

# The Chemistry of Life

The image features a central, bright yellow sun-like sphere with a gradient, from which numerous lines radiate outwards. These lines are primarily orange and red, with some yellow segments, and they curve and taper as they extend. The background is dark, with a large, semi-transparent purple circle behind the central sun. The overall effect is that of a vibrant, energetic burst, symbolizing the dynamic nature of life's chemistry.

# Learning Target

**10 I can review basic chemistry properties and characteristics:**

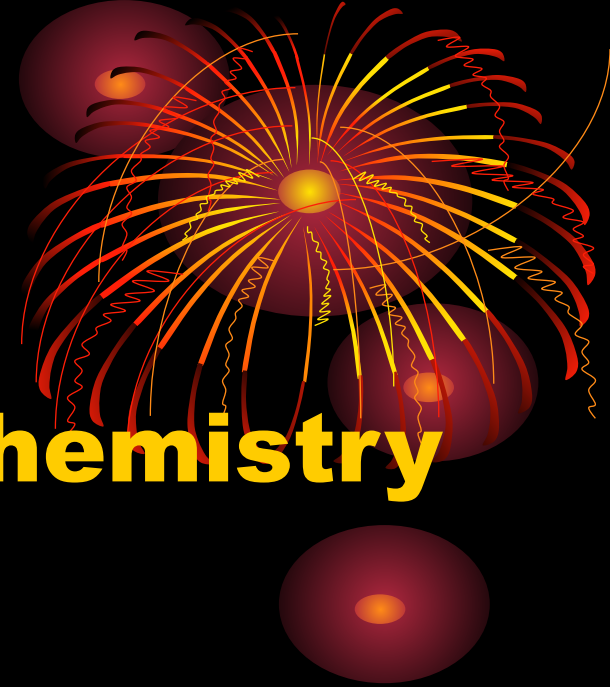
**10 Atoms**

**10 Subatomic particles**

**10 Ions**

**10 Chemical bonding**

**10 Water**



# The Nature of Matter



⑩ **An atom is the basic unit of matter.**

⑩ **Protons and neutrons are in the nucleus**

⑩ **Electrons surround the nucleus**

# Atoms

⑩ Protons are + charged

⑩ Electrons are - charged

⑩ Neutrons have 0 charge

⑩ Have equal numbers of protons and electrons



# Elements



- ⑩ A pure substance that is made of only one type of atom**
- ⑩ Over 100 are known**
- ⑩ 90 or so are natural**
- ⑩ About 24 are found in living organisms**

# Elements



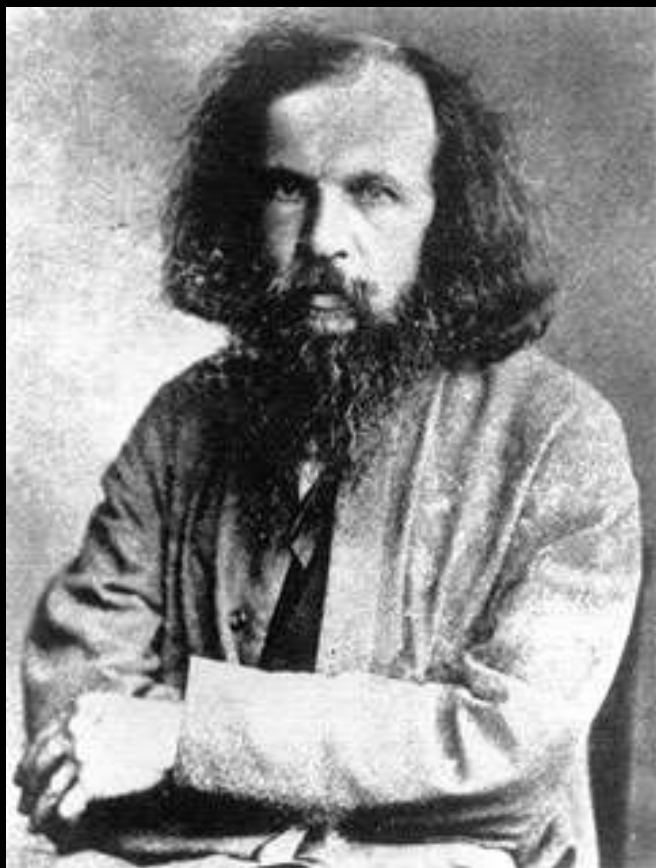
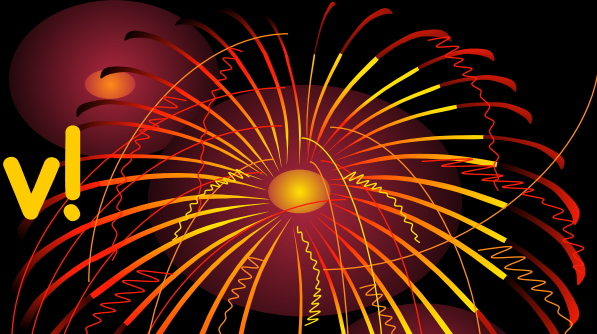
**⑩ Represented by a one or two letter symbol**

**⑩ H is hydrogen**

**⑩ Na is sodium**

**⑩ All elements are arranged on the Periodic Table of Elements**

# I am Dmitri Mendeleev!



### Periodic Table

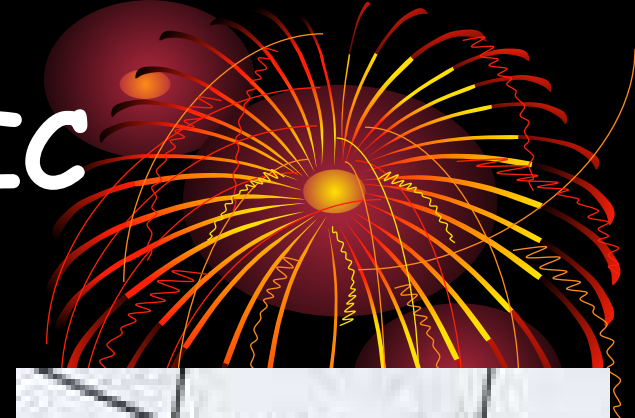
- Group numbering is based on the new IUPAC system.
- Atomic weights are based on  $^{12}\text{C} = 12$  and conform to the 1995 IUPAC reported values. Number in ( ) indicates the isotope of longest half-life.

1																	18				
H (1.00794) Hydrogen																	He (4.002602) Helium				
2																	10				
Li (6.941) Lithium	Be (9.012182) Beryllium															B (10.811) Boron	C (12.011) Carbon	N (14.00644) Nitrogen	O (15.999) Oxygen	F (18.9984032) Fluorine	Ne (20.1797) Neon
3	4	5	6	7	8	9	10	11	12									18			
Na (22.98976928) Sodium	Mg (24.304) Magnesium	Sc (44.955912) Scandium	Ti (47.867) Titanium	V (50.9415) Vanadium	Cr (51.9961) Chromium	Mn (54.938044) Manganese	Fe (55.845) Iron	Co (58.933194) Cobalt	Ni (58.6934) Nickel	Cu (63.546) Copper	Zn (65.38) Zinc	Ga (69.723) Gallium	Ge (72.630) Germanium	As (74.9216) Arsenic	Se (78.96) Selenium	Br (79.904) Bromine	Kr (83.80) Krypton				
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	36			
K (39.0983) Potassium	Ca (40.078) Calcium	Sc (44.955912) Scandium	Ti (47.867) Titanium	V (50.9415) Vanadium	Cr (51.9961) Chromium	Mn (54.938044) Manganese	Fe (55.845) Iron	Co (58.933194) Cobalt	Ni (58.6934) Nickel	Cu (63.546) Copper	Zn (65.38) Zinc	Ga (69.723) Gallium	Ge (72.630) Germanium	As (74.9216) Arsenic	Se (78.96) Selenium	Br (79.904) Bromine	Kr (83.80) Krypton				
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	54			
Rb (85.4678) Rubidium	Sr (87.62) Strontium	Y (88.905848) Yttrium	Zr (91.224) Zirconium	Nb (92.90638) Niobium	Mo (95.94) Molybdenum	Tc (98.90625) Technetium	Ru (101.07) Ruthenium	Rh (101.07) Rhodium	Pd (106.3675) Palladium	Ag (107.8682) Silver	Cd (112.411) Cadmium	In (114.818) Indium	Sn (118.710) Tin	Sb (121.757) Antimony	Te (127.603) Tellurium	I (126.90547) Iodine	Xe (131.29) Xenon				
55	56	Lanthanides		72	73	74	75	76	77	78	79	80	81	82	83	84	85	86			
Cs (132.90545196) Cesium	Ba (137.327) Barium	Lanthanides		Hf (178.49) Hafnium	Ta (180.94788) Tantalum	W (183.84) Tungsten	Re (186.207) Rhenium	Os (190.23) Osmium	Ir (192.222) Iridium	Pt (195.084) Platinum	Au (196.966569) Gold	Hg (200.59) Mercury	Tl (204.3833) Thallium	Pb (207.2) Lead	Bi (208.980389) Bismuth	Po (209) Polonium	At (210) Astatine	Rn (222) Radon			
87	88	Actinides		104	105	106	107	108	109	110	111	112	113	114	115	116	117	118			
Fr (223) Francium	Ra (226) Radium	Actinides		Rf (261) Rutherfordium	Db (262) Dubnium	Sg (263) Seaborgium	Bh (264) Bohrium	Hs (265) Hassium	Mt (266) Meitnerium	Ds (267) Darmstadtium	Rg (268) Roentgenium	Uub (269) Ununbium	Uut (270) Ununtrium	Uuq (271) Ununquadium	Uup (272) Ununpentium	Uuh (273) Ununhexium	Uus (274) Ununseptium	Uuo (276) Ununoctium			
Lanthanides		57	58	59	60	61	62	63	64	65	66	67	68	69	70	71					
Lanthanides		La (138.90547) Lanthanum	Ce (140.12) Cerium	Pr (140.90766) Praseodymium	Nd (144.24) Neodymium	Pm (145) Promethium	Sm (150.36) Samarium	Eu (151.964) Europium	Gd (157.25) Gadolinium	Tb (158.92534) Terbium	Dy (162.5) Dysprosium	Ho (164.93032) Holmium	Er (167.255) Erbium	Tm (168.93032) Thulium	Yb (173.05448) Ytterbium	Lu (174.967) Lutetium					
Actinides		89	90	91	92	93	94	95	96	97	98	99	100	101	102	103					
Actinides		Ac (227) Actinium	Th (232.037724) Thorium	Pa (231.036888) Protactinium	U (238.02891) Uranium	Np (237) Neptunium	Pu (244) Plutonium	Am (243) Americium	Cm (247) Curium	Bk (247) Berkelium	Cf (251) Californium	Es (252) Einsteinium	Fm (257) Fermium	Md (288) Mendelevium	No (289) Nobelium	Lr (260) Lawrencium					

Illustrated by Masahiko Suenaga  
<http://www1.bbq.jp/zzz/fst/>

# I made the PERIODIC TABLE !

# What is the PERIODIC TABLE?



- Shows all known elements in the universe.
- Organizes the elements by chemical properties.

6	C	7
Carbon		N
12.011		Nitrogen
14	Si	15



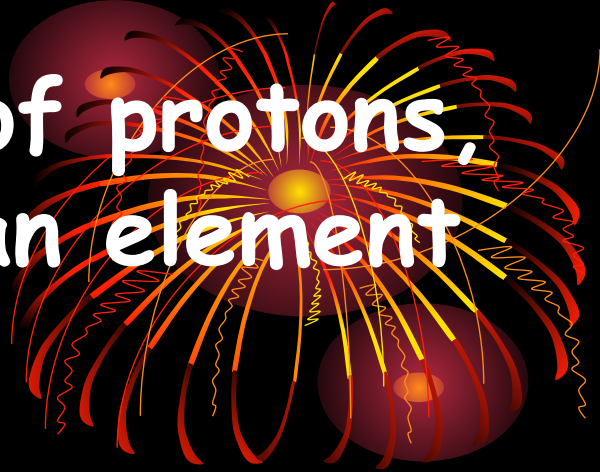
# How do you read the PERIODIC TABLE?



6
<b>C</b>
Carbon
12.01

- Atomic number
- Symbol
- Name
- Atomic Weight

How do I find the number of protons, electrons, and neutrons in an element using the periodic table?

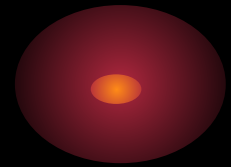
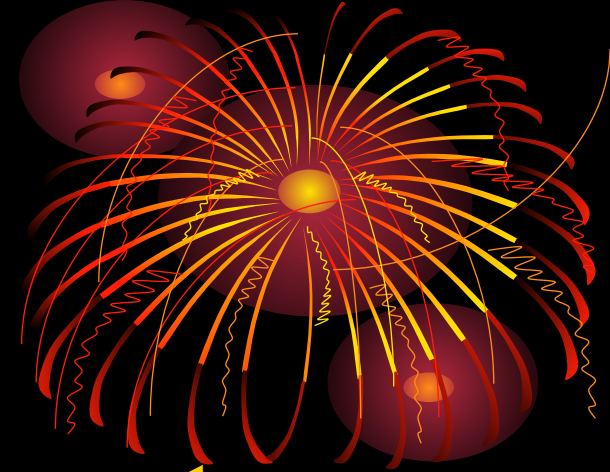


□ # of PROTONS = ATOMIC NUMBER



□ # of ELECTRONS = ATOMIC NUMBER

□ # of NEUTRONS = ATOMIC WEIGHT - ATOMIC NUMBER

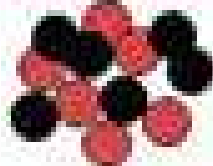
# Isotopes




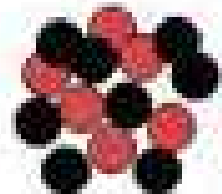
⑩ **Atoms of the same element with different numbers of neutrons**

 = Proton  
 = Neutron

$\begin{matrix} A \\ Z \end{matrix} C$

$\begin{matrix} 12 \\ 6 \end{matrix} C$  

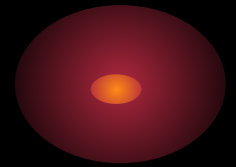
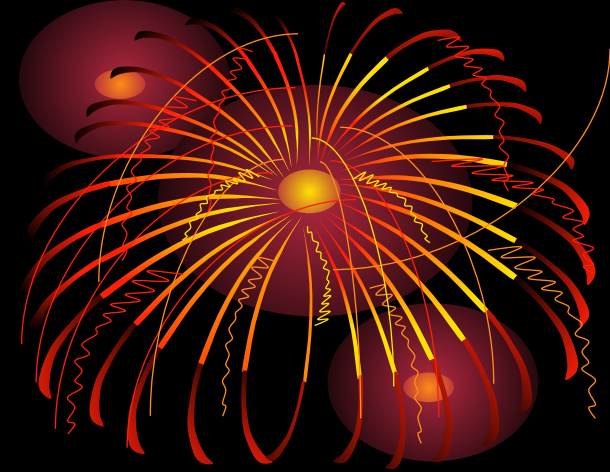
$\begin{matrix} 13 \\ 6 \end{matrix} C$  

$\begin{matrix} 14 \\ 6 \end{matrix} C$  

Z = Protons  
A = Mass Number  
A = Protons + Neutrons

# Isotopes

- ⑩ Some are radioactive
- ⑩ The nuclei are unstable and break down at a constant rate
- ⑩ Carbon dating
- ⑩ Medical procedures



# Chemical Compounds



**⑩ A substance formed by the chemical combination of two or more elements**

**⑩  $\text{H}_2\text{O}$**

**⑩  $\text{NaCl}$**

**⑩ Physical and chemical properties of the compound are very different from the individual elements**

*DIE*  
*ANOTHER*  
*DAY*

A promotional image for the movie 'Die Another Day' featuring James Bond. He is shown from the chest up, wearing a dark suit, white shirt, and dark tie. He is holding a handgun in his right hand, looking off to the side with a serious expression. The background is a plain, light-colored wall.

