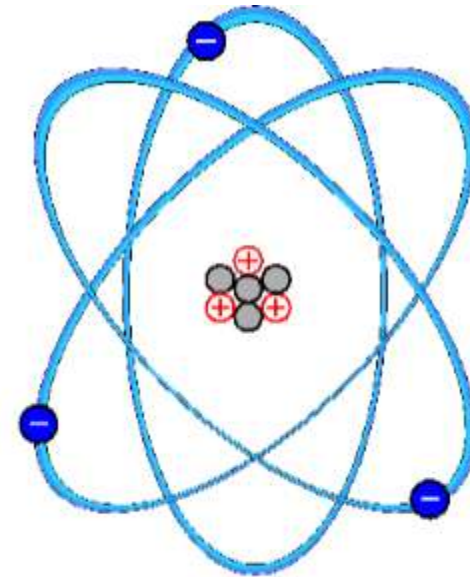


Chemical Context of Life

- Matter (*space & mass*)
- Element; compound
- The atom
- Atomic number (*# of protons*); mass number (*protons + neutrons*)
- Isotopes (*different # of neutrons*); radioactive isotopes (*nuclear decay*)
- Energy (*ability to do work*); energy levels (*electron states of potential energy*)

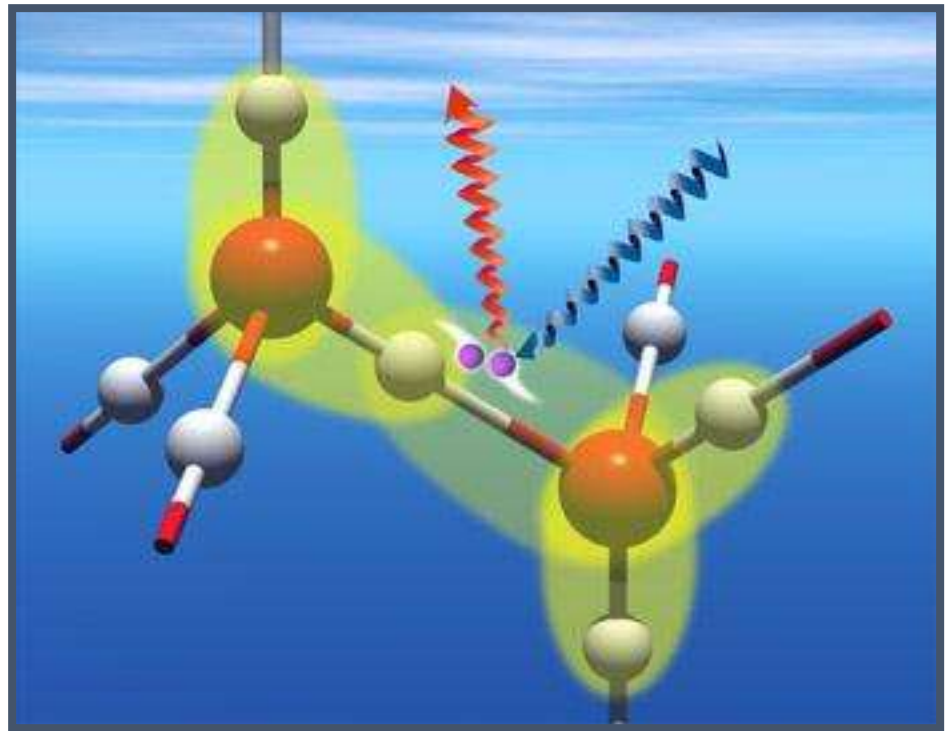


Lithium atom

- Neutron
- ⊕ Proton
- Electron

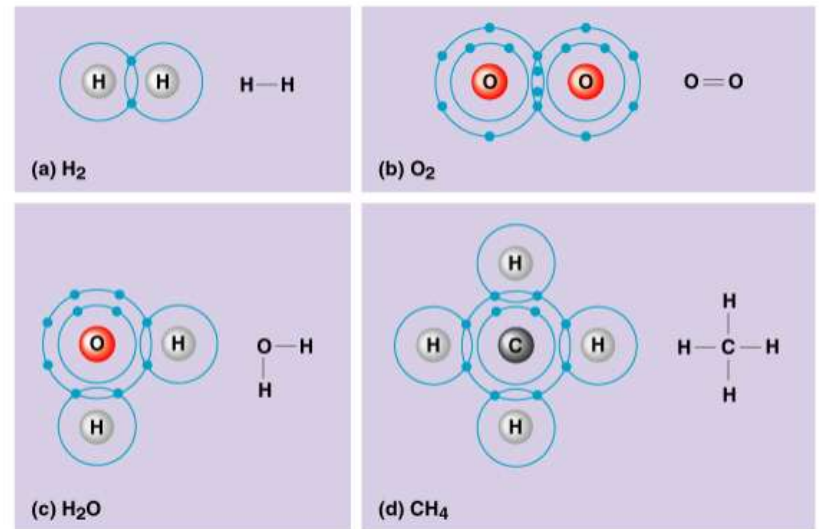
Chemical Bonding

- Covalent
- Double covalent
- Nonpolar covalent
- Polar covalent
- Ionic
- Hydrogen
