

CHEMISTRY REVIEW - PHYSIOLOGY (SPRING '06)

CHEMISTRY : “*Study of matter*”

Matter :

- Anything that has :

Atom :

- Smallest units of matter that can :
- Structure :
 1. **Nucleus** :
 2. **Energy Shells (Orbitals)** :

• **Sub-atomic Particles** :

1. **Proton** :

- Contained w/in :
- **Atomic Mass** =
(1 atomic mass unit)

2. **Neutron** :

- Contained w/in :
- **Atomic Mass** =

3. **Electrons** :

- Contained w/in *energy shell* :
- **Atomic Mass** =

★ **Atomic Configuration** :

a. **Unreacted Atom**:

- Equal #'s of :
⇒ **Carbon** : 6 protons (+); 6 neutrons (0); 6 electrons (-)

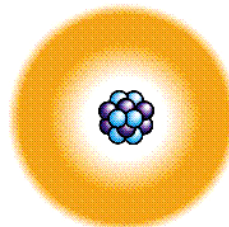
b. **Ion** : *Charged atom*

- Unequal #'s of :
⇒ **Sodium** : 11 protons (+) ; 11 neutrons (0) ; 10 electrons (-)

⇒ **Cation** :

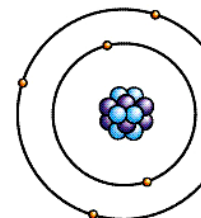
⇒ **Anion** :

c. **Isotope** :



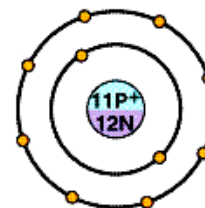
Proton ●

Carbon
6 protons
6 neutrons
6 electrons



Neutron ●

Electron ●



Sodium ion (Na⁺)

- Unequal #'s of :

ISOTOPES OF CARBON

	Carbon-12	Carbon-13	Carbon-14
Protons	6	6	6
Neutrons	6	7	8
Electrons	6	6	6

- Tend to have *unstable* nuclei :

Pet Scan : Positron-emission Tomography

- ★ **Hydrogen** : Most common atomic form is :

ATOMIC MASS :

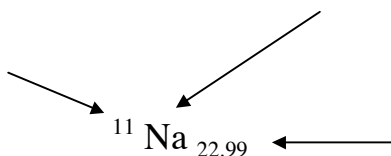
- ★ Sum weight of Protons & Neutrons

ie : *Carbon*

$$\begin{array}{rcl}
 6 \text{ protons} & = & (1 \text{ dalton}) \\
 \underline{6 \text{ neutrons}} & = & \underline{(1 \text{ dalton})} \\
 \text{Atomic Mass} & = & \text{daltons} \\
 & = & \text{amu}
 \end{array}$$

- ★ Average mass of ALL :

Sodium :



ATOMIC NUMBER :

- ★ Defines :

- Equal to :

$$\begin{array}{rcl}
 \text{Carbon} & = & 6 \\
 \text{Nitrogen} & = & 7 \\
 \text{Oxygen} & = & 8 \\
 \text{Hydrogen} & = & 1
 \end{array}$$

ENERGY SHELLS: Electron location

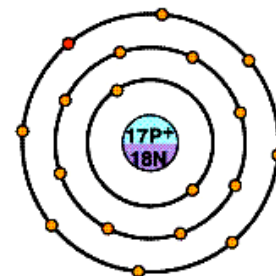
- Contain :

• OCTET Rule

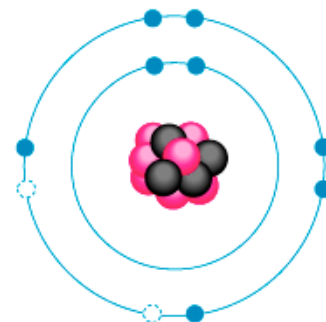
$$\begin{array}{l}
 \Rightarrow 1^{\text{st}} : \\
 \Rightarrow 2^{\text{nd}} : \\
 \Rightarrow 3^{\text{rd}} :
 \end{array}$$

- ★ **Valencies** :

Oxygen : Atomic # = 8



Chloride ion (Cl⁻)



OXYGEN (O)
Atomic number
= 8

Protons =
Electrons =

★ 1st Orbital : _____ Electrons

★ 2nd Orbital : _____ Electrons

Electron (Bohr) Diagram :

★ **Valencies** = _____

Hydrogen : Atomic # 1

Protons =
Electrons =

★ 1st Shell : _____ Electrons

Electron (Bohr) Diagram :

★ **Valencies** = _____

ATOMIC STABILITY :

- Atomic **GOAL** : *Complete Shells*

Question : How do atoms complete valencies ?

Answer :

- Share electrons
- Loose electrons
- Gain electrons

ie : **Oxygen & Hydrogen** :

- Electrons arrange to fill all :

Electron Diagrams :

What did we make ?