# Chemical Bonds

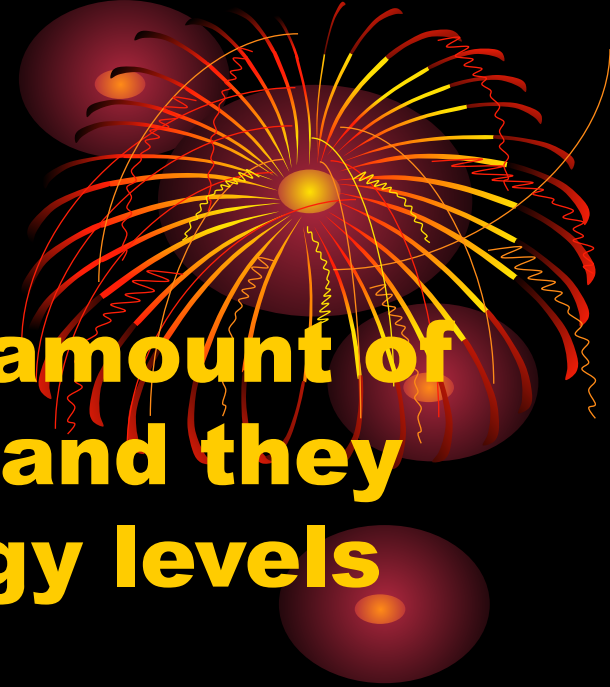
M16.CO.UK

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# Electron Shells

**Electrons vary in the amount of energy they possess, and they occur at certain energy levels or electron shells.**

**Electron shells determine how an atom behaves when it encounters other atoms**



Electrons are placed in shells according to rules:

**The 1st shell can hold up to two electrons, and each shell thereafter can hold up to 8 electrons.**

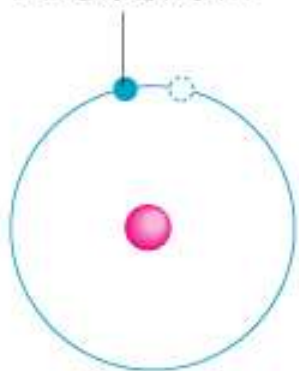




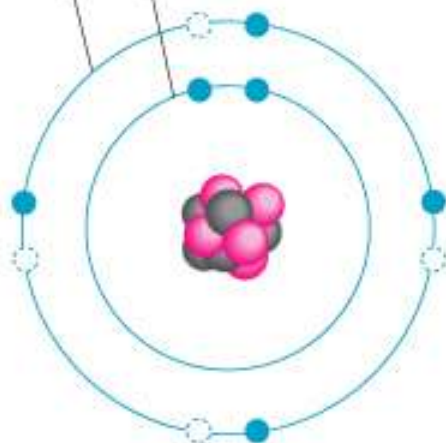
**Outermost electron shell (can hold 8 electrons)**

**First electron shell (can hold 2 electrons)**

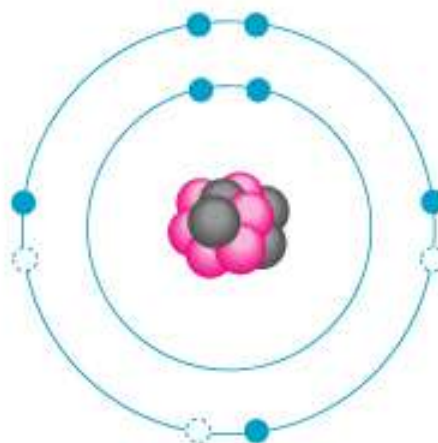
**Electron**



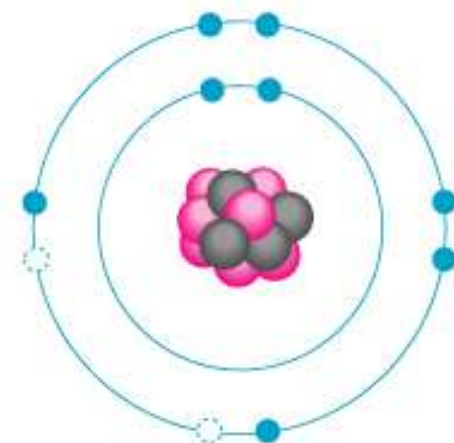
**HYDROGEN (H)**  
**Atomic number**  
**= 1**



**CARBON (C)**  
**Atomic number**  
**= 6**



**NITROGEN (N)**  
**Atomic number**  
**= 7**



**OXYGEN (O)**  
**Atomic number**  
**= 8**

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**Octet Rule = atoms tend to gain, lose or share electrons so as to have 8 electrons**

**C would like to**

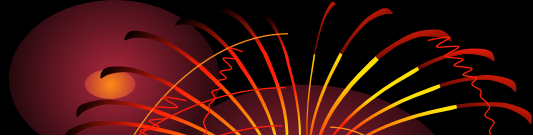
**Gain 4 electrons**












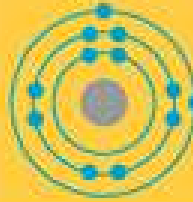
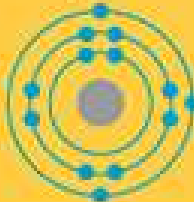

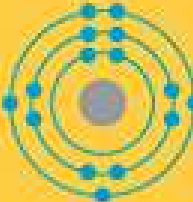

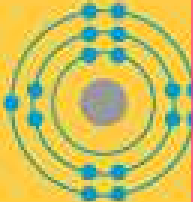
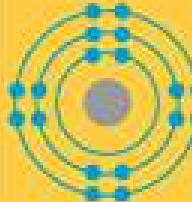
**N would like to**

**Gain 3 electrons**

**O would like to**

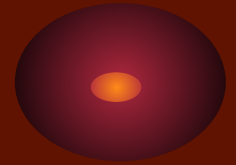
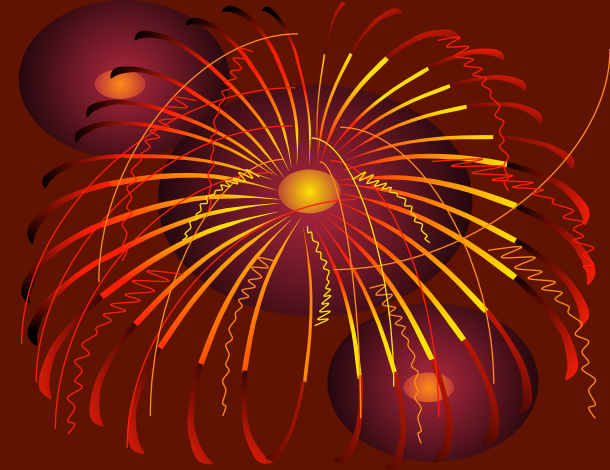
**Gain 2 electrons**

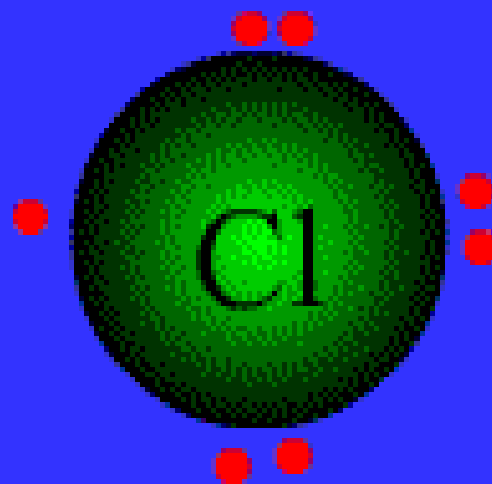


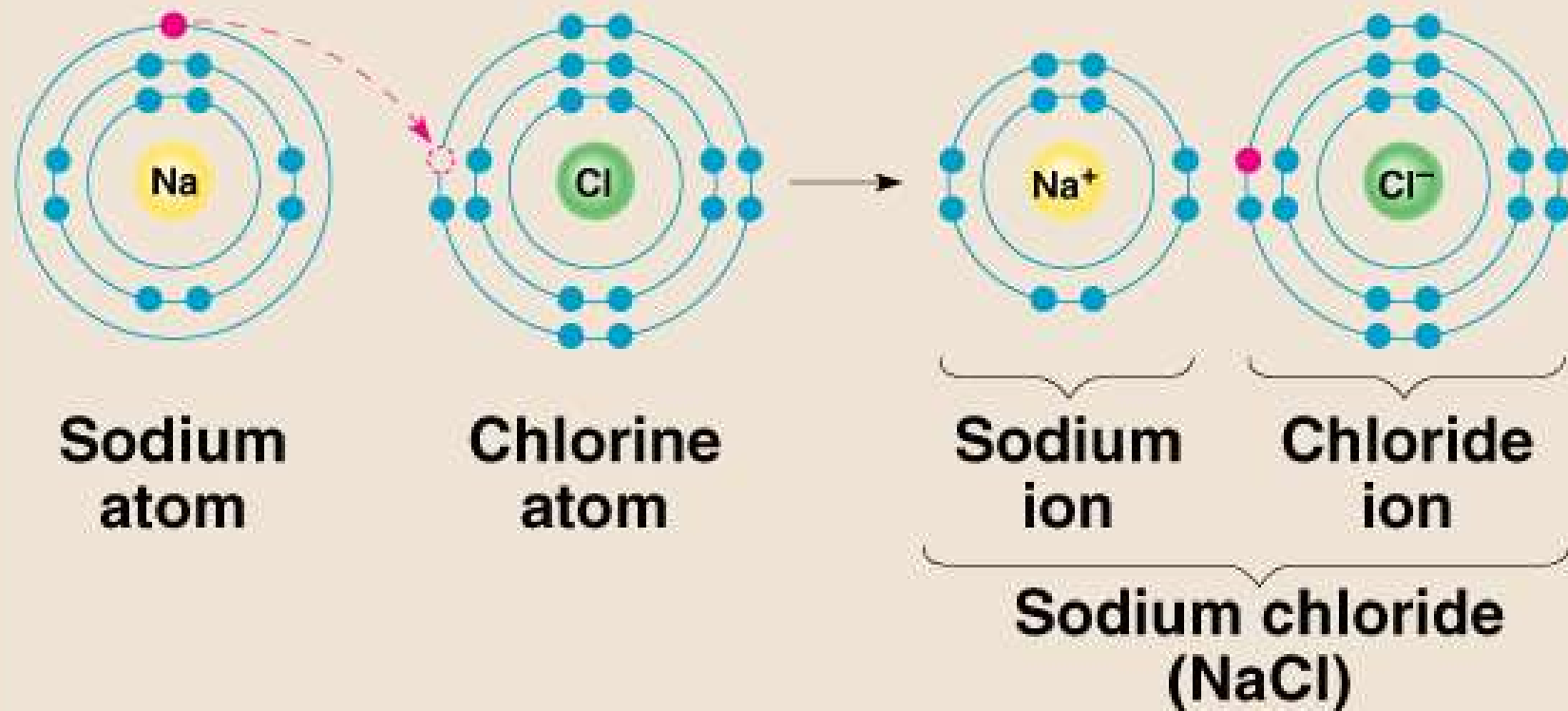
<b>FIRST SHELL</b>	<b>Hydrogen</b> ${}_{1}\text{H}$ 							<b>Helium</b> ${}_{2}\text{He}$ 
<b>SECOND SHELL</b>	<b>Lithium</b> ${}_{3}\text{Li}$ 	<b>Beryllium</b> ${}_{4}\text{Be}$ 	<b>Boron</b> ${}_{5}\text{B}$ 	<b>Carbon</b> ${}_{6}\text{C}$ 	<b>Nitrogen</b> ${}_{7}\text{N}$ 	<b>Oxygen</b> ${}_{8}\text{O}$ 	<b>Fluorine</b> ${}_{9}\text{F}$ 	<b>Neon</b> ${}_{10}\text{Ne}$ 
<b>THIRD SHELL</b>	<b>Sodium</b> ${}_{11}\text{Na}$ 	<b>Magnesium</b> ${}_{12}\text{Mg}$ 	<b>Aluminum</b> ${}_{13}\text{Al}$ 	<b>Silicon</b> ${}_{14}\text{Si}$ 	<b>Phosphorus</b> ${}_{15}\text{P}$ 	<b>Sulfur</b> ${}_{16}\text{S}$ 	<b>Chlorine</b> ${}_{17}\text{Cl}$ 	<b>Argon</b> ${}_{18}\text{Ar}$ 

# IONIC BOND

**bond formed between  
two ions by the  
*transfer* of electrons**







1). Ionic bond – electron from Na is transferred to Cl, this causes a charge imbalance in each atom. The Na becomes (Na<sup>+</sup>) and the Cl becomes (Cl<sup>-</sup>), charged particles or ions.

# COVALENT BOND

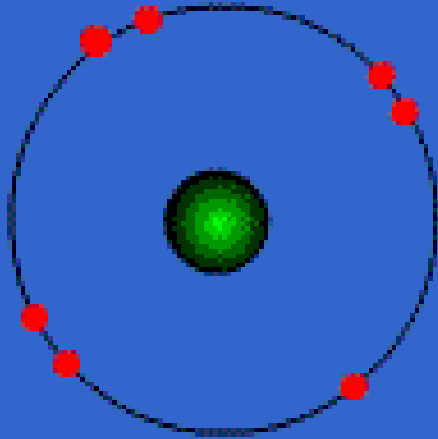
bond formed by the *sharing* of electrons



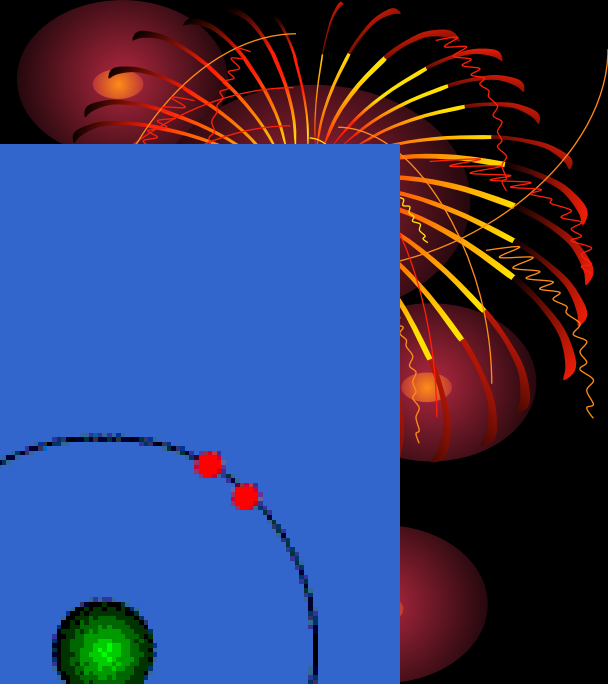
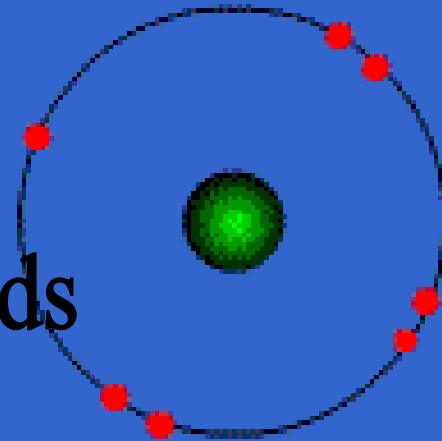
# Covalent Bond



- ⑩ **Between nonmetallic elements of similar electronegativity.**
- ⑩ **Formed by sharing electron pairs**
- ⑩ **Examples; O<sub>2</sub>, CO<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>, H<sub>2</sub>O, SiC**