- van der Waals



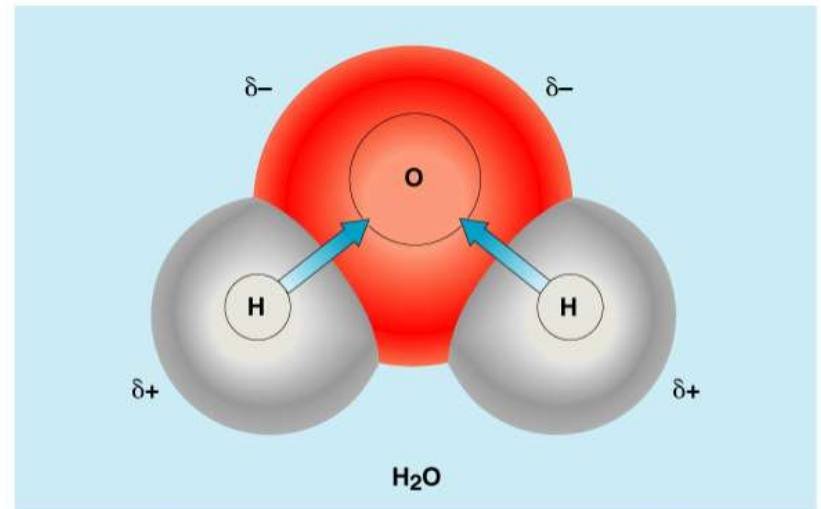
Covalent Bonding

- **Sharing pair of valence electrons**
- **Number of electrons required to complete an atom's valence shell determines how many bonds will form**
- **Ex: Hydrogen & oxygen bonding in water; methane**



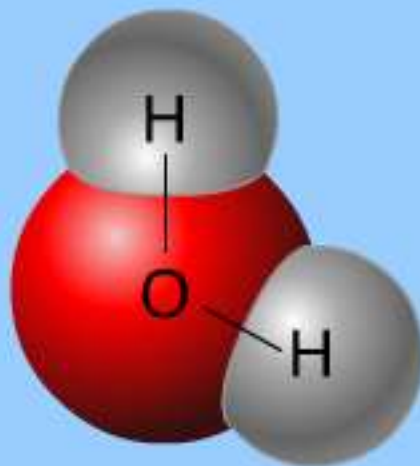
Polar/nonpolar covalent bonds

- **Electronegativity**
attraction for electrons
- **Nonpolar covalent**
 - electrons shared equally
 - Ex: diatomic H and O
- **Polar covalent**
 - one atom more electronegative than the other (charged)
 - Ex: water



©1999 Addison Wesley Longman, Inc.

