


Bio 115 Cells & Evolution of Life

The Basics of Life

Chemical Interactions



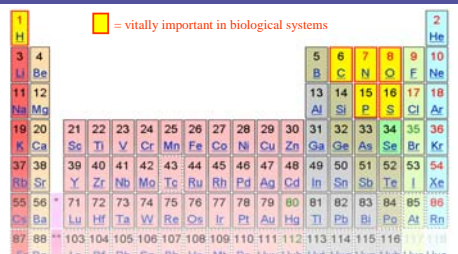
University of Idaho

Start Audio Lecture!

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Biological systems follow physical and chemical laws



1 = vitally important in biological systems

1 Lanthanides: La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb

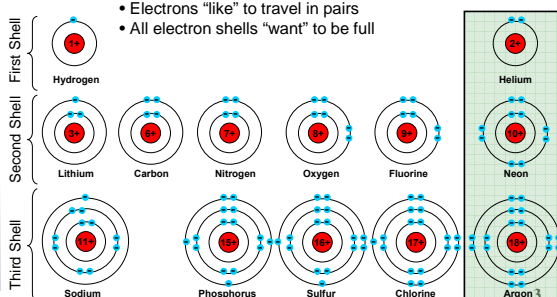
2 Actinides: Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No

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Properties of Atoms

- Atoms "like" to be electrically neutral
- Electrons "like" to travel in pairs
- All electron shells "want" to be full



First Shell

Second Shell

Third Shell

Hydrogen

Helium

Lithium

Carbon

Nitrogen

Oxygen

Fluorine

Neon

Sodium

Phosphorus

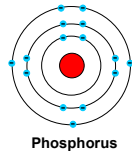
Sulfur

Chlorine

Argon

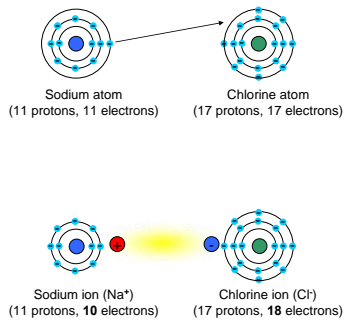
Properties of Atoms – electron shells

Chemical interactions and bonds:
the way in which atoms maintain electrical neutrality
while filling their outer shells with electrons.



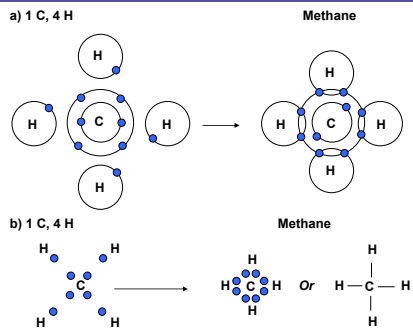
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Ionic bonding



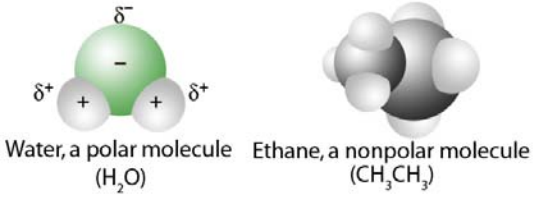
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Covalent bonding – sharing electrons



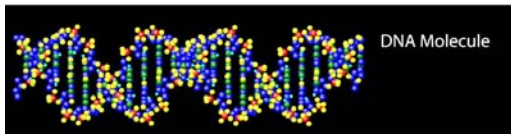
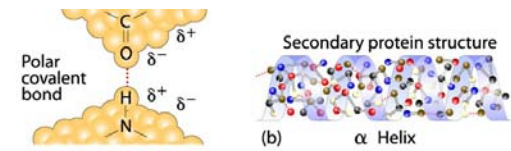
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Polarity in covalent bonds



7

Hydrogen bonds



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Bond strength comparison

Chemical Bonds/Interactions			
Name	Basis for Interaction	Structure	Bond Energy* (Kcal/Mol)
Covalent Bond	Sharing of electron pairs	$\begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ -\text{N}-\text{C}- \end{array}$	50-110
Hydrogen Bond	Sharing of H atom	$\begin{array}{c} \text{H} \quad \delta^- \\ \quad \cdots \quad \delta^+ \\ -\text{N}-\text{H} \cdots \text{O}=\text{C}- \end{array}$	3-7
Ionic Interaction	Attraction of opposite charges	$\begin{array}{c} \text{H} \quad \delta^+ \quad \delta^- \quad \text{O} \\ \quad \cdots \quad \cdots \quad \\ -\text{N}-\text{H} \cdots \text{O}-\text{C}- \\ \\ \text{H} \end{array}$	3-7
van der Waals Interaction	Interaction of electron clouds	$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{H} \cdots \text{C} \cdots \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	1
Hydrophobic Interaction	Interaction of nonpolar substances	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ -\text{C}-\text{C}-\text{H} \cdots \text{H}-\text{C}-\text{C}- \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$	1-2

*Bond Energy is the amount of energy needed to separate two bonded or interacting atoms under physiological conditions

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Functional groups

Functional Groups	Ball and Stick Model	Structural Formula
Hydroxyl Group		$R-OH$
Carbonyl Group		$R-C(=O)OH$
Amino Group		$R-NH_2$
Phosphate Group		$R-O-P(=O)(OH)_2$

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