# Covalent Bonds

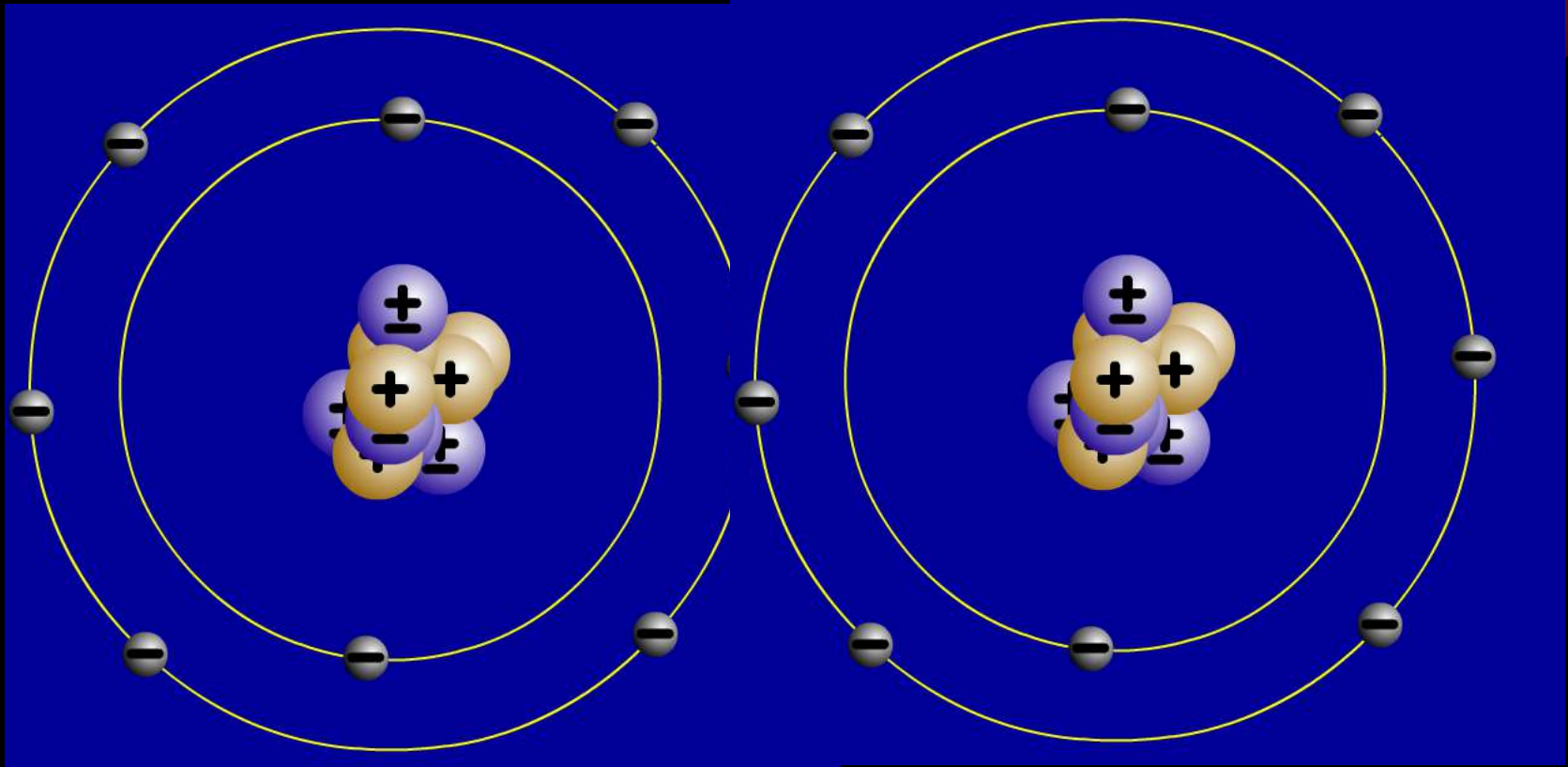




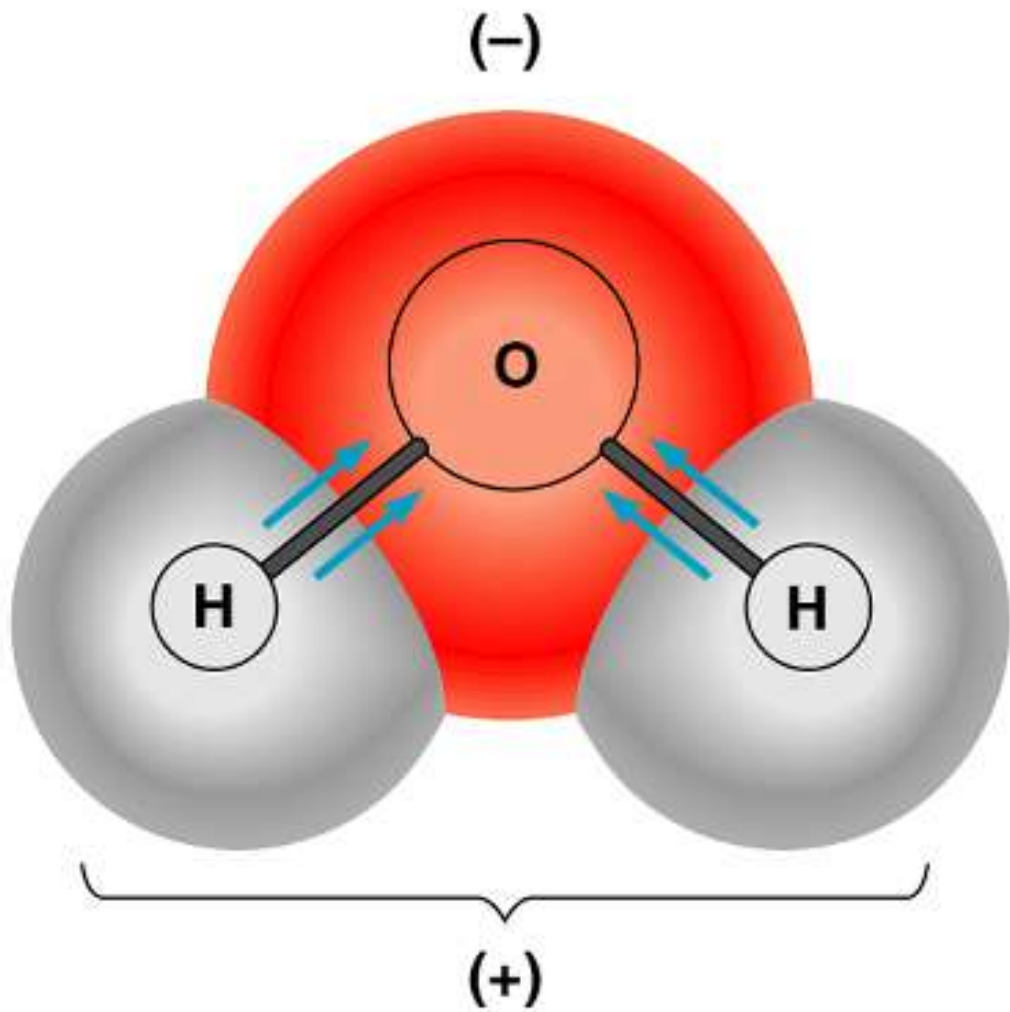
## 2. Covalent bonds- Two atoms share one or more pairs of outer-shell electrons.

Oxygen Atom

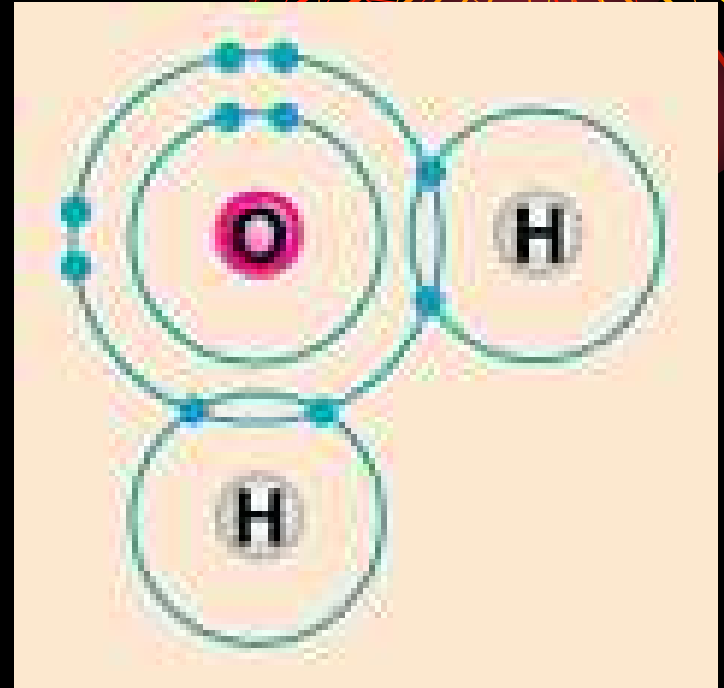
Oxygen Atom



Oxygen Molecule ( $O_2$ )

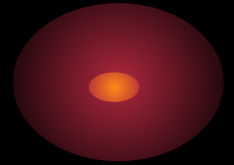
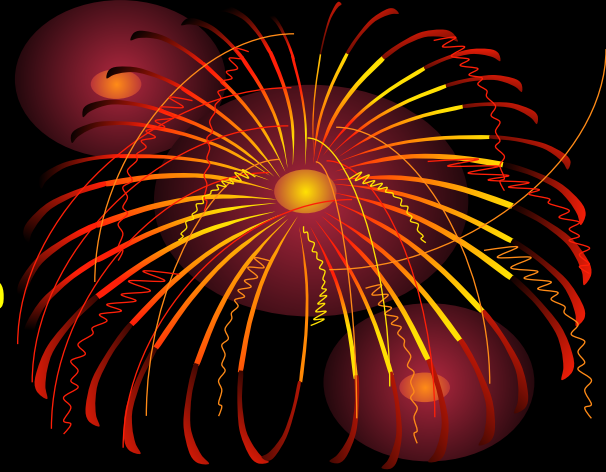


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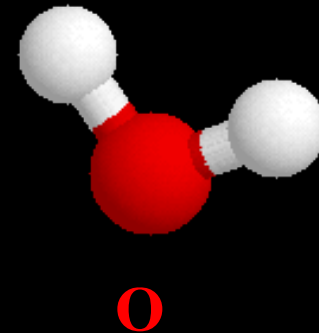
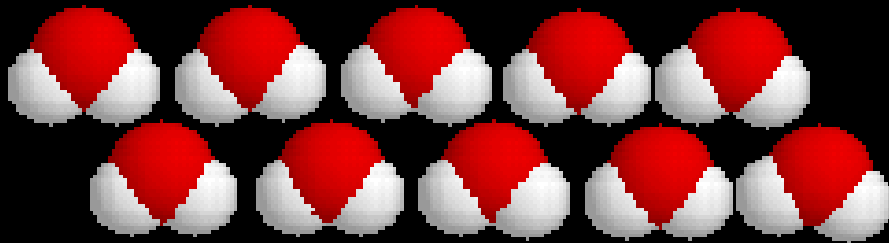
- water is a *polar molecule* because oxygen is more electronegative than hydrogen, and therefore electrons are pulled closer to oxygen.

# The Extraordinary Properties of Water



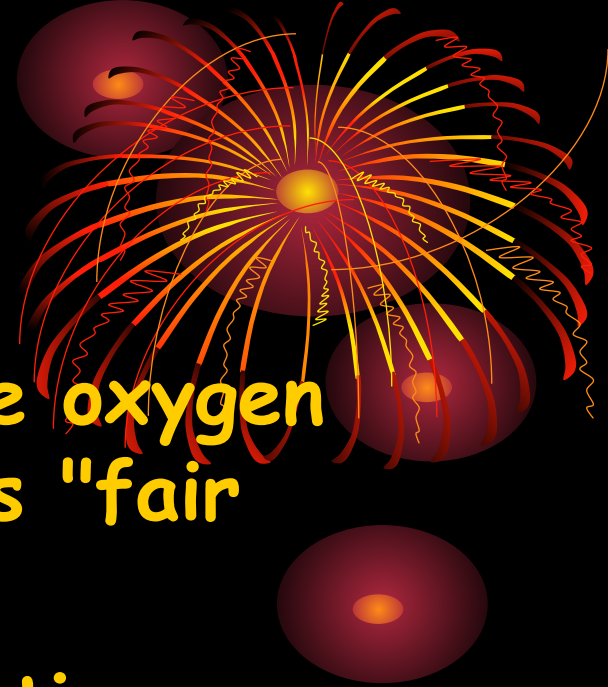
# Water

10 A water molecule ( $H_2O$ ), is made up of three atoms --- one oxygen and two hydrogen.



# Water is Polar

- ⑩ In each water molecule, the oxygen atom attracts more than its "fair share" of electrons
- ⑩ The oxygen end "acts" negative
- ⑩ The hydrogen end "acts" positive
- ⑩ Causes the water to be POLAR
- ⑩ However, Water is neutral (equal number of  $e^-$  and  $p^+$ ) --- Zero Net Charge

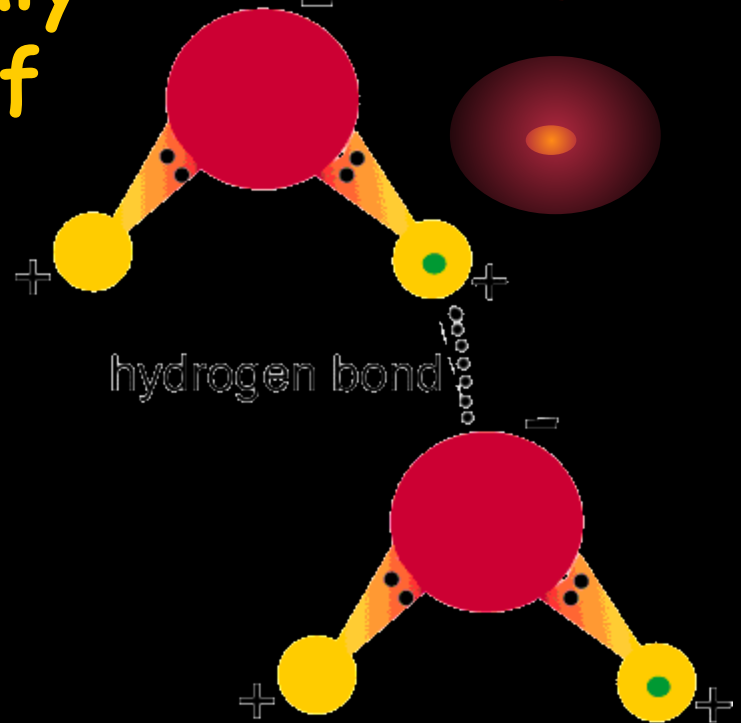


# Hydrogen Bonds Exist Between Water Molecules



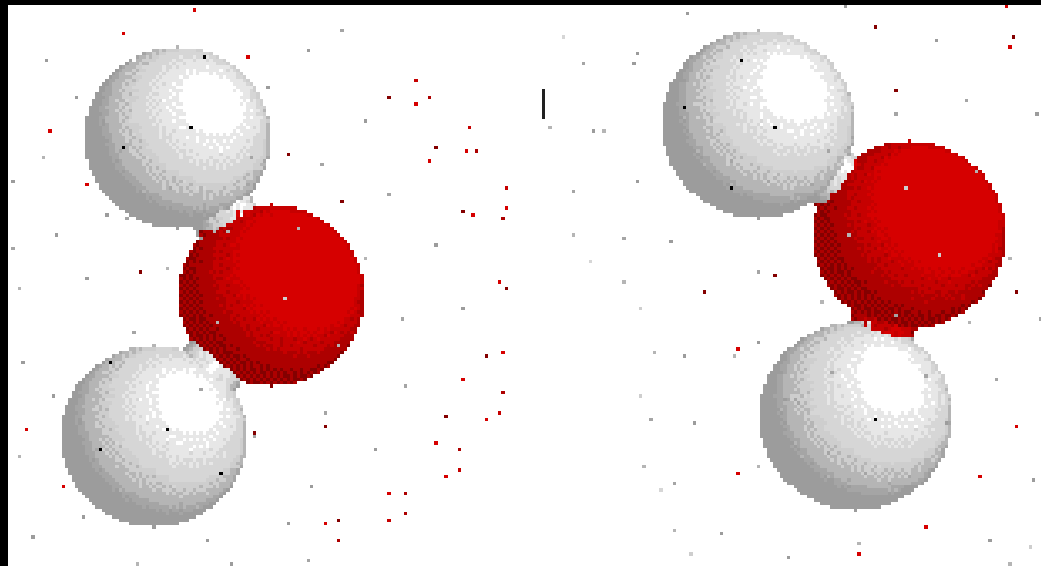
⑩ Formed between a highly **Electronegative atom** of a polar molecule and a **Hydrogen**

