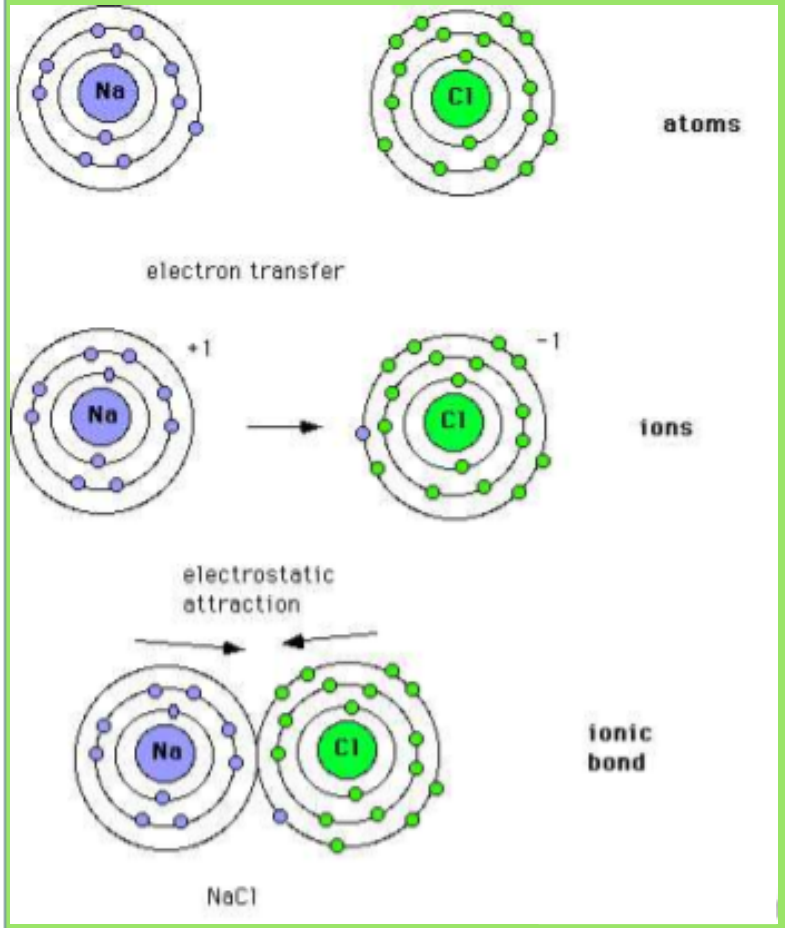
Atomic Bonds

Click button to jump to correct page



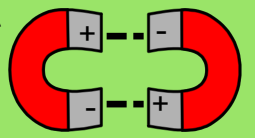
Click to move on when done with all bonds

Ionic Bonds



Ion = charged atom (+ or -)
Like NA^{+1} or Cl $^{-1}$

Pull

Ionic bonds = attraction of a positively charged atom and a negatively charged atom
(like magnets  ***)***

