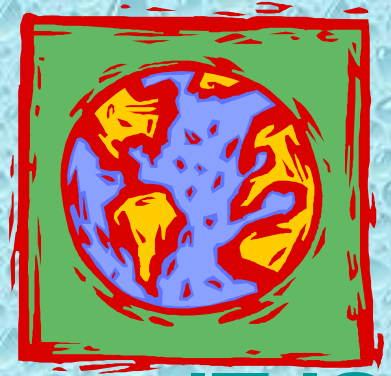
PROPERTIES OF WATER

1. BONDS

- The O-H bonds in water molecules are polar because the H atoms are partially positive & the O atoms are partially negative.

2. HYDROGEN BONDING

- IS WHAT HOLDS WATER MOLECULES TOGETHER

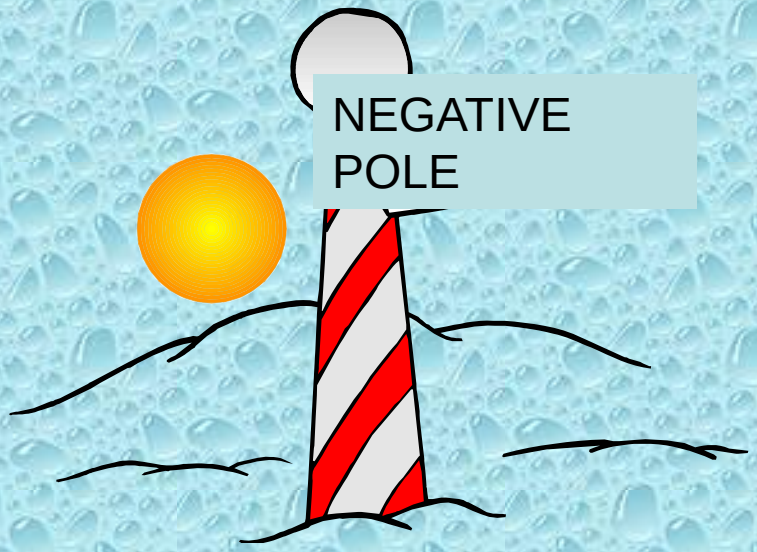


3. WATER IS UNIQUE BECAUSE…

- IT IS A LIQUID AT ROOM TEMPERATURE
- IT HAS A HIGH BOILING POINT
- IT EXISTS IN ALL 3 STATES ON EARTH
- ITS SOLID FORM IS LESS DENSE THAN ITS LIQUID FORM