⑩ One hydrogen bond is **weak** but **many** hydrogen bonds are **strong**

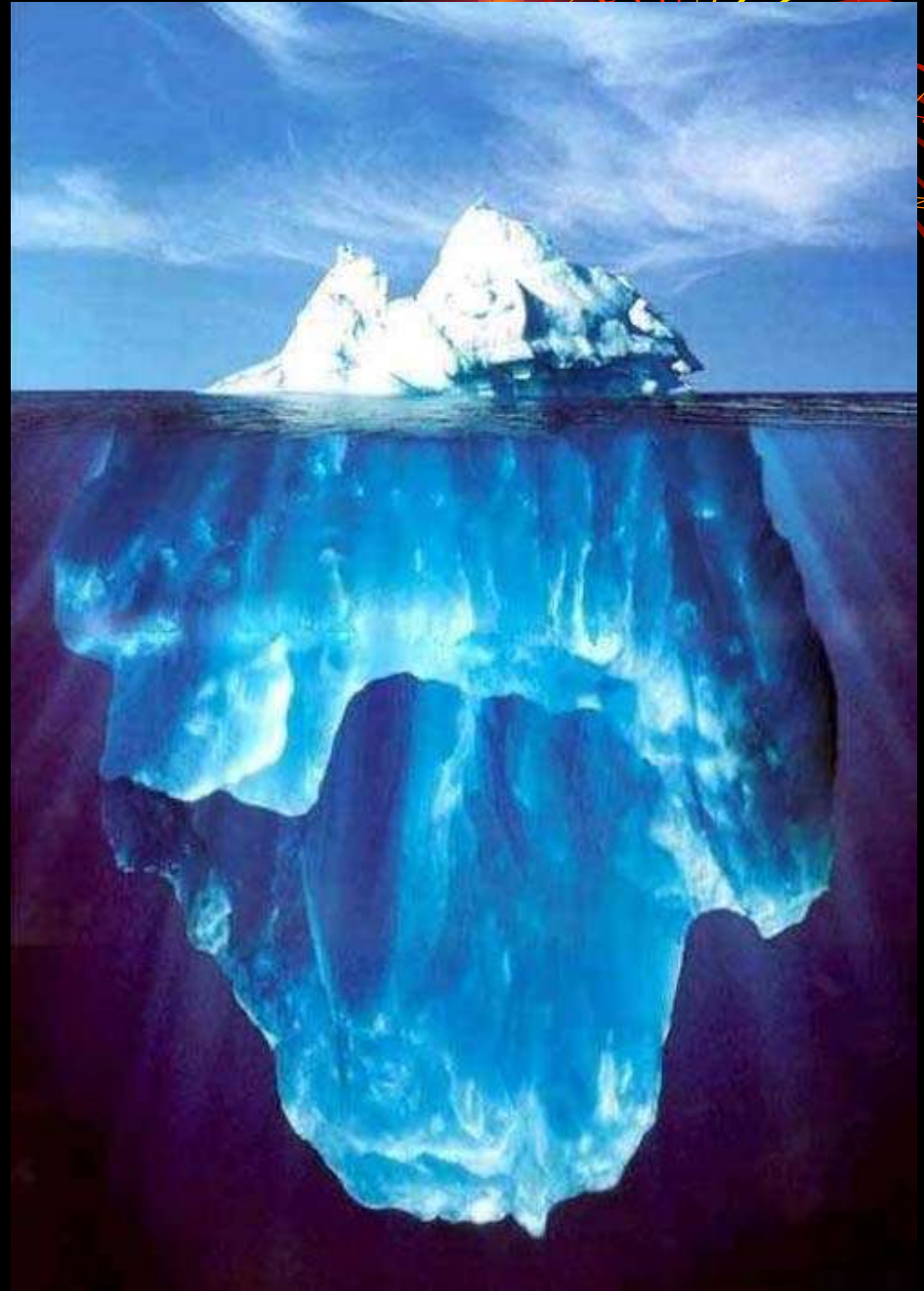


# Interaction Between Water Molecules

Negative Oxygen end of one water molecule is attracted to the Positive Hydrogen end of another water molecule to form a **HYDROGEN BOND**



# What are the Properties of Water?



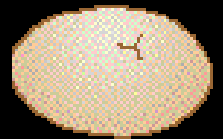
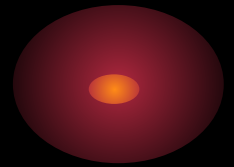


# Properties of Water

⑩ At sea level, pure water boils at 100 °C and freezes at 0 °C

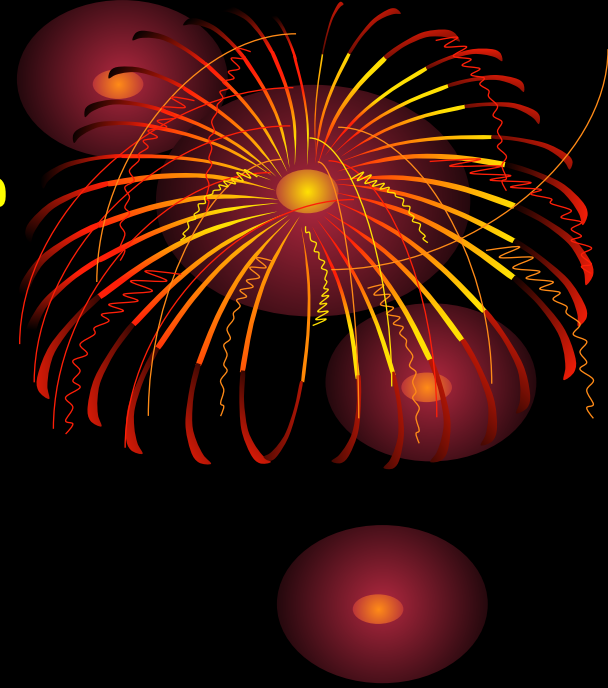
⑩ The boiling temperature of water decreases at higher elevations (lower atmospheric pressure).

⑩ For this reason, an egg will take longer to boil at higher altitudes



# Properties of Water

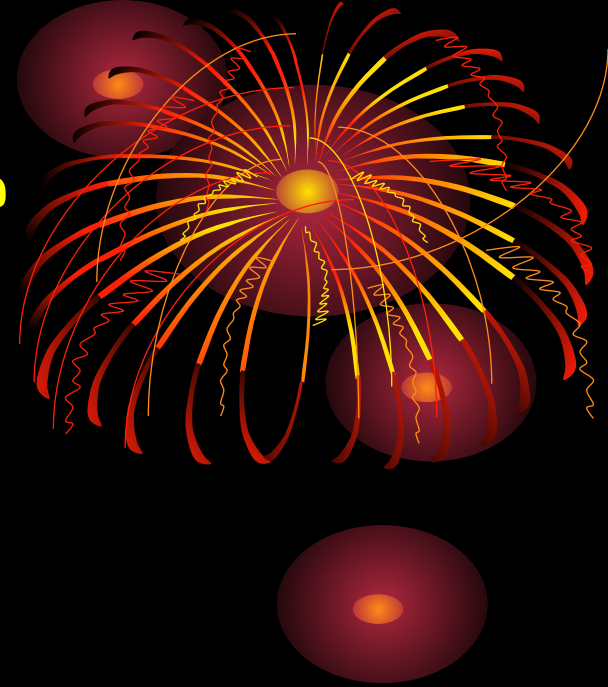
## 10 Cohesion



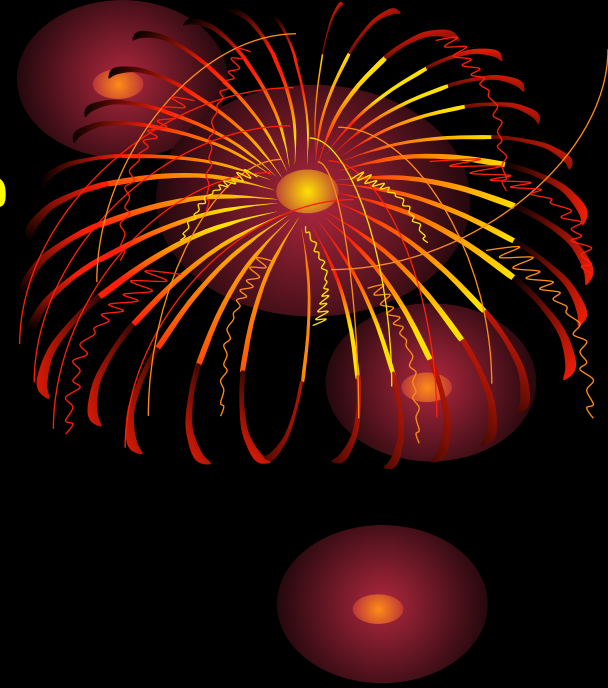
# Properties of Water

10 Cohesion

10 Adhesion



# Properties of Water

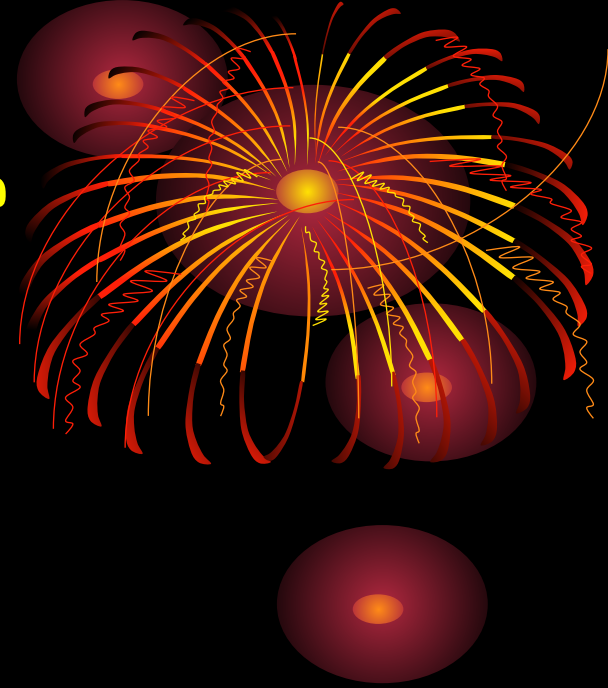


10 Cohesion

10 Adhesion

10 High Specific Heat

# Properties of Water



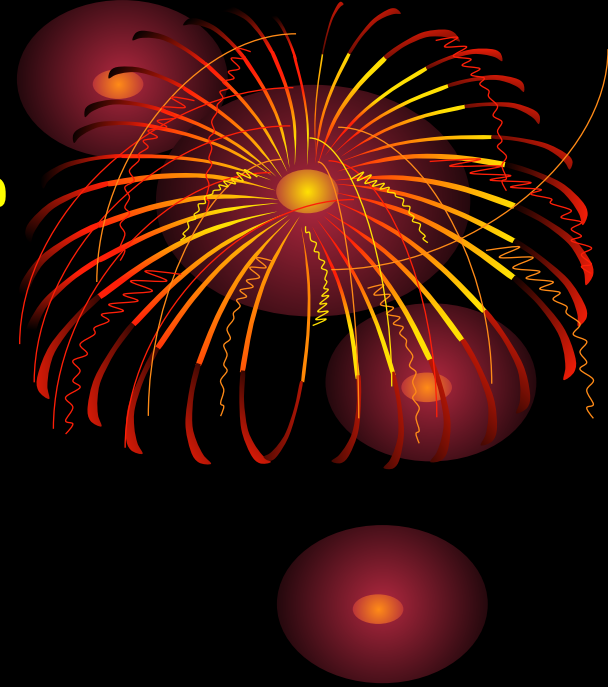
10 Cohesion

10 Adhesion

10 High Specific Heat

10 High Heat of Vaporization

# Properties of Water



10 Cohesion

10 Adhesion

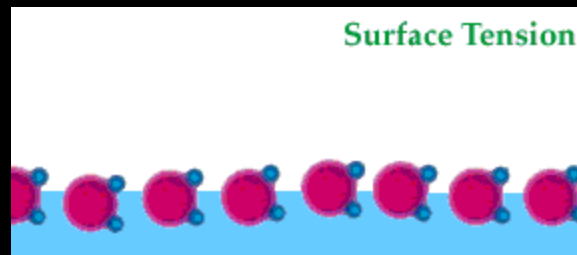
10 High Specific Heat

10 High Heat of Vaporization

10 Less Dense as a Solid

# Cohesion

- ⑩ Attraction between particles of the same substance ( why water is attracted to itself)
- ⑩ Results in Surface tension (a measure of the strength of water's surface)
- ⑩ Produces a surface film on water that allows insects to walk on the surface of water



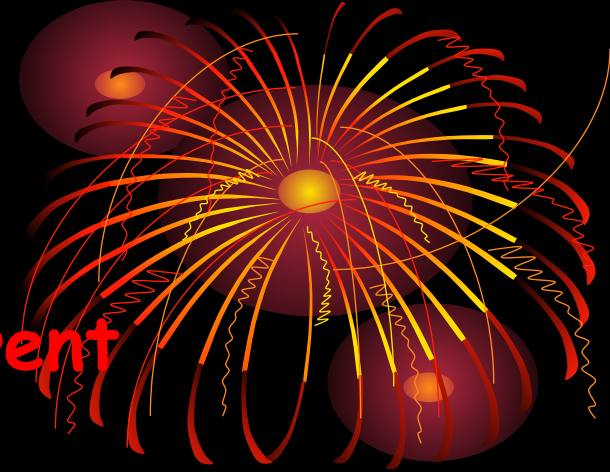
# Cohesion ...



Helps insects walk across water



# Adhesion



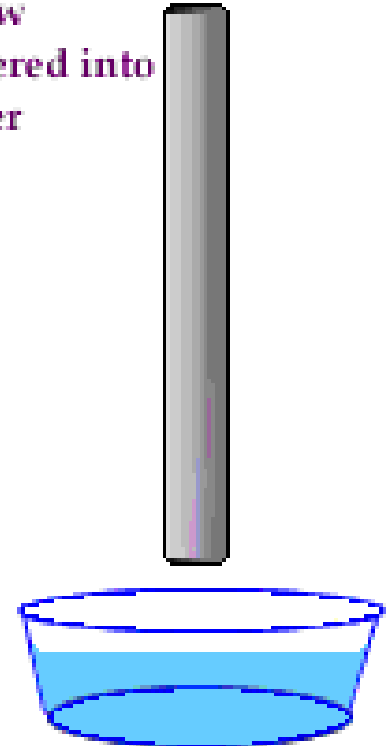
- ⑩ **Attraction between two different substances**
- ⑩ Water will make **hydrogen bonds with other surfaces** such as glass, soil, plant tissues, and cotton.
- ⑩ **Capillary** action-water molecules will “tow” each other along when in a thin glass tube.
- ⑩ Example: **transpiration** process which plants and trees remove water from the soil, and paper towels soak up water.

