
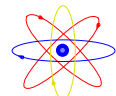


The Chemistry of Life

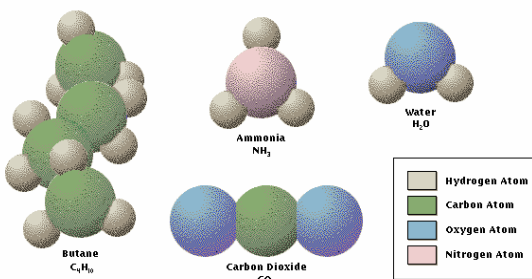
Chapter 2



Units of Matter

- Atoms 
- Elements ○ C, O, H, N, S
- Compounds & Molecules ○ CO₂, H₂O, C₆H₁₂O₆

Common Molecules



Butane C₄H₁₀

Ammonia NH₃

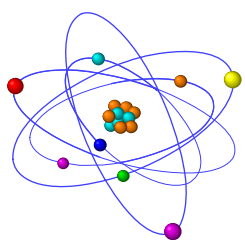
Water H₂O

Carbon Dioxide CO₂

Legend:
 - Hydrogen Atom (white)
 - Carbon Atom (green)
 - Oxygen Atom (blue)
 - Nitrogen Atom (pink)

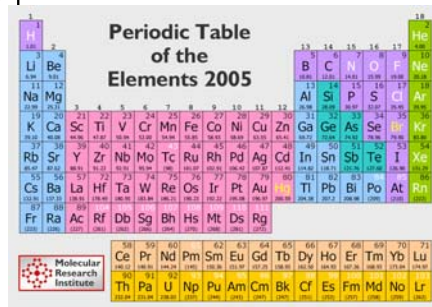
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Atoms of the same Element:



- Same number of protons, electrons & neutrons
- Same atomic structure

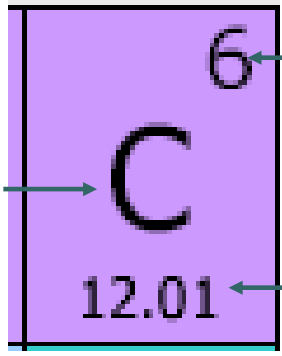
PERIODIC TABLE



Periodic Table of the Elements 2005

Molecular Research Institute

WHAT DOES IT ALL MEAN?



Atomic Number: 6

Chemical Symbol: C

Molecular Weight: 12.01

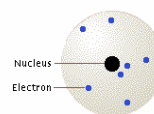
Practice with the Periodic Table

For Each element below identify:

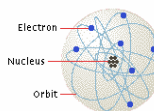
- Chemical Symbol
- Atomic Number
- Atomic Mass
- # of Protons, # of Neutrons, # of Electrons

Carbon Oxygen Sodium Lead

Atomic Models



The Rutherford Model pictured the atom as a miniature solar system with the electrons moving like planets around the nucleus.



The Bohr Model "quantized" the orbits in order to explain the stability of the atom.



The s orbital: Electrons with no angular momentum occupy regions of space like this. Shading shows probability of finding an electron at that distance.

The Schrodinger Model abandoned the idea of precise orbits, replacing them with a description of the regions of space (called orbitals) where the electrons were most likely to be found.

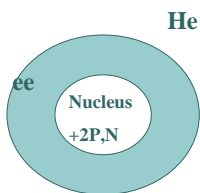
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Rules for Bohr model:

Atomic number = # protons

Nucleus contains protons (+) and neutrons (no charge)

Outer shell = electrons (-)



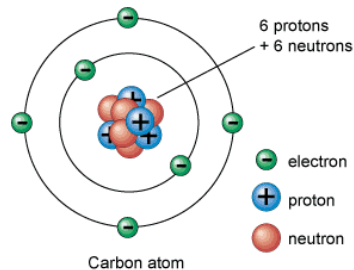
1st shell = 2 paired electrons

2nd shell up to 8

3rd shell up to 8

Electrons = # Protons = # Neutrons in a "stable" atom

Structure of Carbon C



Atomic # ?

Electron placement?

Carbon atom

Bohr Model Practice

- Do on your Homework –
- Hydrogen
- Oxygen

How do Compounds/Molecules form?

- In general, elements want to become more stable by:
 - a. filling their shells – gaining e^-
 - b. Emptying outer shell – losing e^-
- Two ways in which this is accomplished . . .
 - Ionic Bonding & Covalent Bonding!

IONIC Bonding

Cl needs only one e^- to fill its outer shell, while Na has only one e^- in its outer shell. . . So . . . Na will donate and e^- to Cl.

Opposites Attract – in a sense!

Na donates its electron to Cl.

www.colorado.edu/MCDBL/MCDBL1150/lab/overhead.html

Ions and uses

Ions are atoms that . . .

- Lose electrons → positive charge
- Gain electrons → negative charge

Ions are important in physiological functions

Na^+ K^+ Ca^{+2} Cl^-

Covalent Bonding

- Strong bond due to attraction between + nucleus and $-$ electrons
- Atoms share electrons!!

COVALENT BONDING

shared electrons

Covalent Bonding

In H_2
Both have and need an e^-
Share it equally

H needs one e^-
Cl needs one e^-
So, both will SHARE their outer shell e^- , with Cl getting it most of the time.

Polar covalent bond-HCl

© Microsoft Corporation. All Rights Reserved. Polar covalent bonds-H2

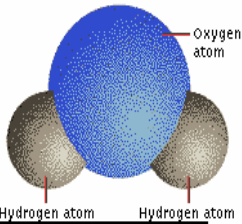
pH

- What is the pH scale?
- How does it affect us?
- What is pH balanced shampoo?

WATER:H₂O

- How many atoms?
- ?Types of bonds?
- ?Strong or Weak
- ? Break

Water molecule.....



- Covalent bonds
- Polar
- + charge at O end
- - charge at H end
- Pull apart ions

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H₂O → H⁺ & OH⁻

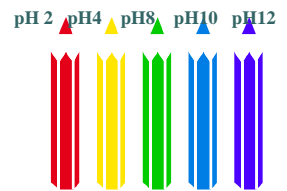
- H⁺ = Hydrogen ion
- in excess = acid
- OH⁻ = Hydroxide ion
- in excess = base

How frequently do they break apart?

- (10)⁻⁷ concentration of H⁺
- .0000001
- 1 for every 10 million water molecules!

pH = measurement

-log of the {H⁺}



For water
= (10)⁻⁷
So pH = 7

?H₂O a neutral pH

- #hydrogen ions = #hydroxide ions.
- H⁺ = (10)⁻⁷
- OH⁻ = (10)⁻⁷

?Makes an acid

- Increase the relative amount of H⁺
- adding a weak acid =
- {H⁺} = 10⁻⁵
- ? pH
- pH = 5

?Base

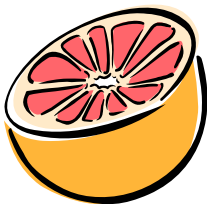
- o {H+} lower than 10^{-7}
- o tips the balance of H+ to OH-
- o = more OH- than H+.
- o = base with pH 8
- o =alkaline

?strong or weak

- o The more acid the _____ the pH number.
- o (lower) (1-5)
- o The more alkaline, the _____ the pH (higher, above 7) (8-12)

Examples

- o Lemons
 - o Vinegar
 - o Aspirin
 - o Battery acid
- “sour”



Bases



- o Ammonia
 - o Lye
 - o Sodium hydroxide
 - o Baking soda
- “slippery”

