

Chemistry of Life



Rattlebox Moth

- Secrete a noxious chemical for defense.
- As a caterpillar, it eats the leaves from the rattlebox plant and stores this chemical in its body.
- The female moth receives an extra dose at mating.
- During the eight hour copulation, the male passes a large mass of sperm, nutrients, and this chemical to the female, supplying additional protection for her and for their offspring.

•Nature's Chemical Language

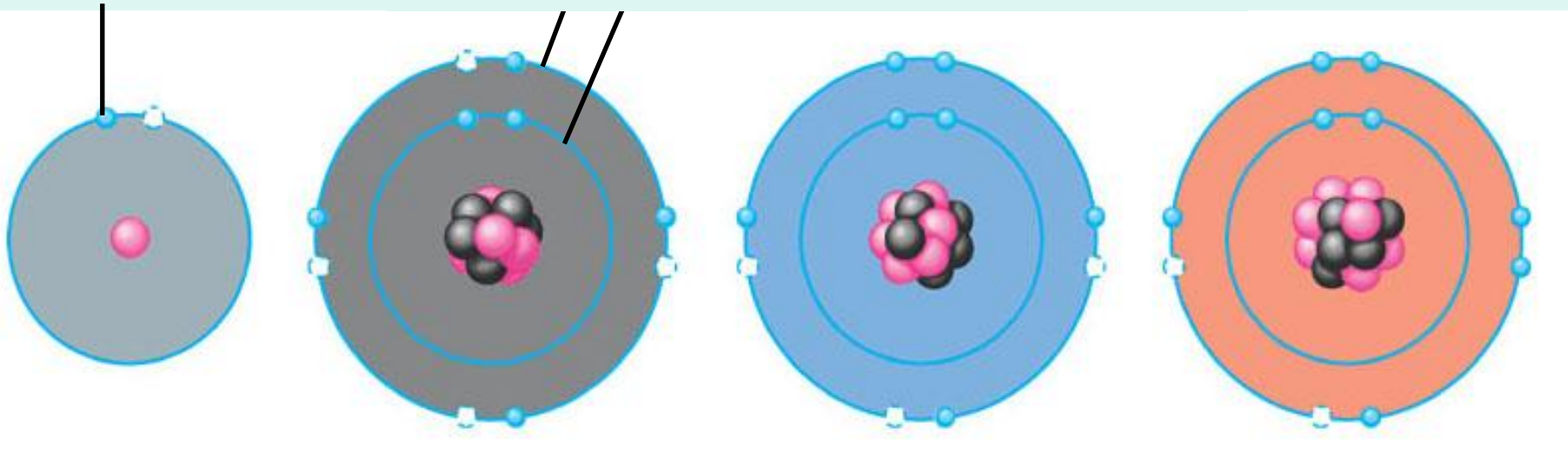
– The rattlebox moth

- Produces chemicals important for mating and defense



An element is an atom with a certain number of protons (electrical charges) circling around it in an orbit.

Electron



Hydrogen (H)
Atomic number = 1

Carbon (C)
Atomic number = 6

Nitrogen (N)
Atomic number = 7

Oxygen (O)
Atomic number = 8

ELEMENTS

- **96% of the human body is composed of just four elements.**
 - Carbon (C)
 - Hydrogen (H)
 - Oxygen (O)
 - Nitrogen (N)
- The other 4% of elements in our body
 - Calcium, phosphorus, potassium, sulfur, sodium, chlorine, and magnesium.

Trace Elements

- **Iron**
 - Needed by all forms of life for transporting the oxygen in the blood.
- **Iodine**
 - only required by certain species; it is an ingredient of a hormone produced by the thyroid gland. Iodine is commonly added to table salt to prevent the formation of goiters.
- **Fluorine**
 - added to water in some communities to reduce tooth decay
- **Zinc**
- **Manganese**



Goiter

Vitamin-Fortified Foods

- Chemicals are added to food to help preserve it, make it more nutritious, or simply to make it look better.
- Iron is frequently added
- Vitamins are frequently added

Nutrition Facts

Serving Size $\frac{3}{4}$ cup (30g)