# Adhesion Causes Capillary Action

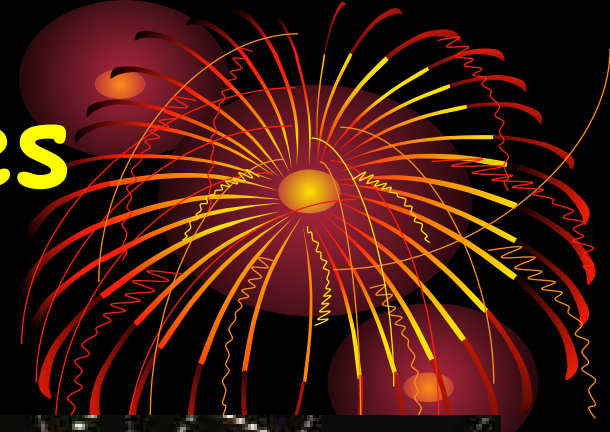
Which gives water the ability to "climb" structures

## Capillary Action

Straw lowered into water



# Adhesion Also Causes Water to ...



Form spheres &  
hold onto plant  
leaves



Attach to a  
silken spider  
web

# High Specific Heat

⑩ Amount of heat needed to raise or lower 1g of a substance 1° C

⑩ Water resists temperature change both for heating and cooling.

⑩ Water can absorb or release large amounts of heat energy with little change in actual temperature.



# High Heat of Vaporization



⑩ Amount of energy to convert 1g or a substance from a **liquid to a gas**

⑩ In order for water to evaporate, **hydrogen bonds must be broken**

⑩ **As water evaporates** it removes a lot of **heat** with it.

# High Heat of Vaporization



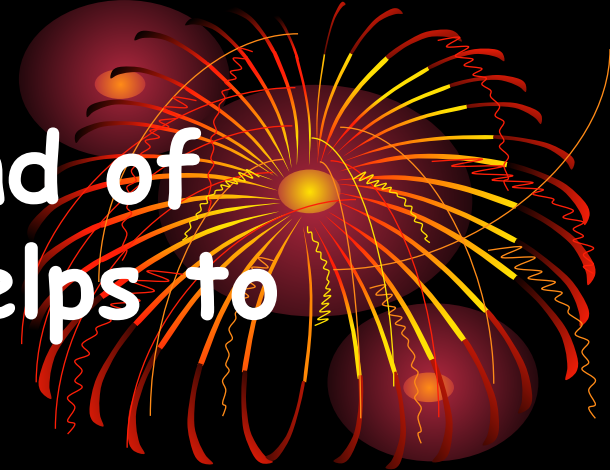
⑩ Water's heat of vaporization is 540 cal/g.

⑩ In order for water to **evaporate** each gram must **GAIN 540** calories (temperature doesn't change --- 100°C).

⑩ **As water evaporates** it removes a lot of **heat** with it (**cooling effect**)

⑩ **Water vapor** forms a kind of global "blanket" which helps to keep the **Earth warm**

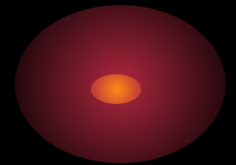
⑩ **Heat radiated from the sun** warmed surface of the earth is **absorbed and held by the vapor**



# Water is Less Dense as a Solid



⑩ Ice is less dense as a solid than as a liquid (ice floats)



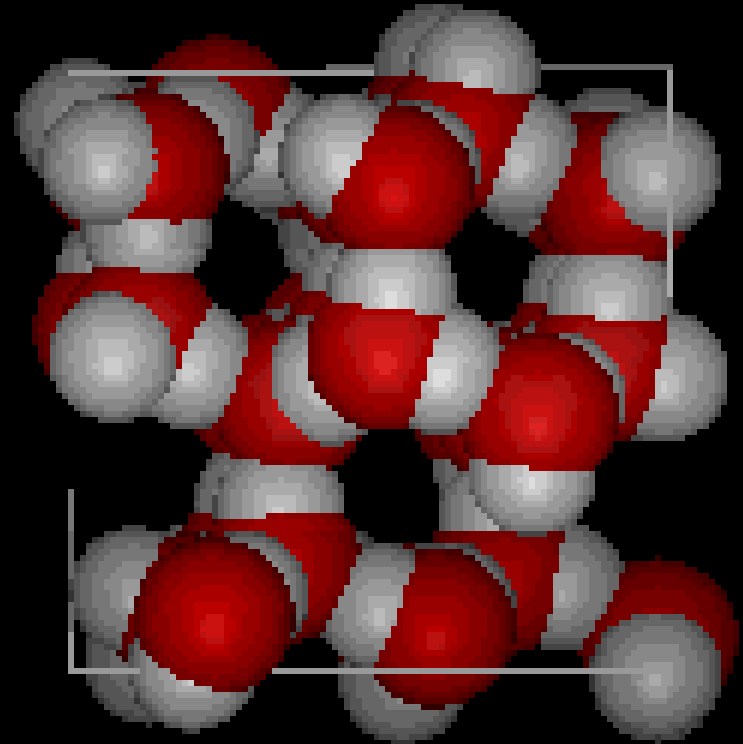
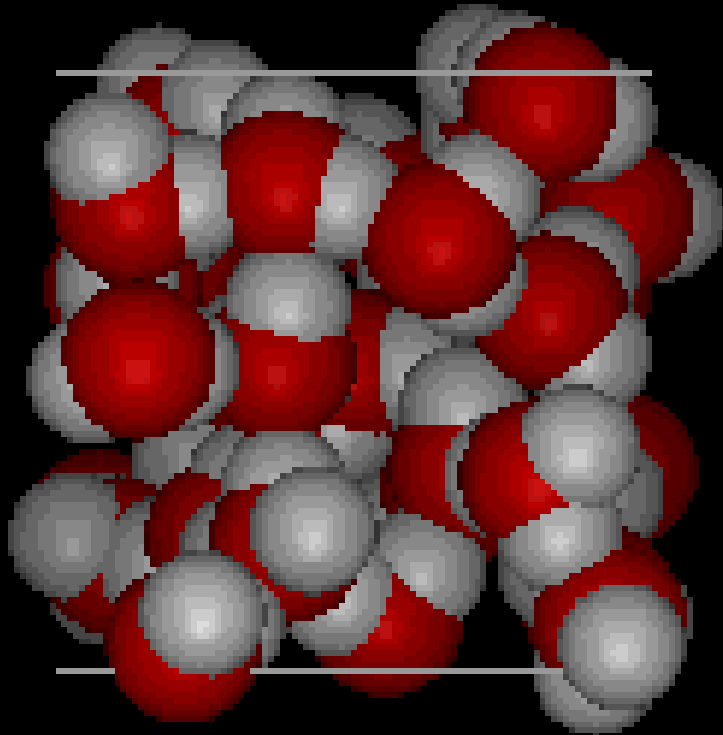
⑩ Liquid water has hydrogen bonds that are constantly being broken and reformed.

⑩ Frozen water forms a crystal-like lattice whereby molecules are set at fixed distances.



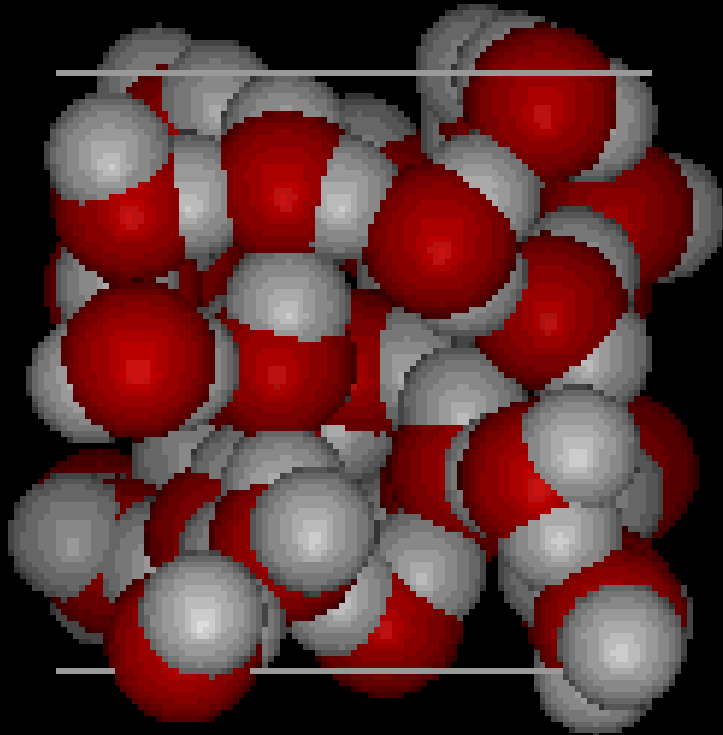
# Water is Less Dense as a Solid

- Which is ice and which is water?

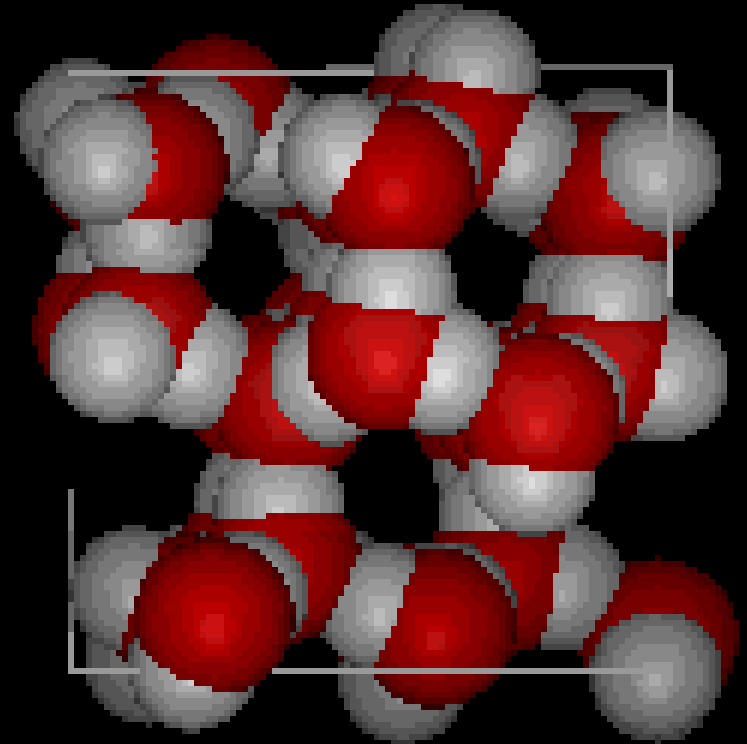


# Water is Less Dense as a Solid

Water



Ice

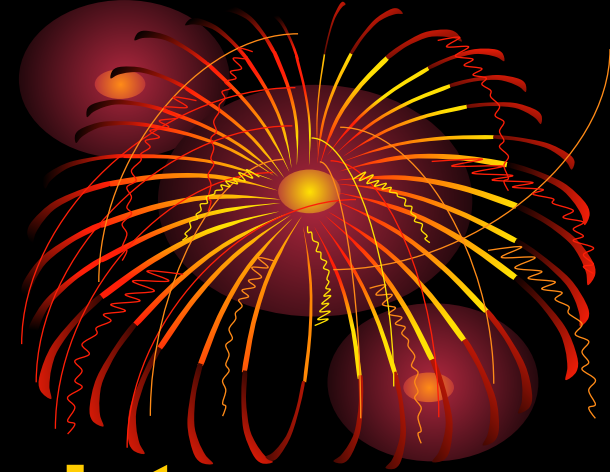


# Homeostasis

- ⑩ Ability to maintain a **steady state** despite changing conditions
- ⑩ Water is important to this process because:
  - a. Makes a **good insulator**
  - b. Resists temperature change
  - c. **Universal solvent**
  - d. Coolant
  - e. Ice protects against temperature extremes (**insulates** frozen lakes)



# Learning Target



**⑩ I can review basic chemistry properties and characteristics:**

**⑩ Atoms**

**⑩ Subatomic particles**

**⑩ Ions**

**⑩ Chemical bonding**

**⑩ Water**

**⑩ pH scale**

# Learning Targets



**10** I can explain the fundamental principles of the pH scale and the consequences of having the different concentrations of hydrogen and hydroxide ions.

# Solutions & Suspensions



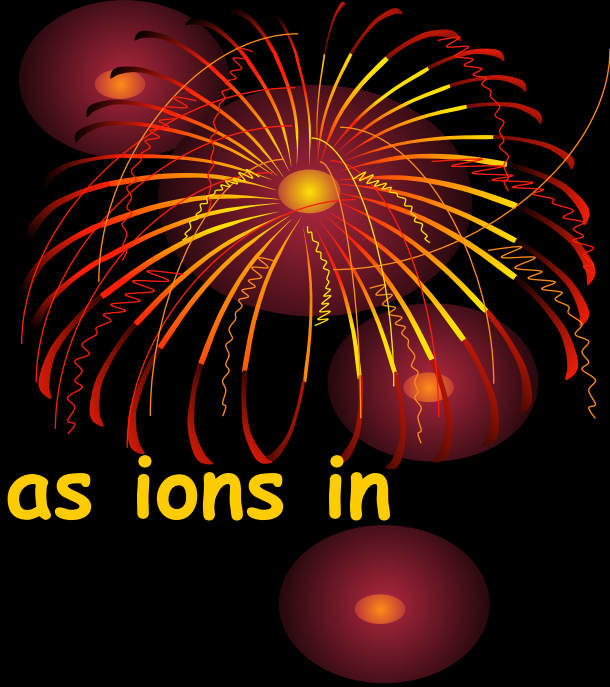
⑩ Water is usually part of a **mixture.**

⑩ There are two types of mixtures:

⑩ **Solutions**

⑩ **Suspensions**

# Solution



⑩ Ionic compounds disperse as ions in water

⑩ Evenly distributed

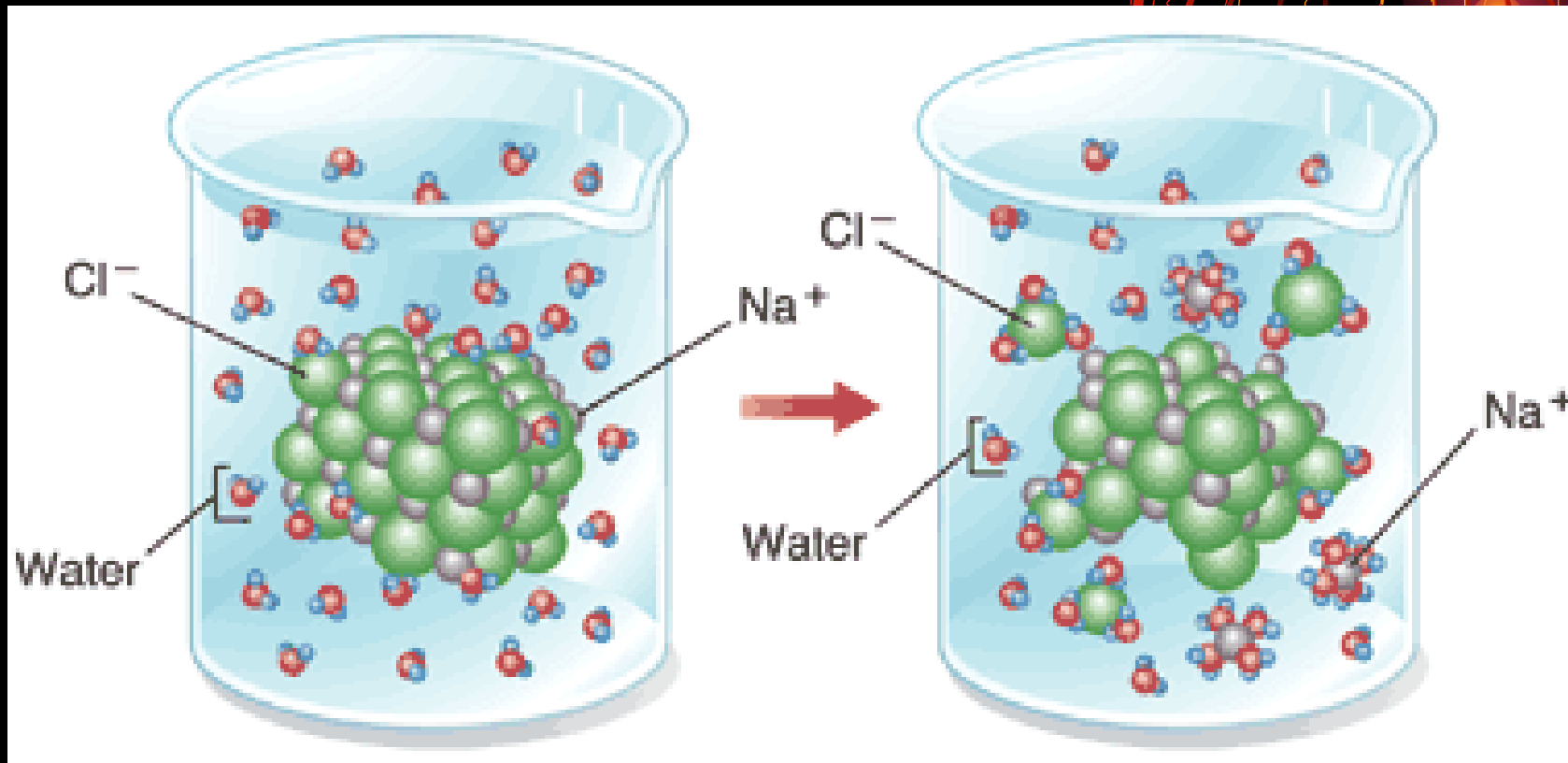
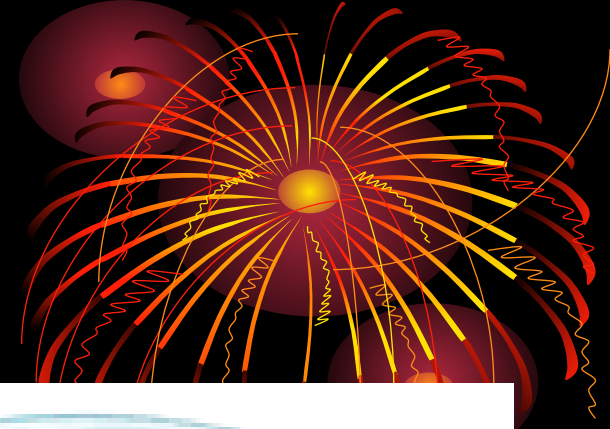
⑩ **SOLUTE**