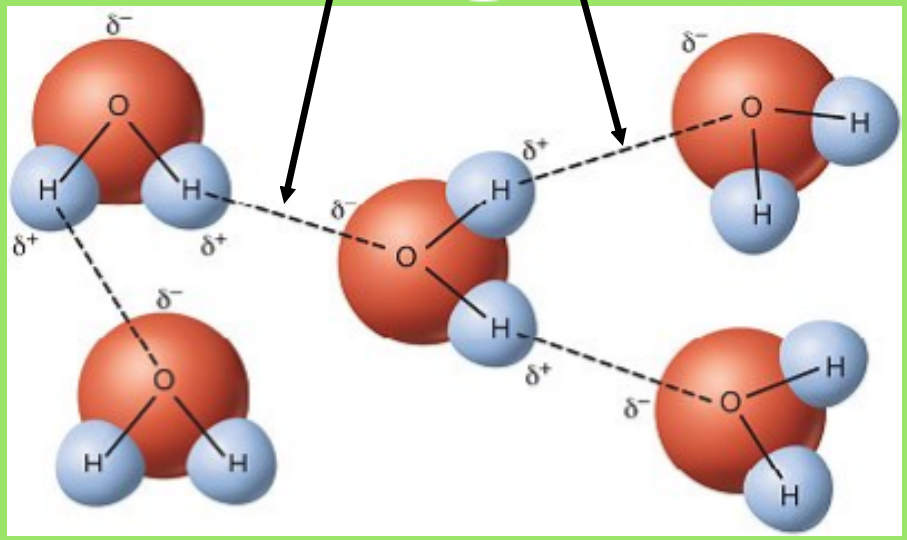
Pull

= forms WEAK bonds

Pull

Click to go back to ATOMIC BONDS

Hydrogen Bonds



= bonding of a hydrogen atom (H^+) with another negatively charged atom

Pull

= weak individually but strong collectively

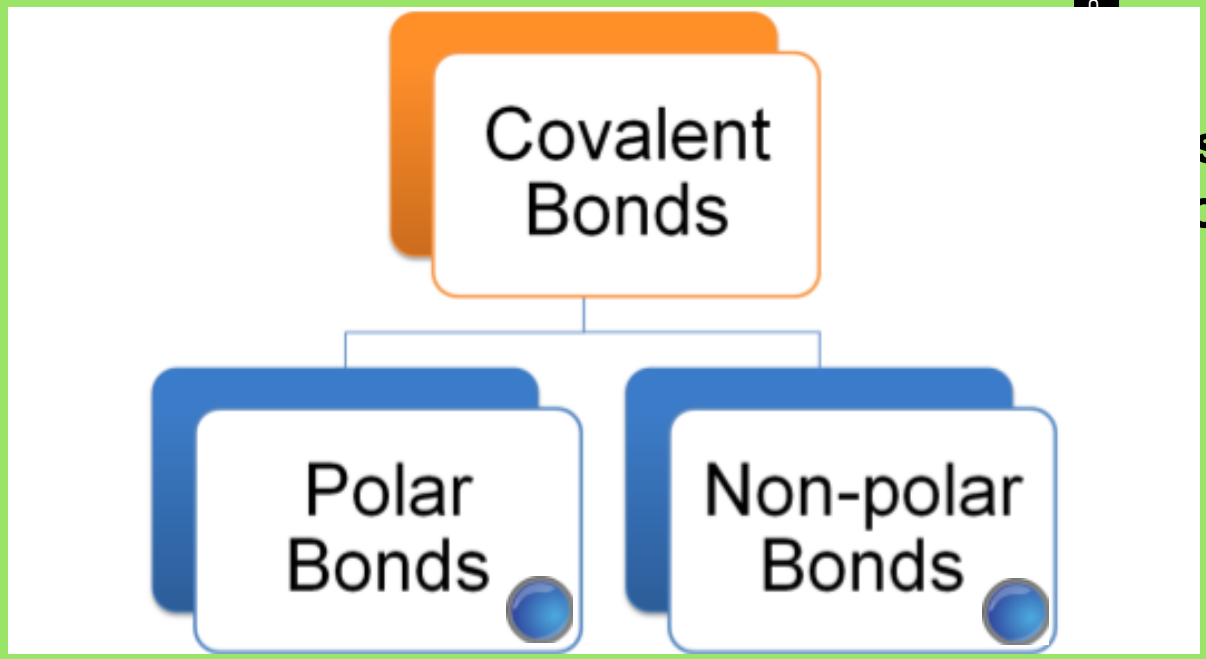
Pull

Click to go back to ATOMIC BONDS

Covalent Bonds

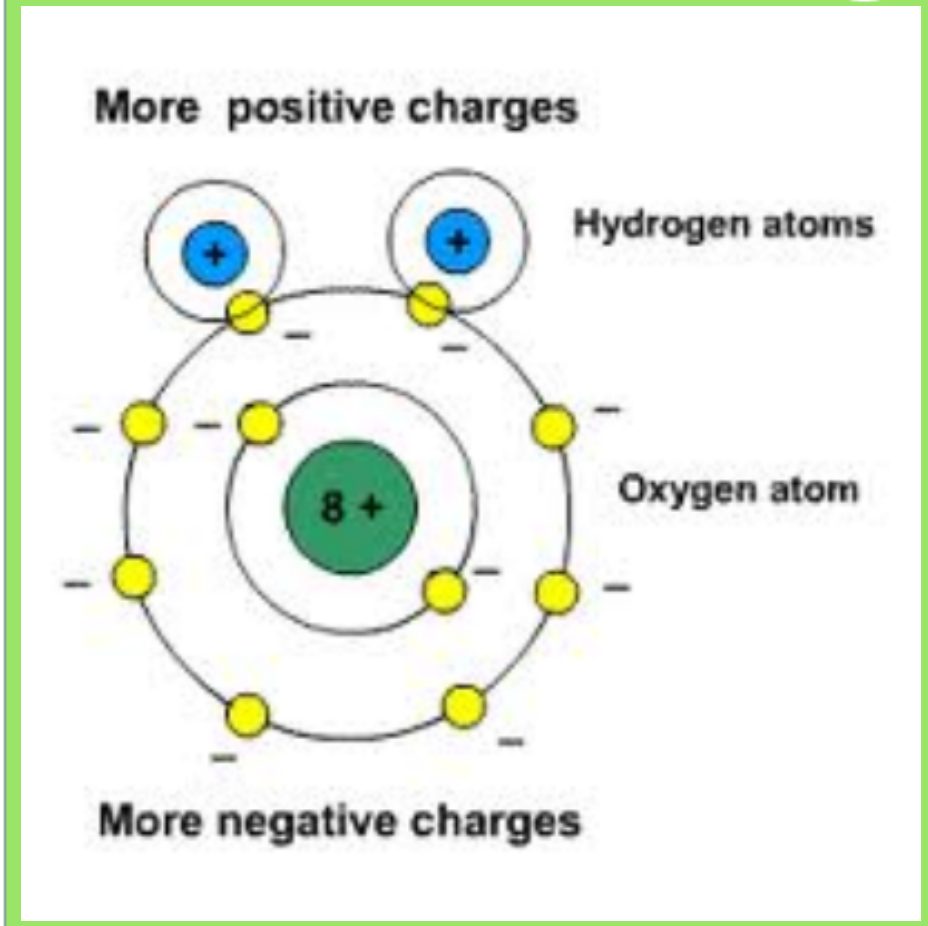
Pull arrow

of
s
oms



Click to go back to ATOMIC BONDS

Polar Bonds

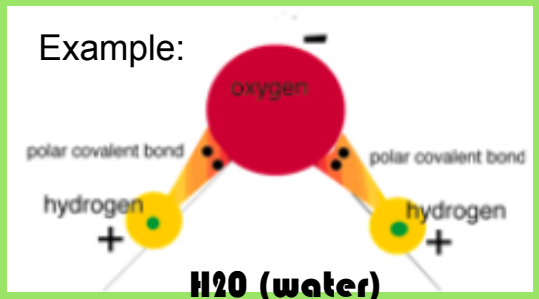


= unequal sharing of electrons

Pull

= creates a molecule that has a slightly negative and a slightly positive side

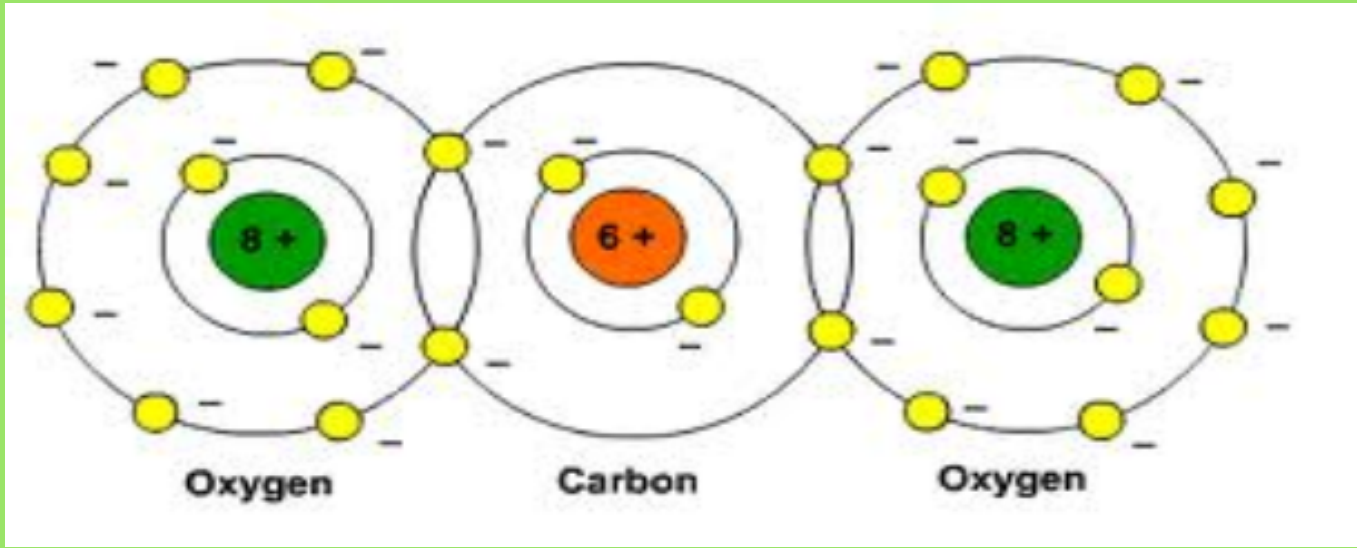
Pull



Pull

Click to go back to COVALENT BONDS

Non-Polar Bonds

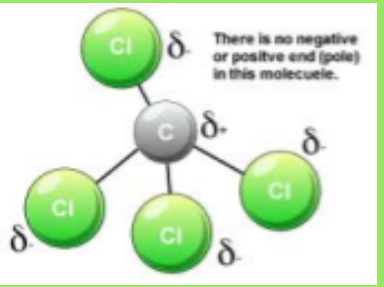