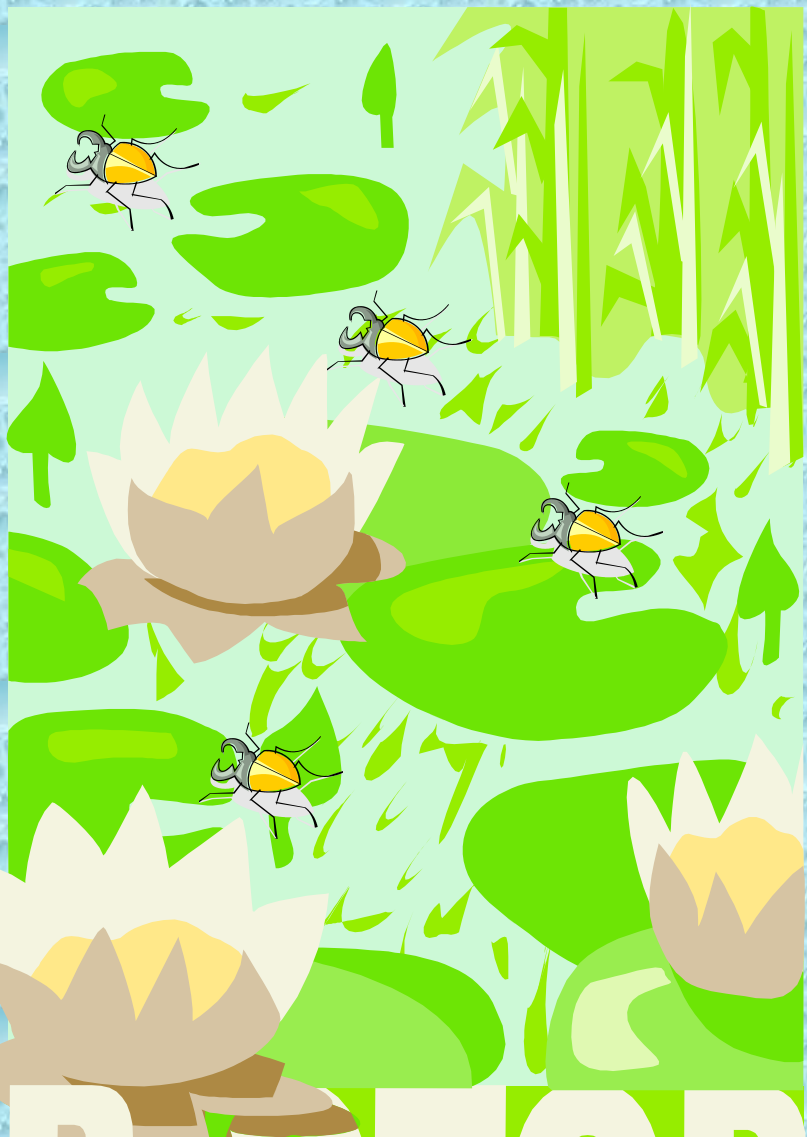
4. WATER IS POLAR

- **IT HAS A POSITIVE POLE AND A NEGATIVE POLE**



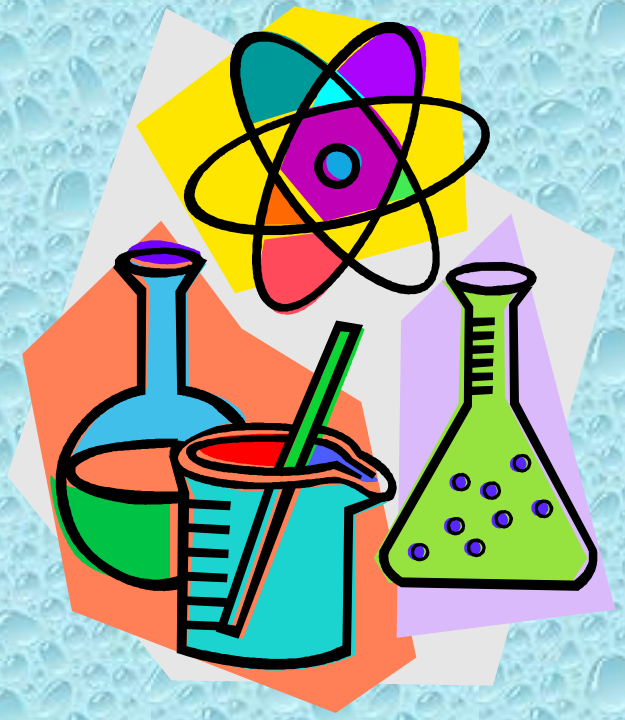
5. SURFACE TENSION

- BECAUSE WATER MOLECULES ARE ATTRACTED INWARD, THEY PULL CLOSE TOGETHER AND CAN FORM A LAYER ON TOP



6. IONIC SOLUTIONS

- An ionic compound dissolves in water because the + ions and the – ions are pulled into solution by water's + and – poles.



Solution

- Mixture that appears the same throughout and is mixed at the molecular level
- Solutions can be liquids, gases, or solids

- A solid solution is called an alloy
- Sacajawea dollar is alloy of copper and nickel

Solute

- Substance being dissolved
- Ex salt, sugar

Solvent

- Substance doing the dissolving
- Ex – water (universal solvent)