⑩ Substance that is being dissolved

⑩ **SOLVENT**

⑩ Substance into which the solute dissolves

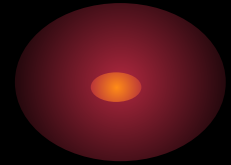
# Solution





# Suspensions

- ⑩ Substances that don't dissolve but separate into tiny pieces.
- ⑩ Water keeps the pieces suspended so they don't settle out.



# Acids, Bases and pH

One water molecule in 550 million naturally dissociates into a Hydrogen Ion ( $H^+$ ) and a Hydroxide Ion ( $OH^-$ )



Hydrogen Ion  
Acid

Hydroxide Ion  
Base

# The pH Scale

⑩ Indicates the concentration of  $H^+$  ions

⑩ Ranges from 0 - 14

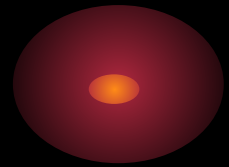
⑩ pH of 7 is neutral

⑩ pH 0 up to 7 is acid ...  $H^+$

⑩ pH above 7 - 14 is basic...  $OH^-$

⑩ Each pH unit represents a factor of 10X change in concentration

⑩ pH 3 is  $10 \times 10 \times 10$  (1000) stronger than a pH of 6

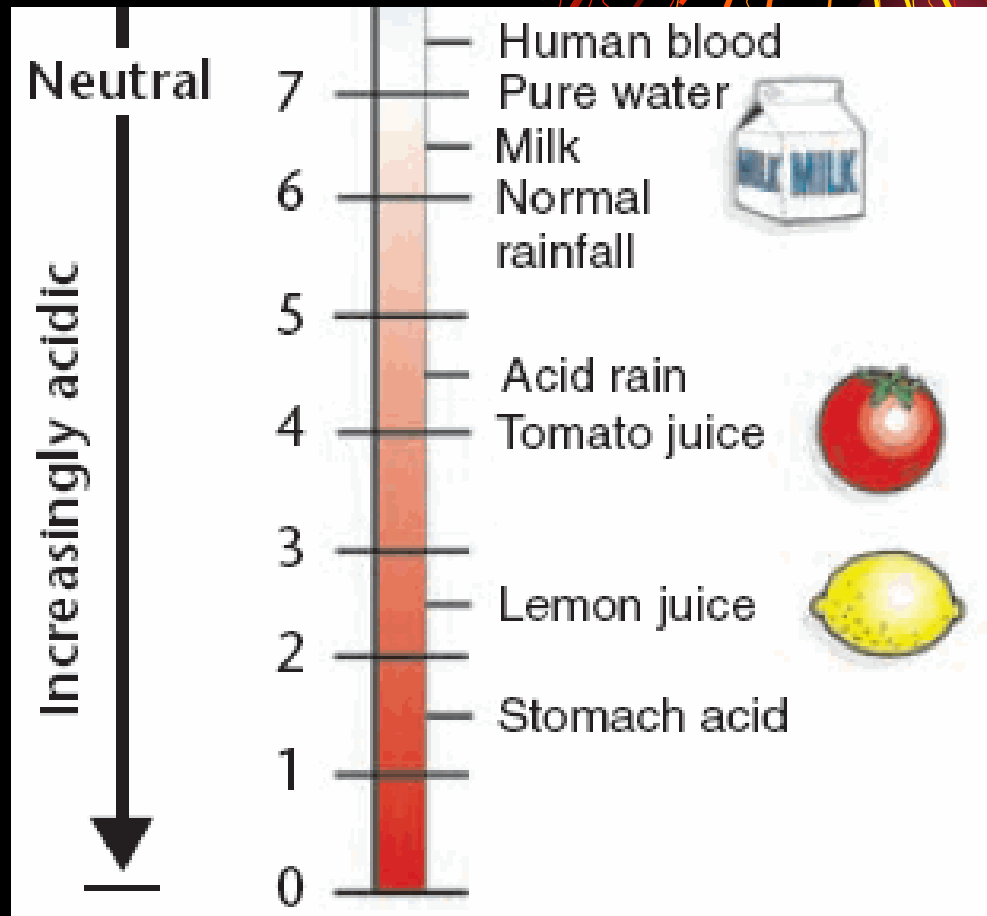


# Acids

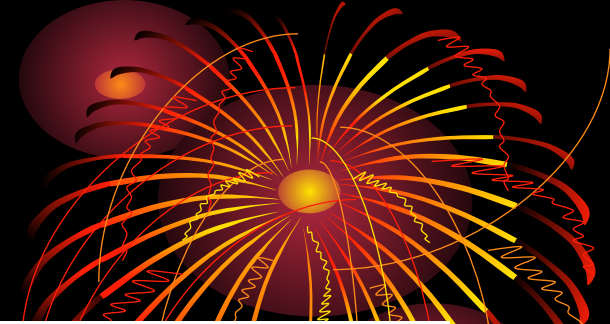
10 Strong Acids

have a pH of 1-3

10 Produce lots of  $H^+$  ions

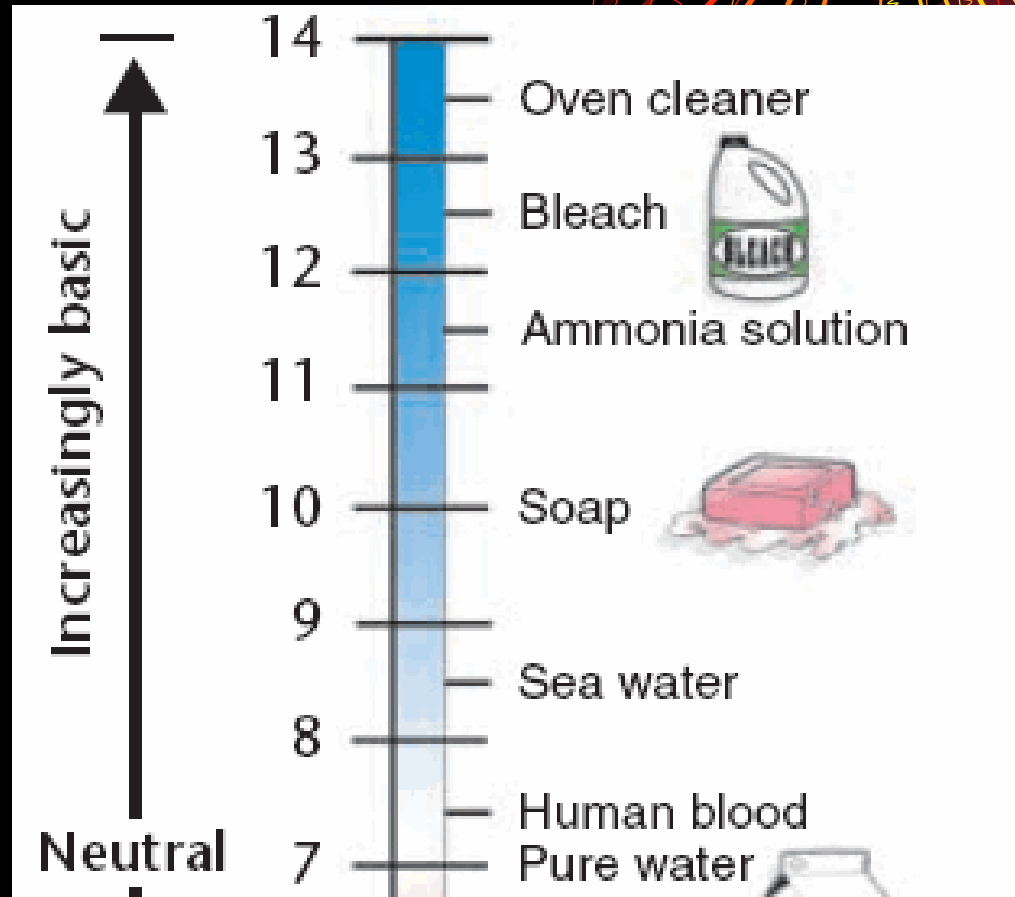


# Bases



⑩ **Strong Bases** have a pH of **11 to 14**

⑩ **Contain lots of OH<sup>-</sup> ions and fewer H<sup>+</sup> ions**



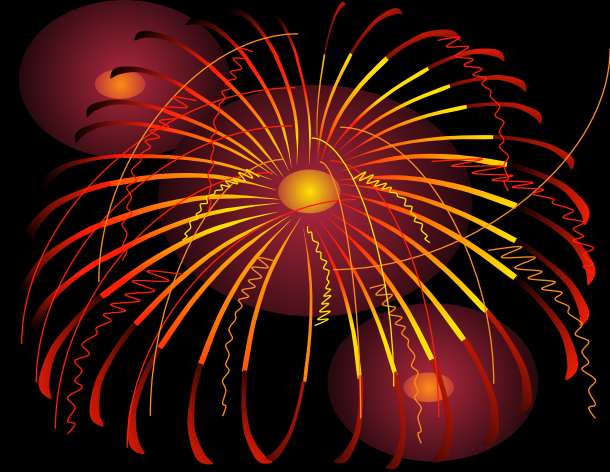
# Buffers

⑩ Weak acids or bases that react with strong acids or bases to prevent sharp, sudden changes in pH (neutralization).

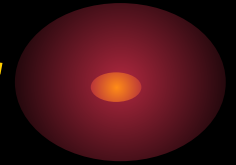
⑩ Produced naturally by the body to maintain homeostasis



# Learning Targets



**10** I can explain the fundamental principles of the pH scale and the consequences of having the different concentrations of hydrogen and hydroxide ions.



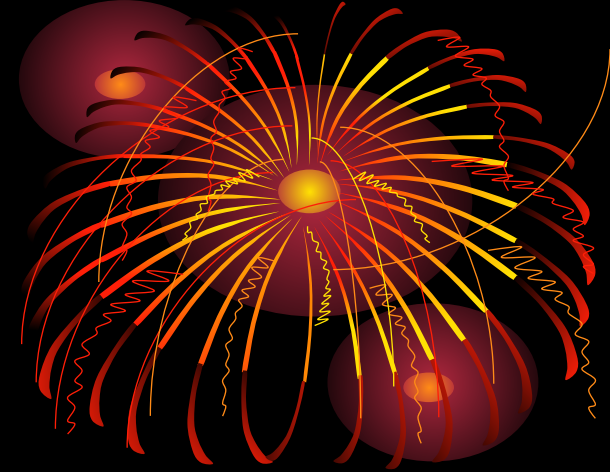
# Learning Targets



**10** I can describe the general structure and function including common functional groups of monosaccharides, disaccharides, polysaccharides, carbohydrates, fatty acids, glycerol, lipids, amino acids, dipeptides, polypeptides, proteins and nucleic acids.



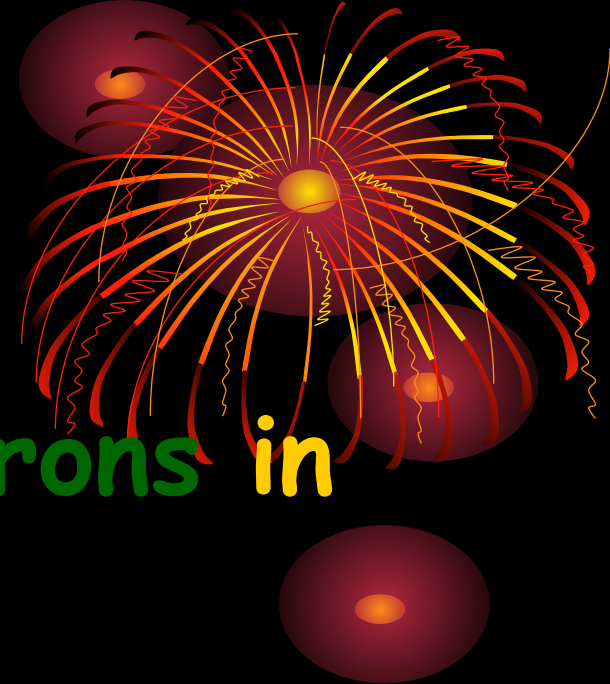
# Carbon Compounds



10 Compounds that contain **CARBON** are called organic.

10 **Macromolecules** are large organic molecules.

# Carbon (C)



10 Carbon has 4 electrons in outer shell.

10 Carbon can form covalent bonds with as many as 4 other atoms (elements).

10 Usually with C, H, O or N.

# Macromolecules



⑩ Large organic molecules.

⑩ Also called **POLYMERS**.

⑩ Made up of smaller "building blocks" called **MONOMERS**.