Servings Per Container About 11

Amount Per Serving	Whole Grain Total	with $\frac{1}{2}$ cup skim milk
Calories	110	150
Calories from Fat	10	10
% Daily Value**		
Total Fat 1g*	1%	1%
Saturated Fat 0g	0%	0%
Polyunsaturated Fat 0g		
Monounsaturated Fat 0g		
Cholesterol 0mg	0%	1%
Sodium 190mg	8%	11%
Potassium 90mg	3%	8%
Total Carbohydrate 23g	8%	10%
Dietary Fiber 3g	10%	10%
Sugars 5g		
Other Carbohydrate 15g		
Protein 2g		
Vitamin A	10%	15%
Vitamin C	100%	100%
Calcium	100%	110%
Iron	100%	100%
Vitamin D	10%	25%
Vitamin E	100%	100%
Thiamin	100%	100%
Riboflavin	100%	110%
Niacin	100%	100%
Vitamin B ₆	100%	100%
Folic Acid	100%	100%
Vitamin B ₁₂	100%	110%
Pantothenic Acid	100%	100%
Phosphorus	8%	20%
Magnesium	6%	10%
Zinc	100%	100%
Copper	4%	4%



Trace elements are essential to human health and may be added to food or water

Compounds

- Two or more elements
- Hydrogen (H) and Oxygen (O) = H₂O
- Sodium (Na) and Chlorine (Cl) = NaCl
- Demonstrates new properties with a higher level of structural organization
- Carbon, hydrogen, oxygen, and nitrogen form most of the compounds in living organisms