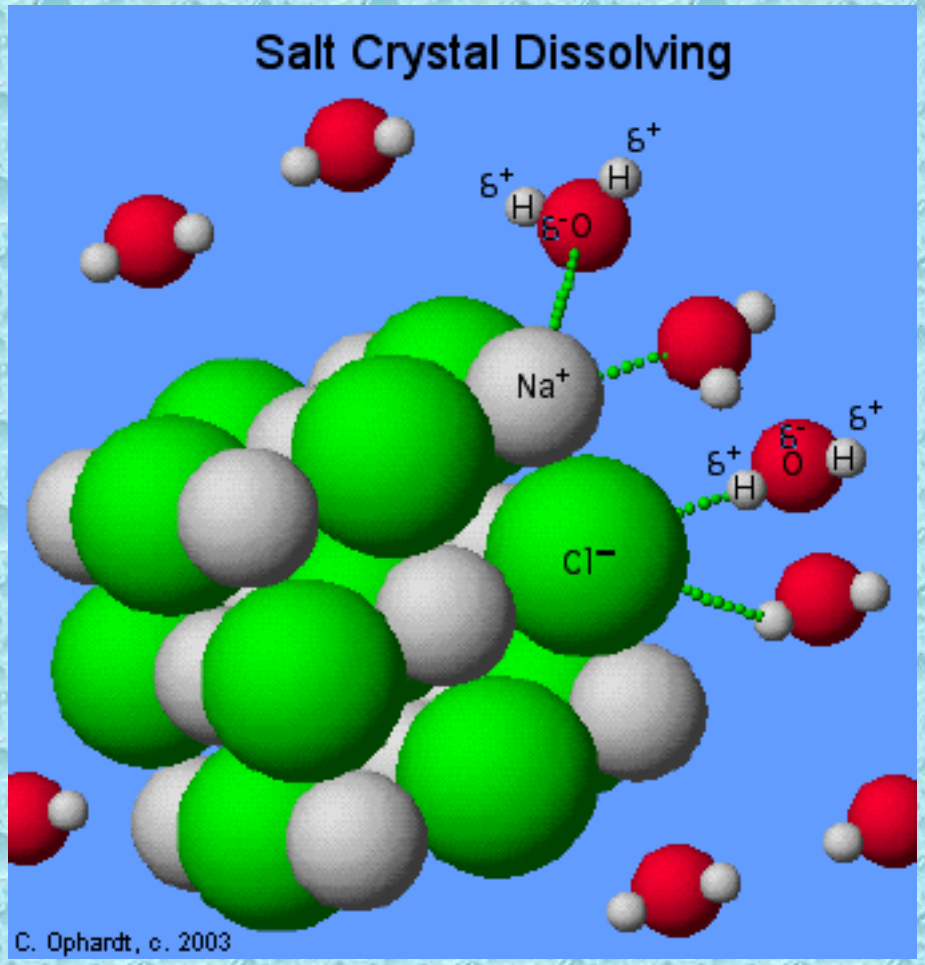
How dissolving works

- Water's plays tug-of-war with solid particles
- The negative ends of water pull at the solid's positive ends
- The positive ends of water pull at the solid's negative ends
- The moving water molecules and solid molecules spread out and mix evenly to form a solution

Making alloys (metal solutions)

- You must melt the metals so the same kind of tug-of-war and mixing can occur

- http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/molvie1.swf


Salt Crystal Dissolving
δ+
δ+
H
H
δ-O
Na+
δ+
δ-
O
H
δ+
H
Cl−
C. Ophardt, c. 2003

Kinetics

- Chemical reactions happen when molecules collide with enough force to break the bonds of the compounds.
- A molecule must have enough kinetic energy to break a bond
- The molecule must also come in at the right angle to break a bond

- Like red rover – a molecule must hit a place that can break (like hands), not a place that will not break (like slamming into a body)
- The faster a molecule is traveling, the more kinetic energy it has, the more likely it is to break a bond