= equal sharing of electrons

Pull

= creates a molecule with no charge

Pull



Pull

Properties of H_2O

Click

Since living things are 70%+ made of water, to understand life, you need to understand water

Because of it's polarity, water has unique properties

High Specific Heat

Able to absorb a lot of energy = heats & cools slower than most liquids

Pull

Adhesion

Like an adhesive, water molecules are able to stick to *other* molecules

Pull

Universal Solvent

Other molecules easily dissolve in water = making an aqueous solution

Pull

Cohesion

A type of adhesion; Water molecules are attracted to each other = able to stick together

Pull

High Specific Heat

Why is it important to living things?

Water will retain its temperature after absorbing large amounts of heat, and retains its temperature after losing equally large amounts of heat.

Substances with high specific heat capacities take a lot of heat energy and therefore a long time to heat up and also a long time to cool down.

Living things are primarily made of water (at least 50%) so having high specific heat helps allow an organism to maintain it's internal temperature (ie. homeostasis) regardless of external temperature

By keeping warm or cooling off with sweat & evaporation

The specific heat capacity of sea water is greater than that of the land.

(Hence why the ocean takes longer to heat up/cool off compared to land)

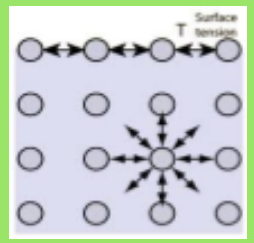
The ocean acts a heat sink/storage to regulate the Earth's temperature.

Cohesion

BACK

Why is it important to living things?