Elements can combine to form compounds



Sodium

+



Chlorine



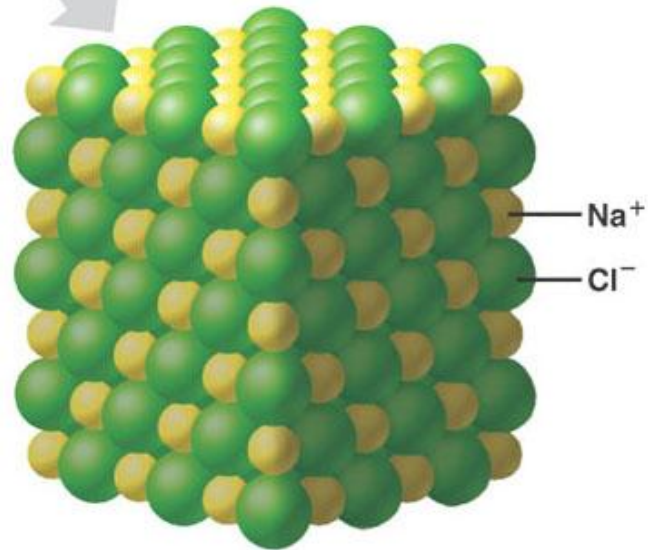
Sodium Chloride

INORGANIC COMPOUNDS

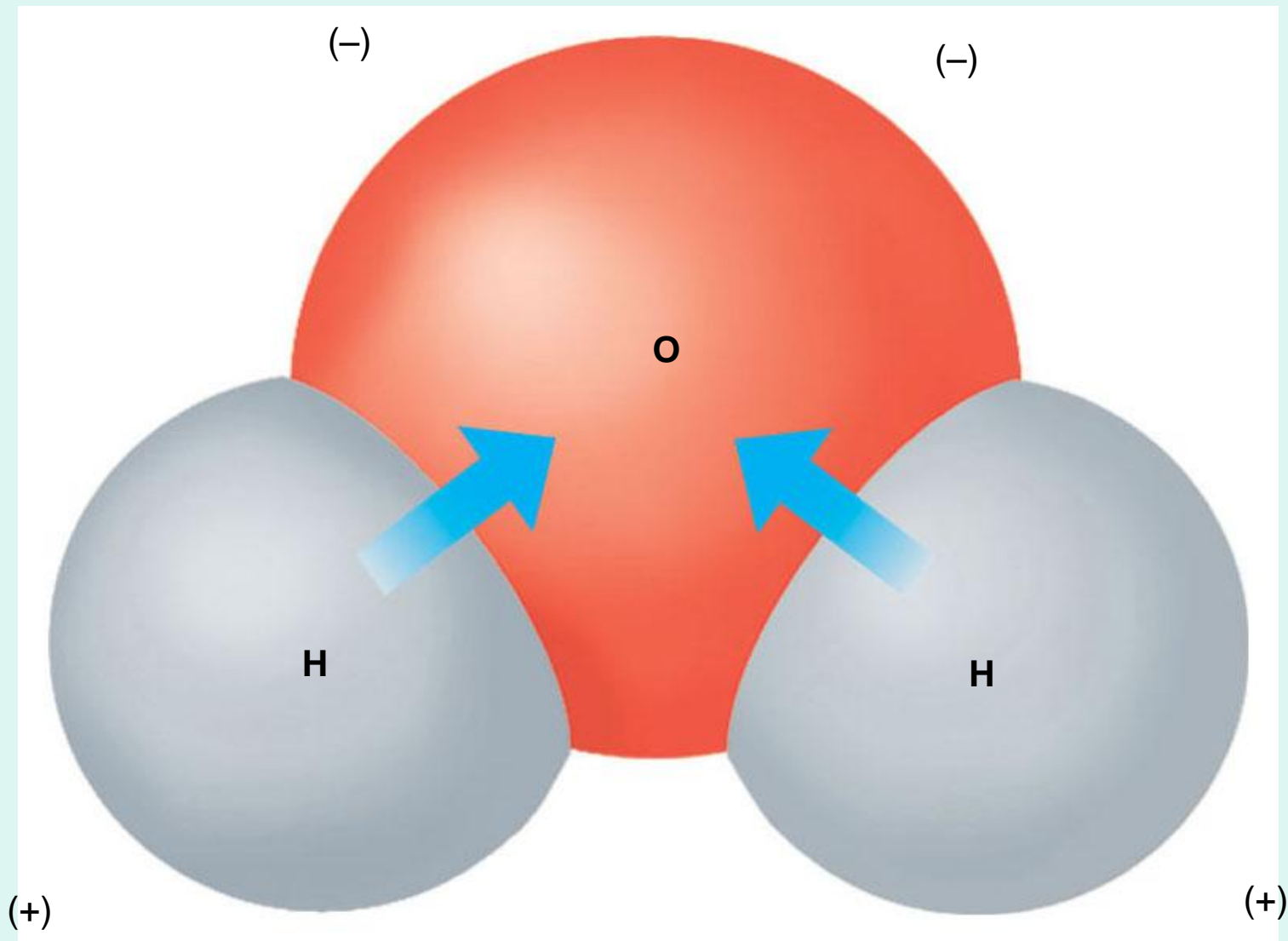
- **Contain NO carbon atoms**
- **SALTS**
 - needed for muscle contraction and nerve conduction.
- **WATER**
 - It keeps the body from overheating
 - It also prevents drastic changes in temperature.