Answer :

Cells :

- “Electron short falls” solved by :

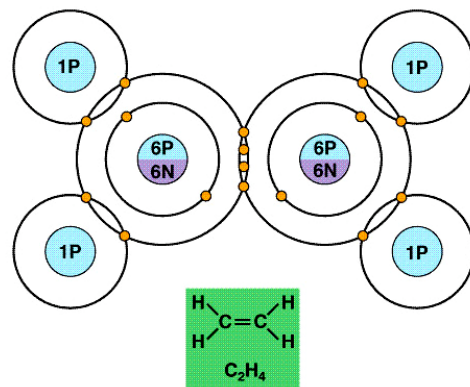
CHEMICAL BONDS :

- Atoms interact to :
- Two or more atoms interacting form:
- Electron interaction :

★ *Sharing, Gaining or Losing electrons*

• **BOND TYPES :**

1. **Covalent Bond** : *Co* = “Together”



Ethylene (C₂H₄)

- Atoms :

A. Non-polar Covalent Bond

★ EQUAL :

★ EQUAL :

⇒ Overall bond charge =

a. Single Covalent Bond :

b. Double Covalent Bond :

B. Polar Covalent Bond :

★ UNEQUAL :

★ UNEQUAL :

⇒ Bond is :

✓ Greater electro-negativity :

ie : H_2O : Neutral Molecule

- Oxygen : High electro-negativity

⇒ Oxygen more :

⇒ Hydrogen more :

• Charged Bonds

2. Ionic Bonds : Formation of ions

- Atomic interaction results in :

i.e. *Sodium chloride* (NaCl)

Na : Atomic # = 11

Cl : Atomic # = 17

Na : ____ valences

Cl : ____ valences

Q : How do atoms complete shells?

A :

Na^+ : _protons & ____ electrons

Cl^- : _protons & ____ electrons

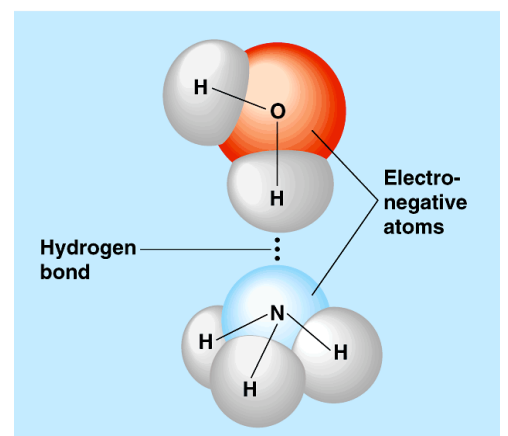
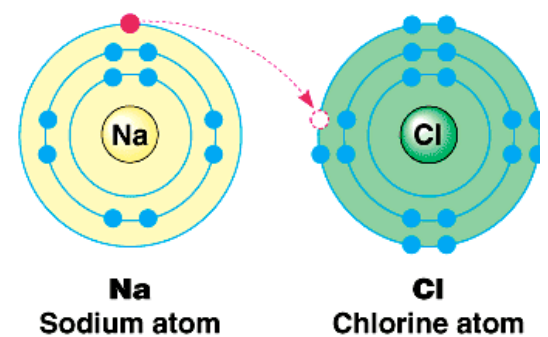
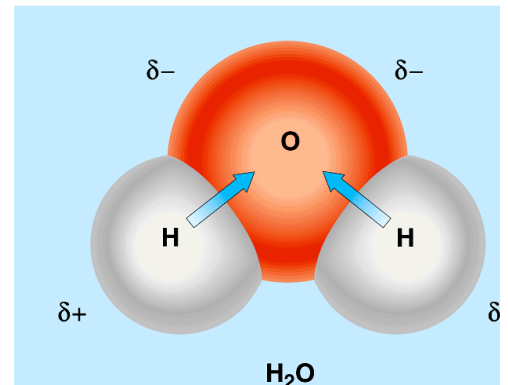
- **Ionic Bond** : Attraction of :

3. Hydrogen Bond :

- Forms between :

⇒ Attractive forces between :

⇒ **NO** sharing or exchange of :



i.e. Water (H₂O)

Significance :

1. Surface Tension & Cohesion :

- Water's ability to :

2. Temperature moderation :

- Heat added is absorbed in the :
- **Evaporation** : Breaking bonds between :

★ *Solid, liquid, gas*

- **Evaporative Cooling** (*Sweating*) Surface temperature cooling as :

Energy : Molecular

Bond Strength :

C-C	83 kcal/mol	C-H	99 kcal/mol	H ⁺	10 kcal/mol
O-H	111 kcal/mol	NaCl	98 kcal/mol		

- **Strength = Energy** :

★ Basic unit of energy =

- **Calorie** (c): Quantity of **HEAT** needed to raise :

★ **1,000 calories** =

- **Molecular Energy** :

⇒ ~ equal to the :

Study Questions :

1. What is an atom? What are the components and arrangement of these components?
2. What are the different configurations in which you might find an atom? Draw the Bohr diagram for Carbon (6).
3. Boron's atomic # is 5 and yet on a periodic table it's atomic weight is listed as 10.81. Why is it not 10.00?
4. Why do atoms form bonds? How many bonds will a particular atom form : Oxygen (8); Nitrogen (7), Carbon (6)?
5. Describe the difference between a Non-polar and a Polar covalent bond. Why do some atoms form ionic bonds?
6. Why do ionic molecules dissolve in water (NaCl), while covalent molecules simply are suspended by the water?
7. What is a hydrogen bond? Is this a bond between molecules or within molecules?
8. What is the significance of hydrogen bonding and water?
9. The alveoli of the lungs are covered by a thin layer of water. One problem is that the water can cause the small air sacs to collapse. What about the water functions to pull the air sacs inwardly?
10. Which type of bond contains the least amount of energy? How is the energy in molecules measured? Which of the 4 organic molecules do you think has the greatest number of bonds? Why?
11. What is a calorie? How is energy quantified (measured) in calories?