Due to the polarity (charge) of water molecules, when together, like magnets, one water molecules pulls together with another water molecule. It is a game of opposites attract.



Since each molecule pulls/attracted to it's neighboring molecule, when there is no molecule above it, it just pulls side-to-side/below it...thereby creating SURFACE TENSION

Pollen, dust, water insects, and other biological materials are able to remain on the surface of the water because of this tension

Water molecules can pull on each other so strongly they bunch into spheres.

This allows water to pulled along a pathway with relative ease (ex: circulatory system/funnel rain to roots). Also, there probably is no other liquid that can fall the height of clouds and reach the ground as drops, hence RAIN.

Universal Solvent

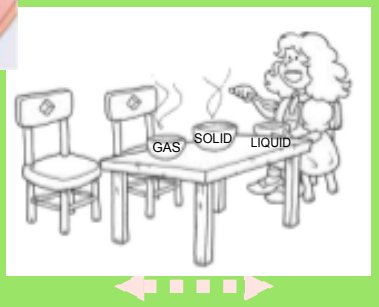
BACK

Why is it important to living things?

Water acts as a solvent, dissolving most molecules into it and thus providing a liquid environment

Organisms are able to obtain essential nutrients & elements that have been dissolved into water.

For example: Even though underwater, fish obtain oxygen from the O_2 that has been dissolved in **OR** Oxygen is able to circulate our body via our blood



Often for chemical reactions, a solid phase is too slow, and a gaseous phase is to quick BUT a liquid phase is just right to carry out chemical reactions

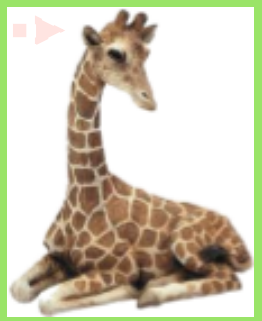
Adhesion

BACK

Why is it important to living things?

When water molecules stick to -non-water molecules, it creates capillary action (where the water molecules 'climb' up the what they stick to). Capillary action is limited by size of a tube and gravity.

Capillary action is essential to plants to help them obtain water from the roots and transport it (via the xylem) to the top of the plant



Capillary action also helps to circulate blood and other vital fluids around the body, from the head to toes and back UP again to get re-oxygenated

Properties of H_2O

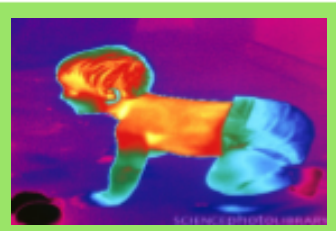
Drag and match each term with a picture
Click on picture to check answers