– Sodium and chloride ions

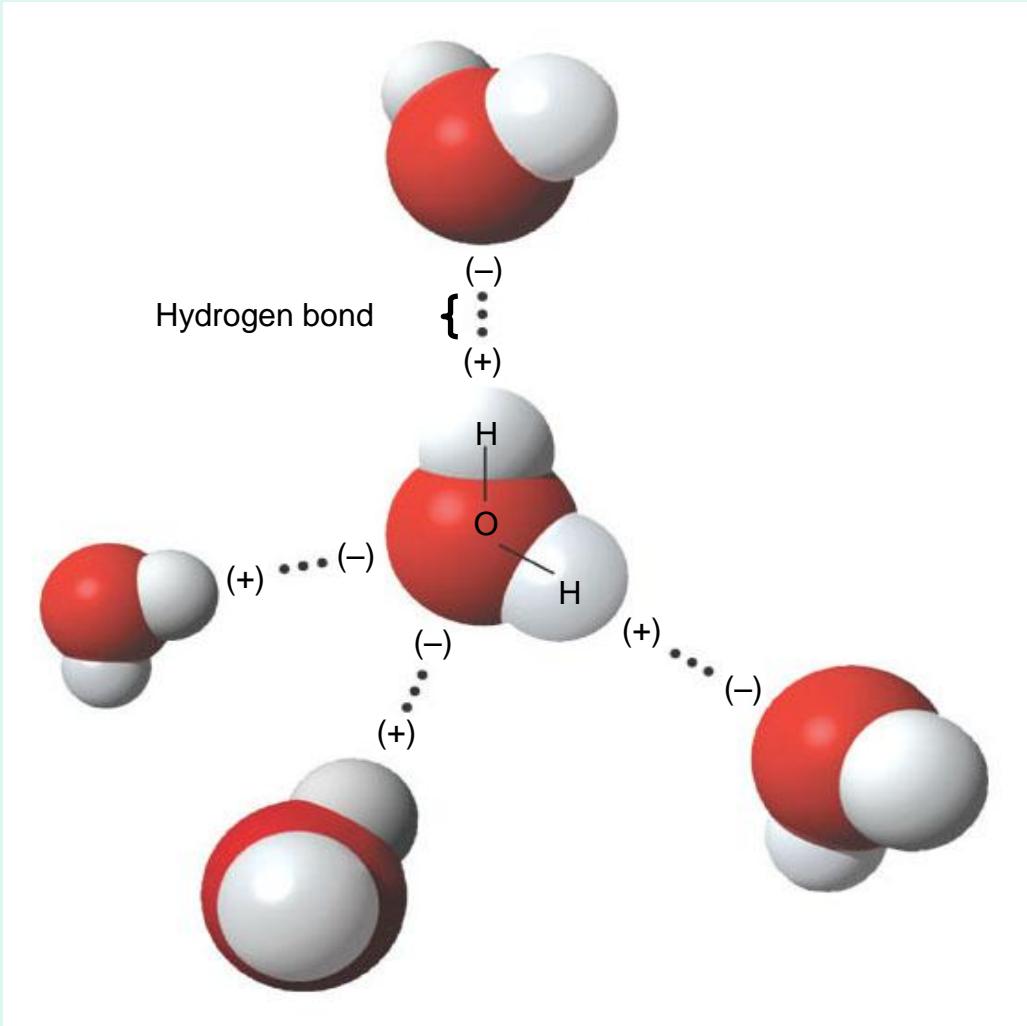
- Bond to form sodium chloride, common table salt