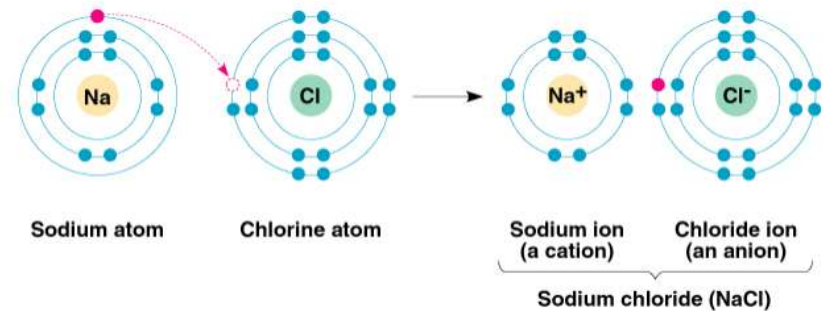
Polar/nonpolar bonds



Copyright © 2001 by Benjamin Cummings,
an imprint of Addison Wesley

Ionic bonding

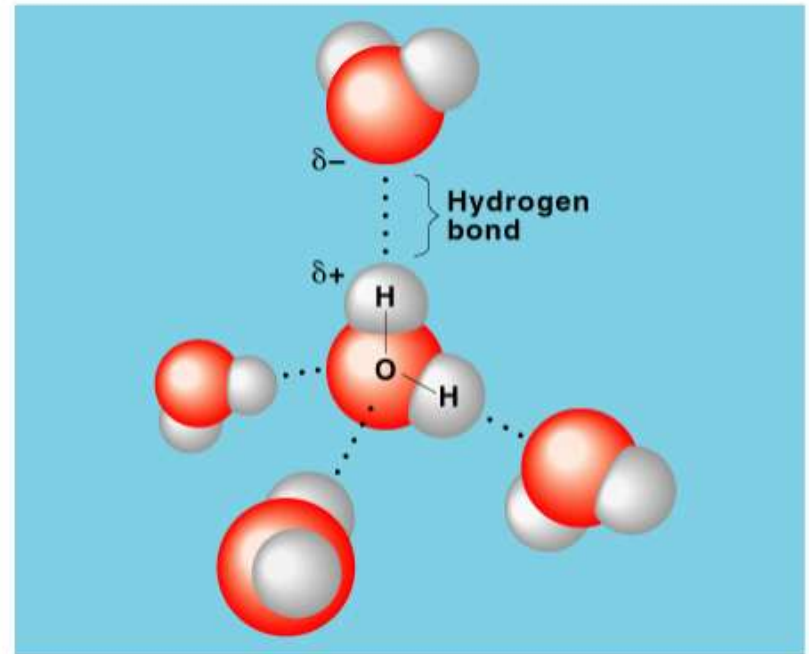
- High electronegativity difference strips valence electrons away from another atom
- Electron transfer creates ions (charged atoms)
- Cation (positive ion); anion (negative ion)
- Ex: Salts (sodium chloride)



©1999 Addison Wesley Longman, Inc.

Hydrogen Bonds

- Hydrogen atom covalently bonded to one electronegative atom is also attracted to another electronegative atom (oxygen or nitrogen)



Van der Waals Interactions

- Weak interactions between molecules or parts of molecules that are brought about by localized charge fluctuations
- Due to the fact that electrons are constantly in motion and at any given instant, ever-changing “hot spots” of negative or positive charge may develop

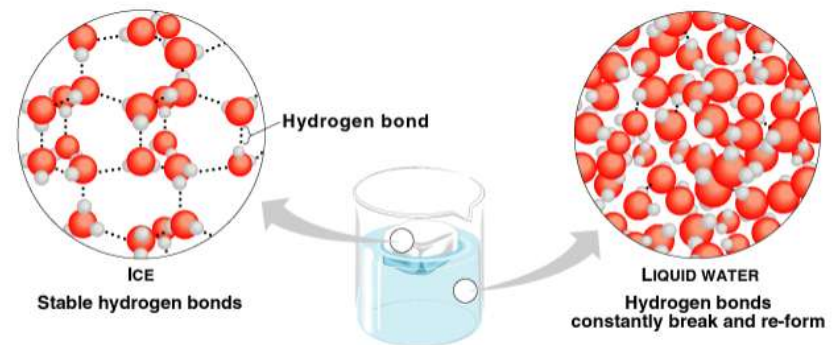
Water

- Polar - *opposite ends, opposite charges*
- Cohesion - *H+ bonds holding molecules together*
- Adhesion - *H+ bonds holding molecules to another substance*
- Surface tension - *measurement of the difficulty to break or stretch the surface of a liquid*
- Specific heat - *amount of heat absorbed or lost to change temperature by 1oC*
- Heat of vaporization - *quantity of heat required to convert 1g from liquid to gas states*
- Density.....



Density

- Less dense as solid than liquid
- Due to hydrogen bonding
- Crystalline lattice keeps molecules at a distance



©1999 Addison Wesley Longman, Inc.

Acid/Base & pH

- *Dissociation* of water into a hydrogen ion and a hydroxide ion
- Acid: *increases the hydrogen concentration of a solution*
- Base: *reduces the hydrogen ion concentration of a solution*
- pH: “power of hydrogen”
- Buffers: *substances that minimize H^+ and OH^- concentrations (accepts or donates H^+ ions)*