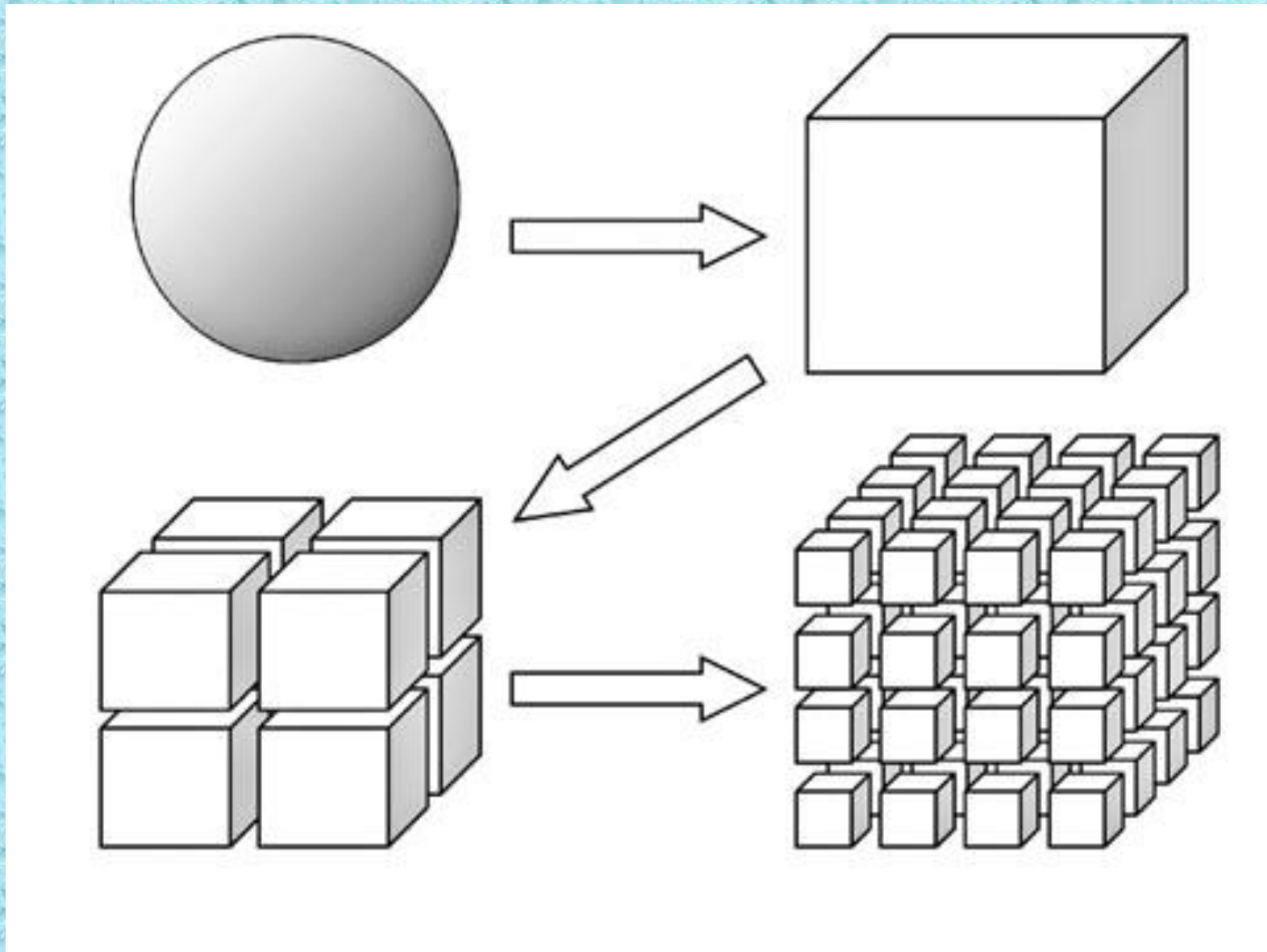
Reaction Rate

- Speed at which the reaction occurs
- 5 factors cause reactions to occur faster (or slower)

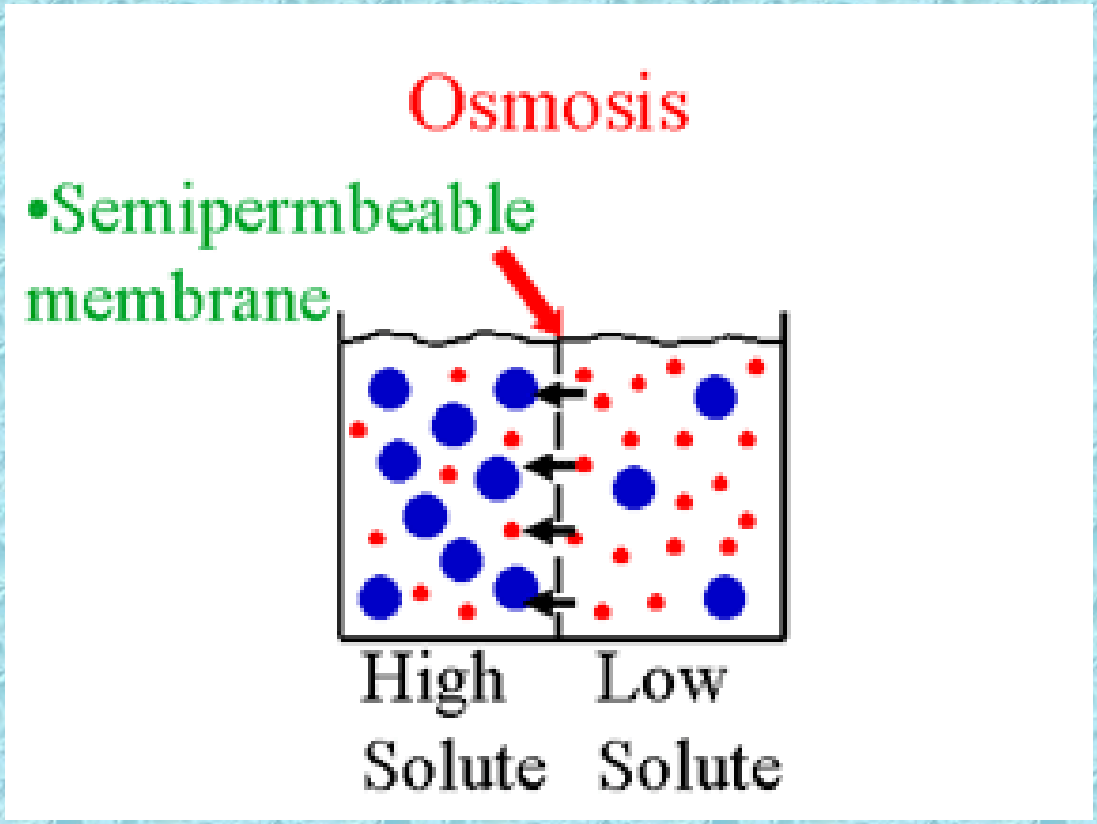
- Nature of reactants – some chemicals are just more reactive than others
- Ex – gasoline is explosive, sugar is not