Water Molecule



Water molecules form weak bonds between each other called hydrogen bonds

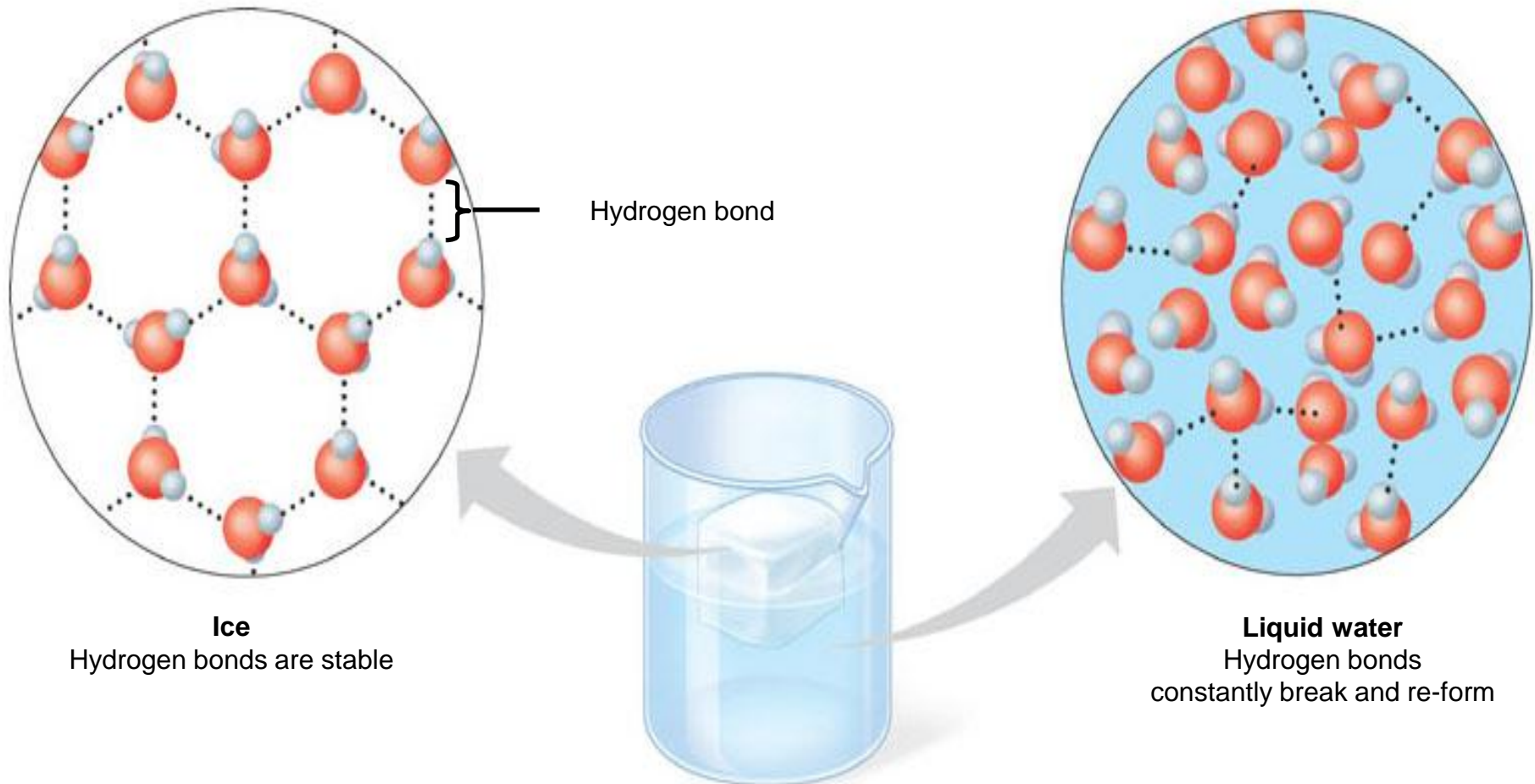


- Insects can walk on water due to surface tension



Ice is less dense than liquid water

- Hydrogen bonds hold molecules in ice farther apart than in liquid water

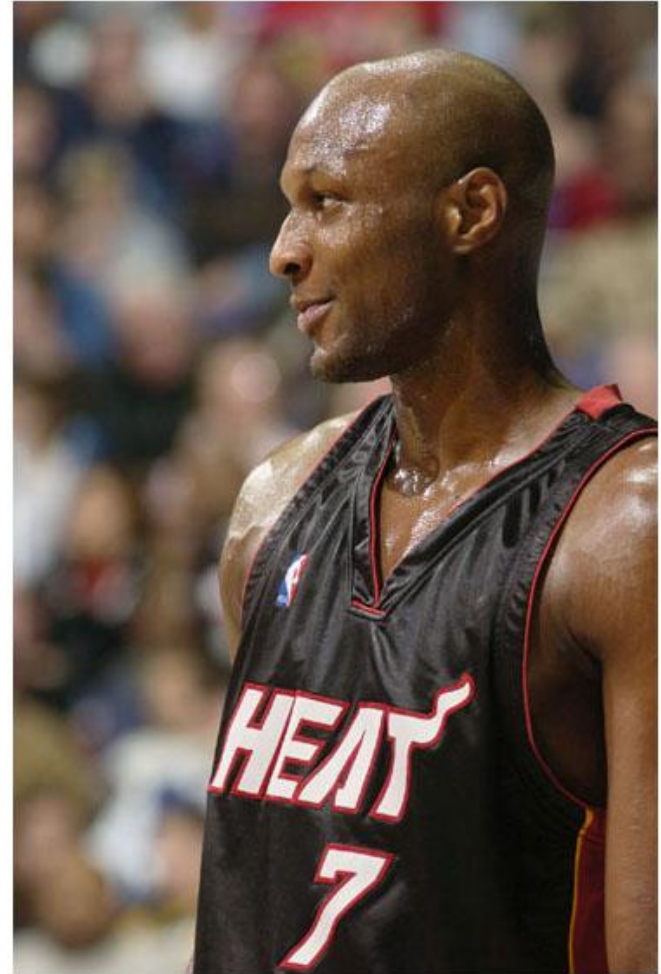


WATER

- Resists temperature change
- A large body of water can store a huge amount of heat from the sun during warm periods.
- At cooler times, heat given off from the gradually cooling water can warm the air.
- Coastal areas have milder climates than inland regions.
- Water's resistance to temperature change stabilizes ocean temperatures, creating a favorable environment for marine life.