Adhesion

Universal Solvent

High Specific Heat

Cohesion

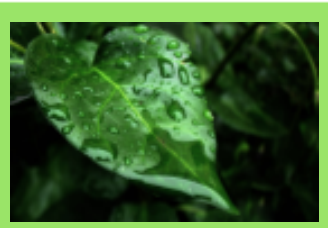


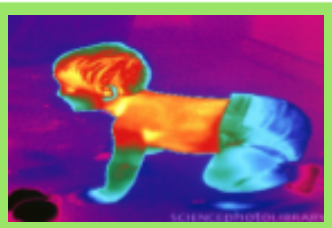
Properties of H_2O

Drag and match each term with a picture
Click on picture to check answers

Adhesion

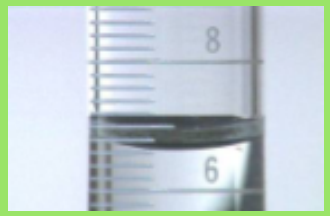
Cohesion





High Specific Heat

Adhesion



Universal Solvent

Universal Solvent

Adhesion

High Specific Heat

Cohesion

Acids & Bases

Pull white arrows

Click on screen shade to reveal

- **pH is used to measure how acidic or basic a solution is**

- **Scale ranges between 0 (very acidic) to 14 (very basic)**

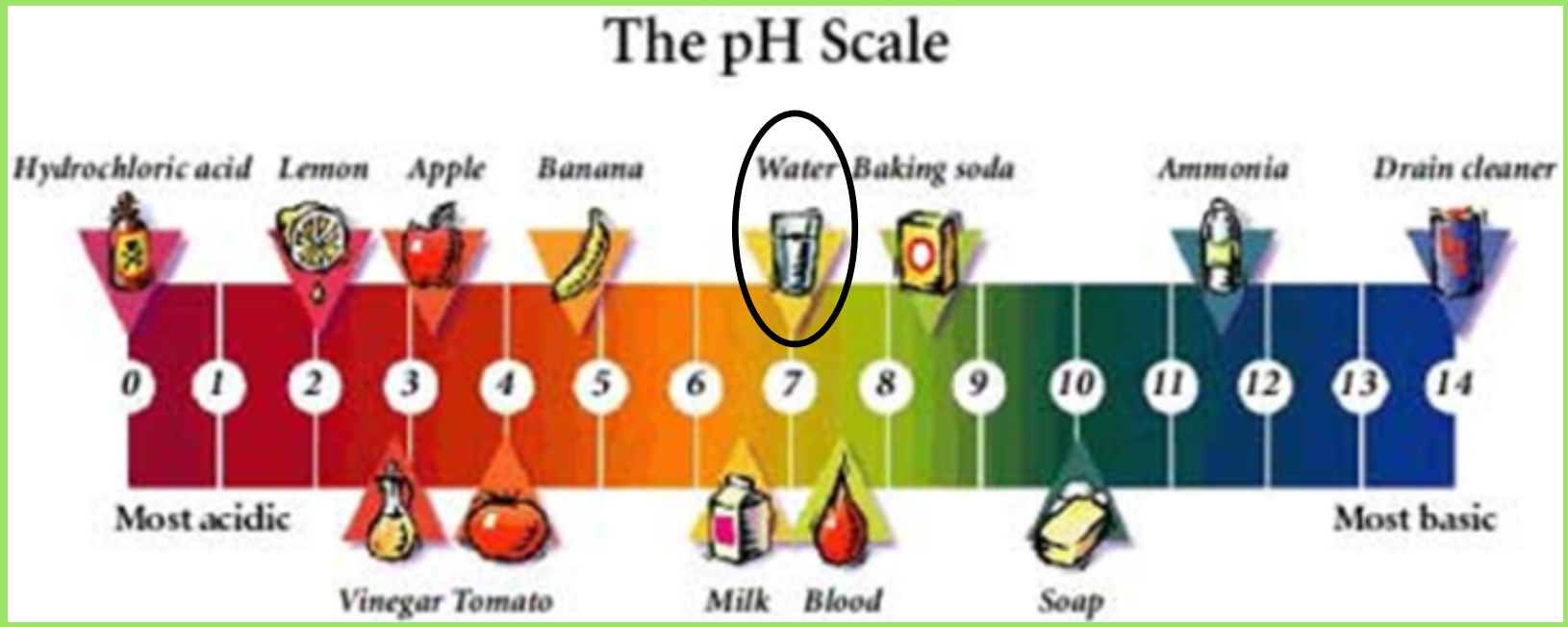
- **A pH of 7 represents a neutral solution**

- **pH 5 is 10 times more acidic then pH 6**

Acid OR Base?	HINT	Acid	Base
Baking Soda	pH 9		
Lemon	pH $2^{.5}$		
Banana	pH 5		
Gastric Acid	pH 1		
Milk	pH $6^{.6}$		
Ivory Soap	pH $9^{.5}$		
Tomato	pH $4^{.6}$		
Vinegar	pH $2^{.4}$		
Apple	pH $3^{.3}$		
Blood	pH $7^{.4}$		
Drain Cleaner	pH 14		

What pH is H_20?

Click in middle of page to reveal pH scale



So...the BIG question...

Click to reveal

Why is it important for water to be neutral?