⑩ **Examples:**

1. Carbohydrates

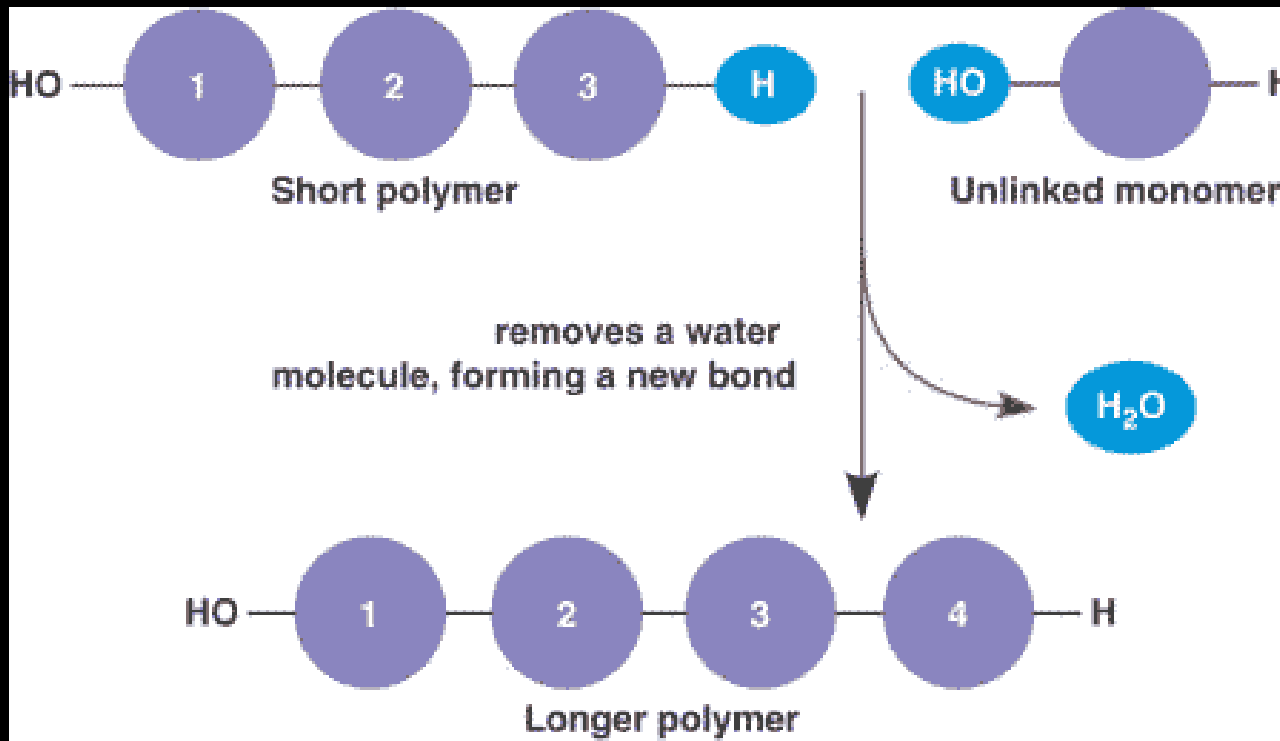
2. Lipids

3. Proteins

4. Nucleic acids (DNA and RNA)

# How are macromolecules made?

⑩ **Condensation (dehydration)** reactions are reactions that remove a molecule of water from two monomers to make a larger polymer



# Carbohydrates



# Carbohydrate Functions



⑩ Provide energy for cells and organisms

⑩ Provide structure to cells, especially plant cells

# Carbohydrates



10 Small sugar molecules to large sugar molecules.

10 Examples:

A. monosaccharide

B. disaccharide

C. polysaccharide

# Carbohydrates

Monosaccharide: one sugar unit

Examples: glucose ( $C_6H_{12}O_6$ )

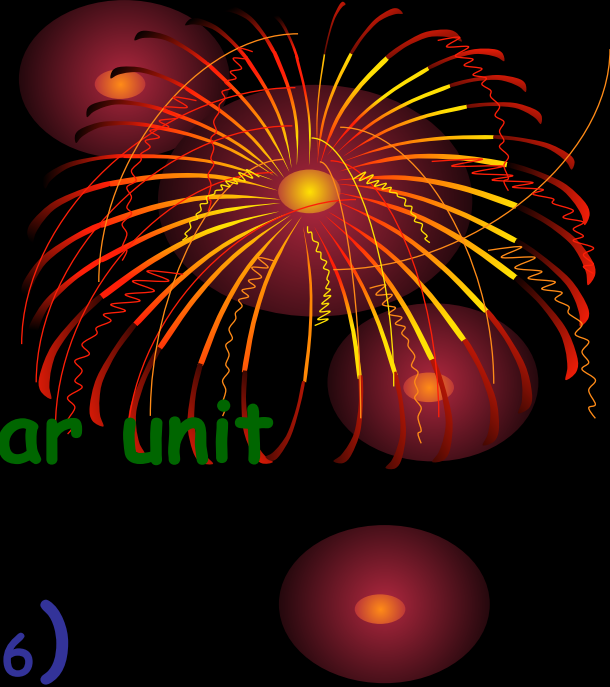
fructose

galactose deoxyribose

ribose



glucose





# Carbohydrates

Disaccharide: two sugar unit

Examples:

- ⑩ Sucrose (glucose+fructose)
- ⑩ Lactose (glucose+galactose)
- ⑩ Maltose (glucose+glucose)



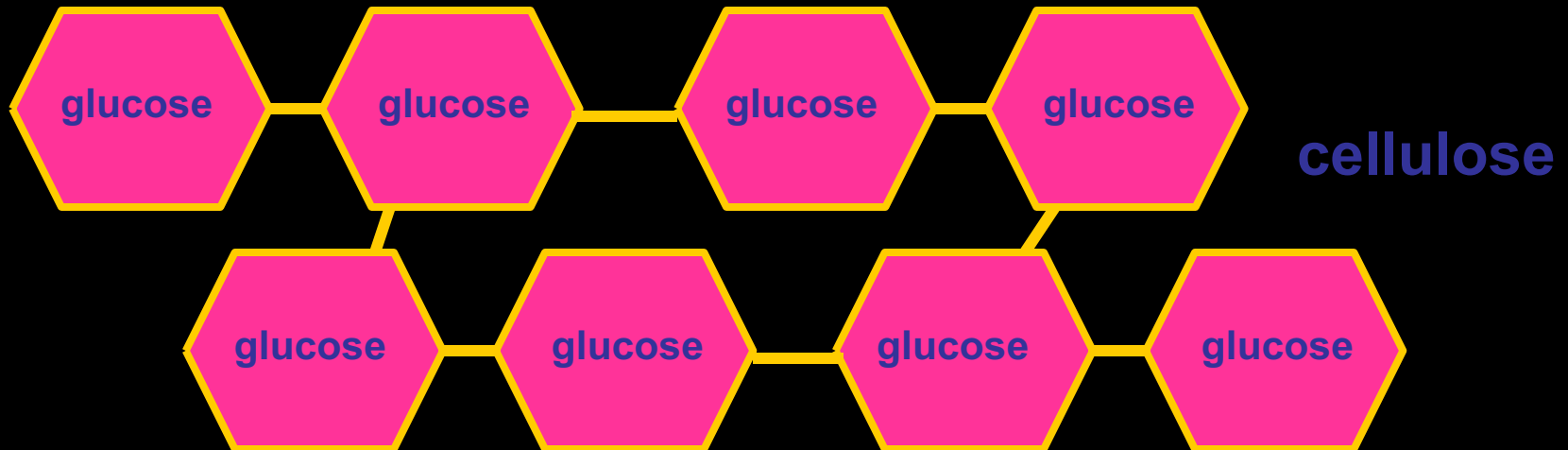
# Carbohydrates

Polysaccharide: many sugar units

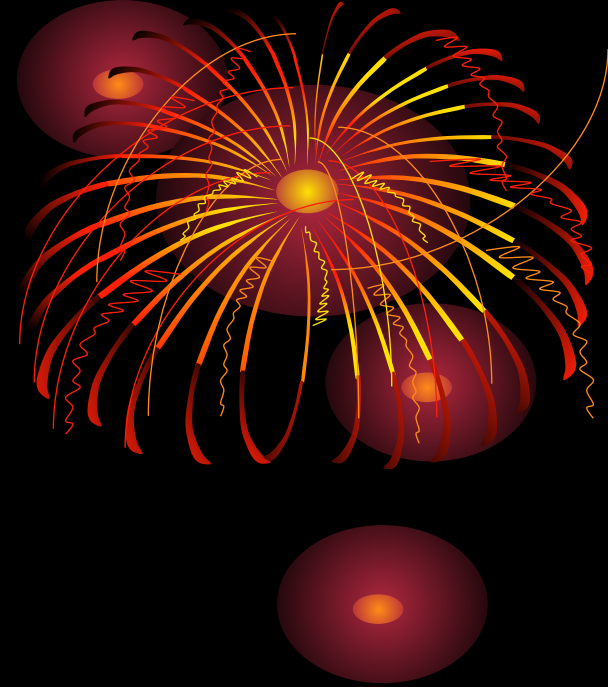
Examples: starch (bread, potatoes)

glycogen (beef muscle)

cellulose (lettuce, corn)



# Lipids



# Lipids

⑩ General term for compounds which are not soluble in water.

⑩ Lipids are soluble in hydrophobic solvents.

⑩ Remember: "stores the most energy"

⑩ Examples: 1. Fats

2. Phospholipids

3. Oils

4. Waxes

5. Steroid hormones

6. Triglycerides

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# Lipids

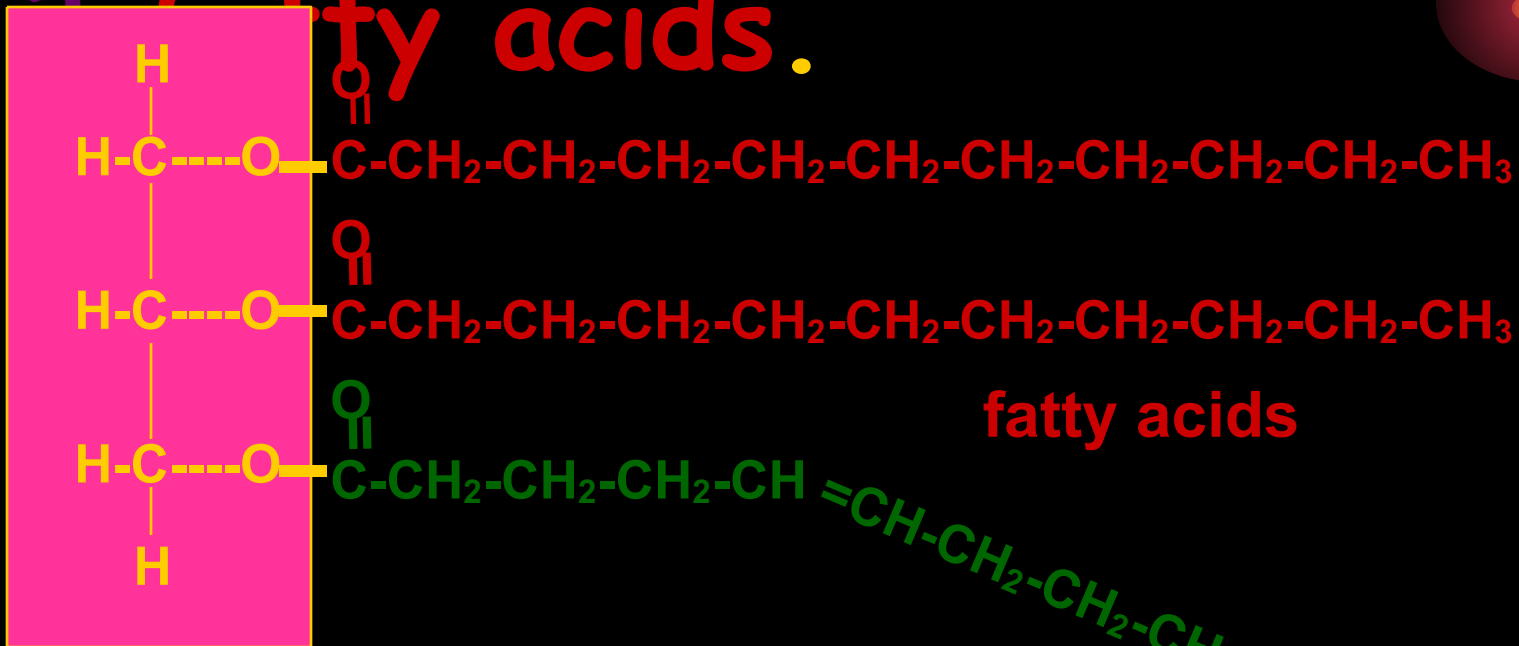
## Functions of lipids:

1. Long term **energy storage**
2. Major component of cell membranes
3. Protection against heat loss, physical shock, water loss



# Lipids

Triglycerides:  
composed of 1 glycerol and  
3 fatty acids.



glycerol

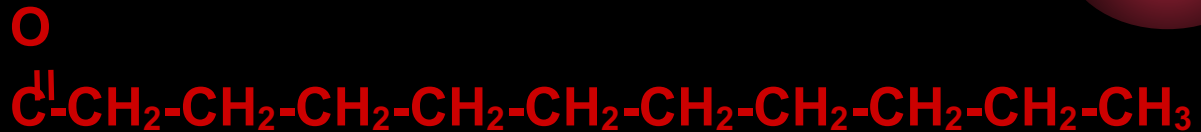
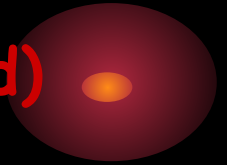
fatty acids

# Fatty Acids



There are two kinds of **fatty acids** you may see these on food labels:

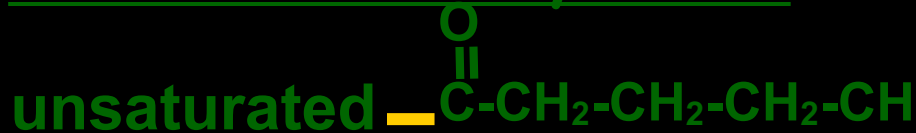
1. Saturated fatty acids: no double bonds (bad)



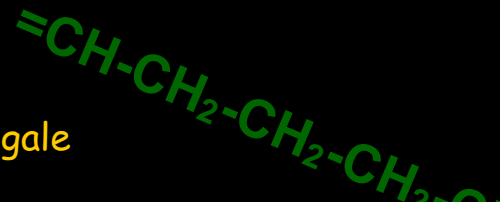
saturated



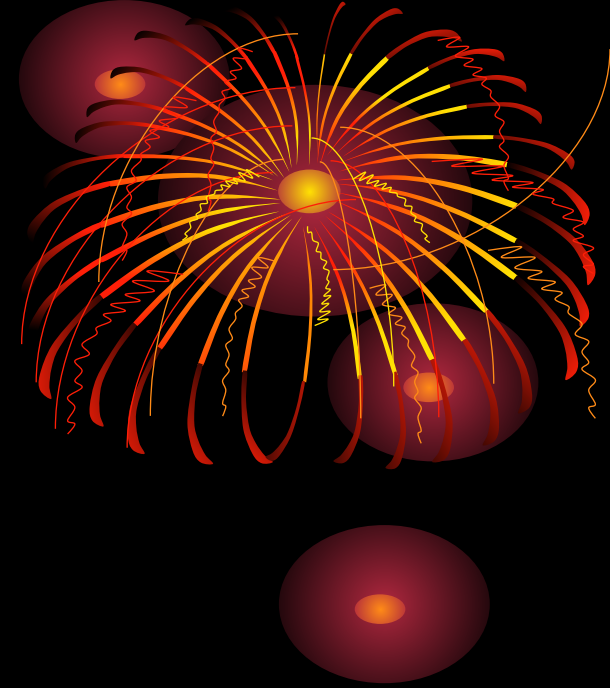
2. Unsaturated fatty acids: double bonds (good)



unsaturated



# Proteins





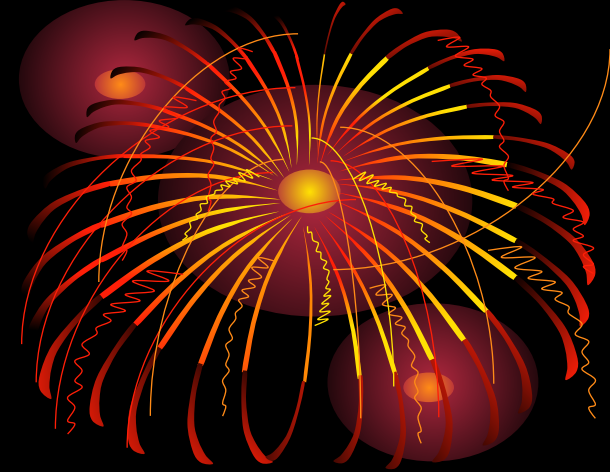
# Proteins (Polypeptides)

⑩ Amino acids (20 different kinds of aa) bonded together by peptide bonds (polypeptides).