- Temperature – the hotter the temperature, the more kinetic energy reactants have, the more likely they will collide and break bonds

- Surface area – the more surface area there is, the more space there is for collisions
- Agitation – stirring causes more surface areas to come into contact, more bonds break



- Concentration of reactants – the more concentrated (less “watered down”) the reactants are, the more reactant particles there are and higher chance for collision



- Catalysts – lower the activation energy needed to start a reaction but are not used up in the reaction
- Ex – a boulder can sit on the edge of a cliff for centuries. A bulldozer can start the boulder rolling. The bulldozer is the catalyst.
- Ex - Friction is required to start a match burning

Ski – catalyst for avalanche

Dissolving Without Water

- Nonpolar materials have no positive or negative areas
- They are not attracted to the polar water molecules, so they do not dissolve easily in water
- Ex. Oils, fats

- Oils are hydrocarbons (large molecules of hydrogen and carbon)
- Their electrons share electrons equally so there are no + or – ends

Useful Nonpolar Molecules

- Nonpolar solvents dissolve nonpolar solutes (hairspray dissolves ink)
- Many nonpolar solvents are toxic
- Soap – used for washing because it has polar and nonpolar propoerties

Polarity and Vitamins

- B vitamins and vitamin C – polar, will dissolve in body cells
- Vitamin A is nonpolar – dissolves in the fat of cells

Solubility and Concentration

- Solubility – the amount of a substance that can dissolve in a solvent
- Depends on the nature of the substance
- Solubilities of two substances can be compared by measuring

Concentration

- Concentrated solutions have a large amount of solute in the solvent
- Dilute solutions have a small amount of solute in the solvent
- Concentration is expressed as percent by volume of the solute (moles per liter)

Saturated Solution

- Contains all the solute it can hold at a given temperature
- As temperature increases, the amount of solute that can dissolve increases
- Solubility curves – lines on graphs used to figure how much solute can dissolve at a particular temperature

Unsaturated Solution

- Able to dissolve more solute at a given temperature

Supersaturated Solution

- Contains more solute that a saturated one at the same temperature
- Made by raising temperature, adding more solute, then lowering temperature without disturbing the solution
- Unstable – will crystallize if disturbed (rock candy)
- Crystallization – gives off energy as heat

Particles in Solution

- Ions – particles with a + or – charge
- Electrolytes – compounds that form charged particles and conduct electricity in water
- Nonelectrolytes – substances that do not

How ions form

- Ionization – molecules break apart in water causing atoms to become ions by taking on a charge
- Dissociation – an ionic solid separates into its positive and negative ions

- All solute particles affect the physical properties of the solvent
- Adding a solute lowers the freezing point of the solvent because the particles interfere with the formation of the orderly freezing pattern
- Adding a solute raises the boiling point because fewer solvent molecules can reach the surface and evaporate