⑩ Functions of proteins:

1. Control rates of chemical reactions
2. Regulate cell processes
3. Transport materials into and out of cells
4. Forms bones and muscles

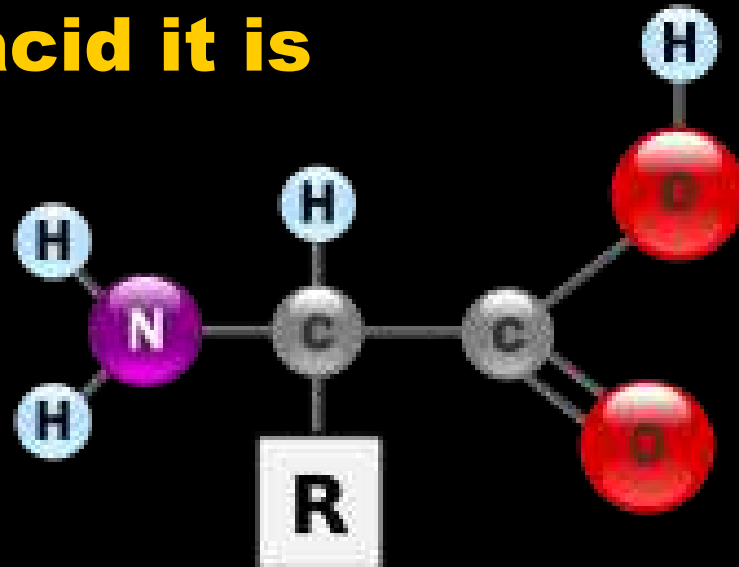
# Proteins



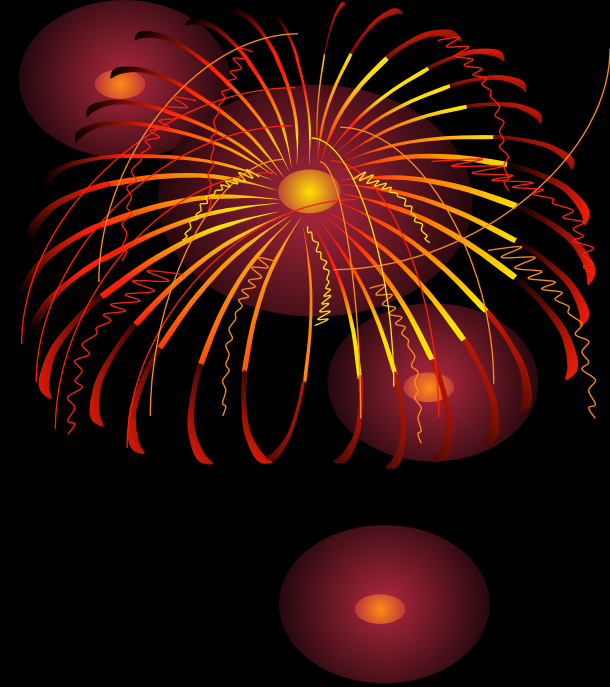
⑩ **Contain N, C, H, O**

⑩ **Each has an amino group and a carboxyl group on each end**

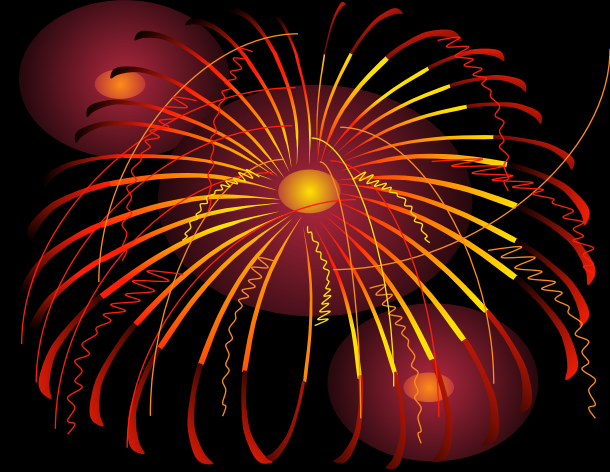
⑩ **Has an R group that makes it the specific amino acid it is**



# Nucleic Acids

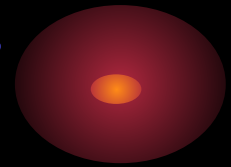


# Nucleic acids



⑩ Two types:

a. Deoxyribonucleic acid (DNA-  
double helix)



b. Ribonucleic acid (RNA-single  
strand)

Each is composed of a nucleotide

# Nucleic acids

⑩ Nucleotides include:

phosphate group

pentose sugar (5-carbon)

nitrogenous bases:

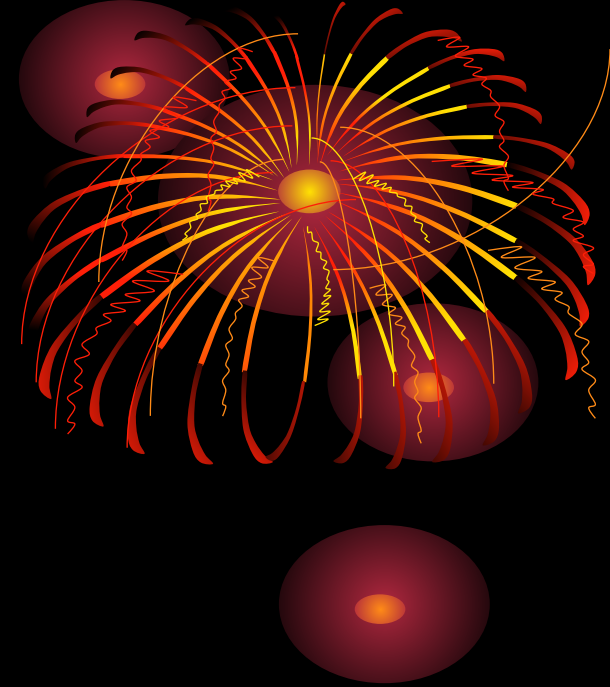
adenine (A)

thymine (T) DNA only

uracil (U) RNA only

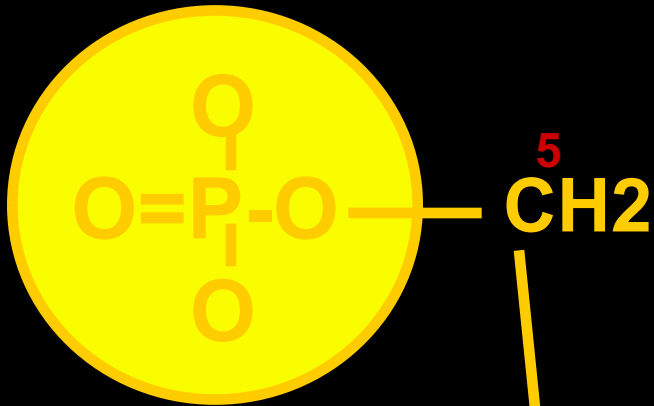
cytosine (C)

guanine (G)

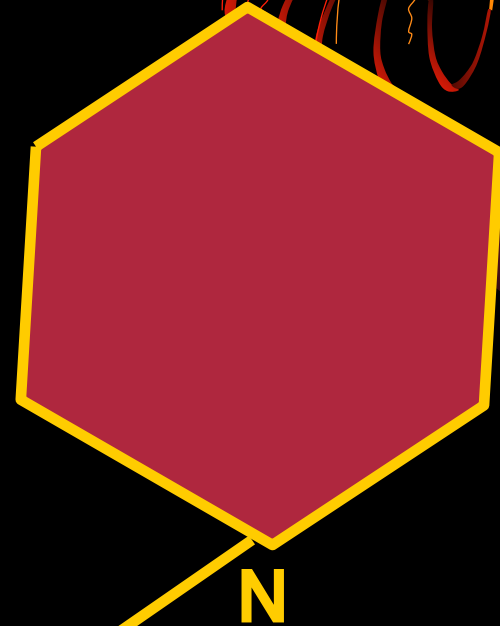
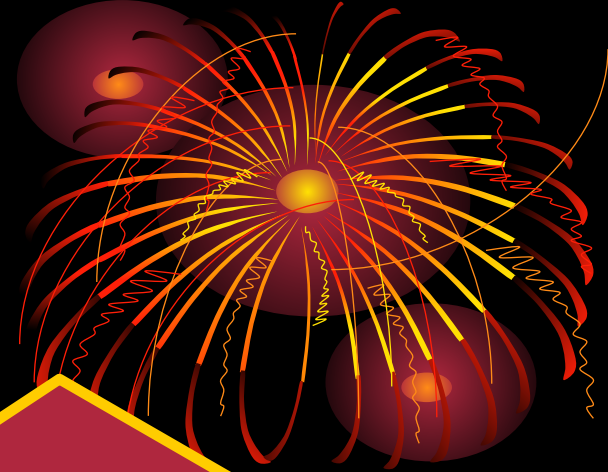
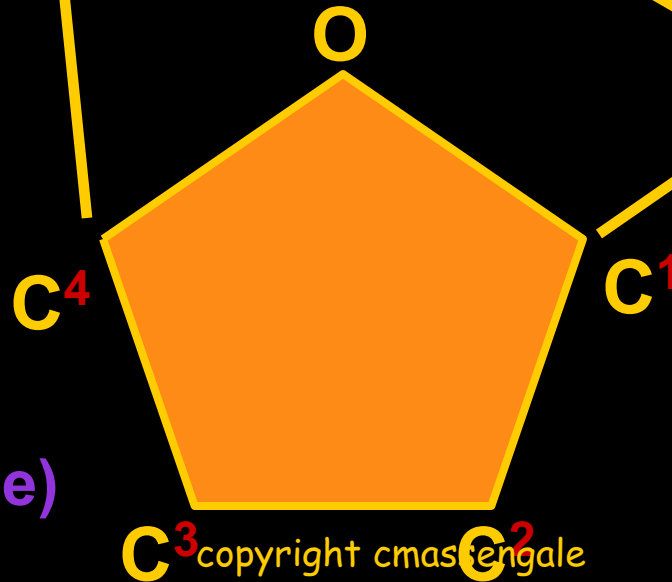


# Nucleotide

Phosphate  
Group



Sugar  
(deoxyribose)



Nitrogenous base  
(A, G, C, or T)

# Learning Targets



**10 I can describe the general structure and function including common functional groups of monosaccharides, disaccharides, polysaccharides, carbohydrates, fatty acids, glycerol, lipids, amino acids, dipeptides, polypeptides, proteins and nucleic acids.**

# Learning Targets



**10** I can show how chemical reactions can be represented by chemical formulas.

**10** I can describe the function of enzymes, including how enzyme-substrate specificity works, in biochemical reactions.



# Chemical Reactions



**10** A process that changes one group of chemicals into another.



**Reactants**

**Product**

# Chemical Reactions



⑩ <http://www.youtube.com/watch?v=66kuhJkQCVM>

⑩ <http://www.youtube.com/watch?v=m8mbGH6b2cg>

# Energy in Reactions

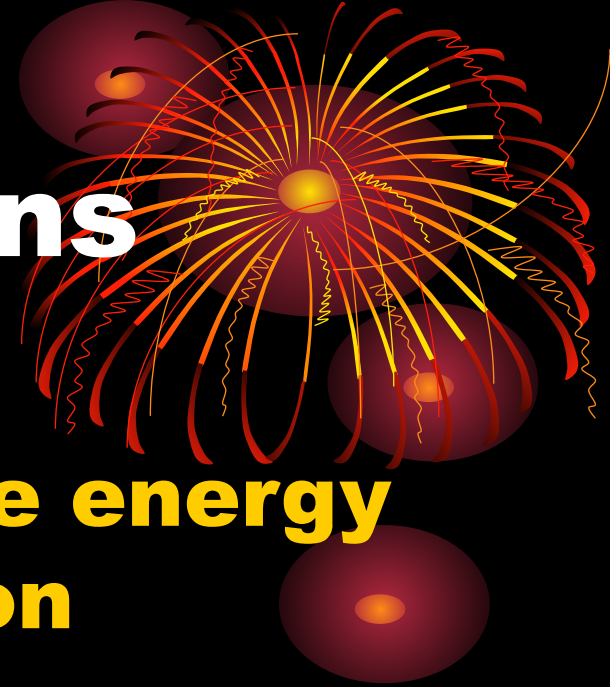


**⑩ Chemical reactions can release or absorb energy**

**⑩ The ones that release energy can happen spontaneously**

**⑩ The ones that absorb energy won't happen with a source of energy**

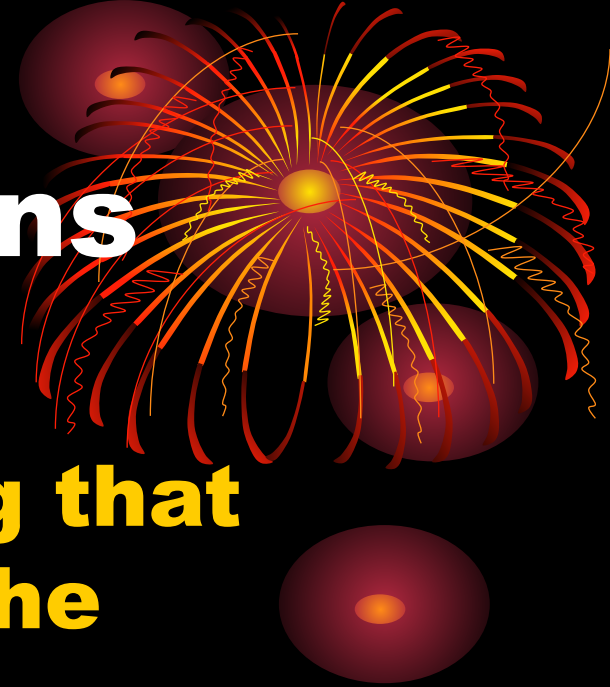
# Energy in Reactions



**10** Activation energy is the energy needed to get a reaction started.

**10** The rate or how fast the reaction occurs depends on catalysts.

# Energy in Reactions



- ⑩ A catalyst is something that speeds up the rate of the reaction.**
- ⑩ Often a catalyst is a special protein called an enzyme.**

# Enzymes



**⑩ Proteins that act as biological catalysts.**

**⑩ Enzymes are very specific; catalyzing only one chemical reaction.**

**⑩ Often end is “ase”**

# Enzyme-Substrate Complex

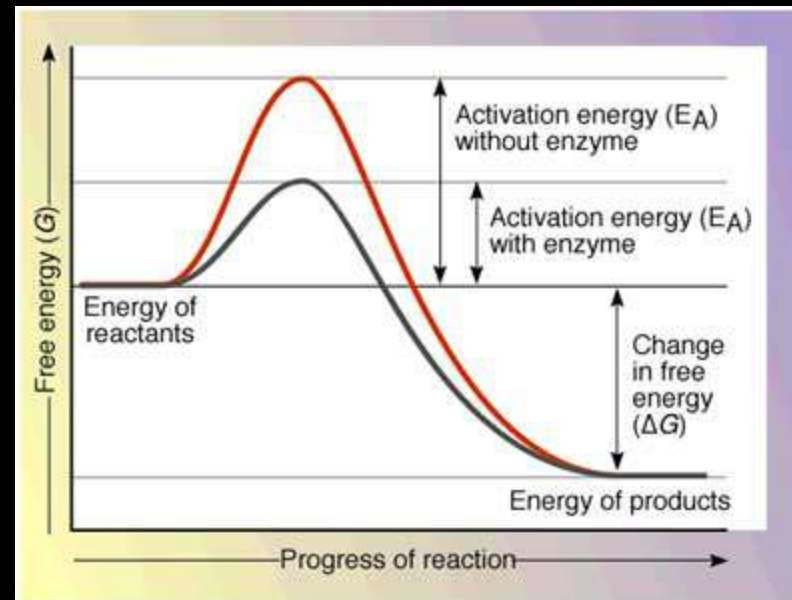


- ⑩ Enzymes provide a site where reactants can be brought together.**
- ⑩ Reactants are known as substrates.**
- ⑩ The substrate fits into the active site on the enzyme to start the reaction.**

# Energy in Reactions

⑩ Enzymes lower a reaction's activation energy

⑩ <http://www.youtube.com/watch?v=VblaK6PLrRM>





# Learning Target



**10** I can show how chemical reactions can be represented by chemical formulas.

**10** I can describe the function of enzymes, including how enzyme-substrate specificity works, in biochemical reactions.