How do land organisms keep from overheating?

- Evaporative cooling
 - Plant's leaves
 - Human sweating
 - Evaporation of surface waters cools tropical seas.



Water is the solvent of life

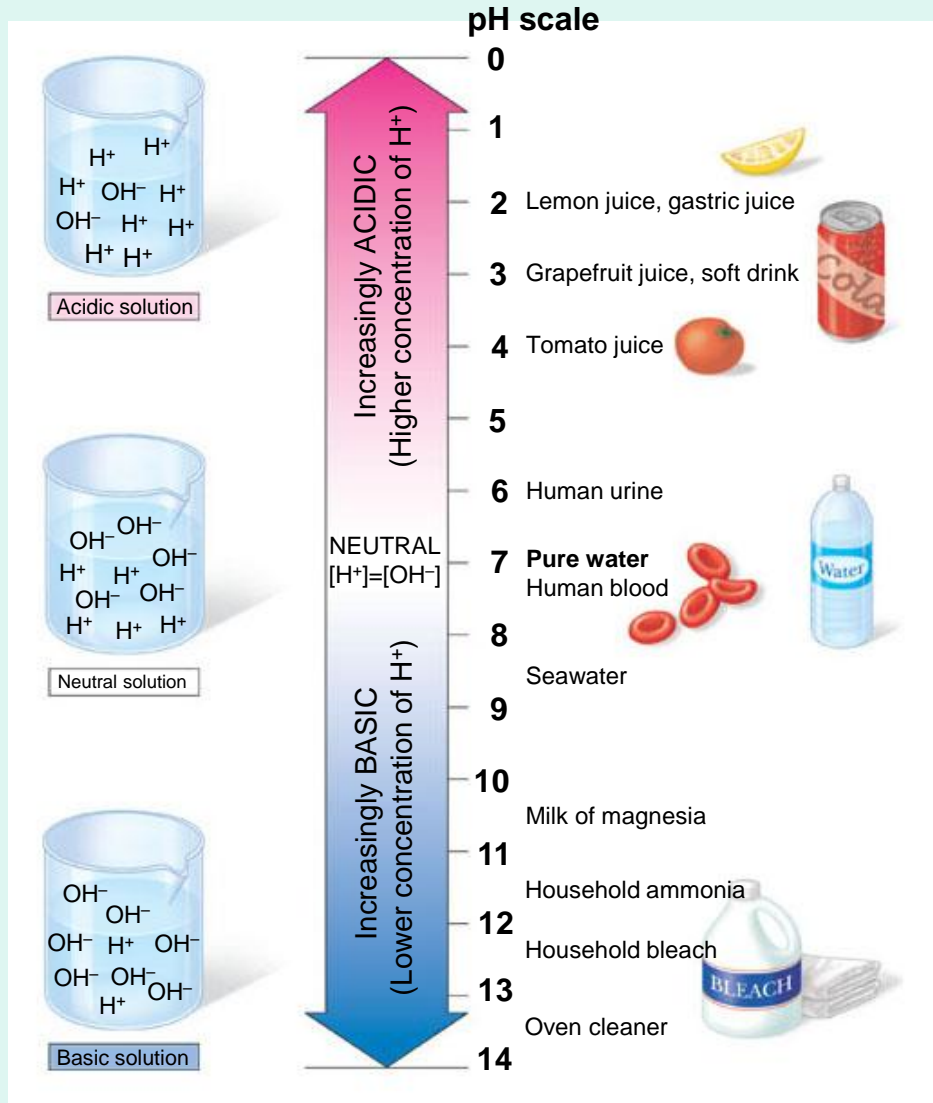
- **Solution:** a liquid consisting of a uniform mixture of two or more substances.
- **Solvent:** the dissolving agent
- **Solute:** the substance that is dissolved

Acids and Bases

- Some water molecules break apart into ions.
 - Hydrogen ions (H^+)
 - Hydroxide ions (OH^-)
- **Acid:** excess hydrogen ions (H^+)
 - hydrochloric acid in your stomach
- **Base:** excess hydroxide ions (OH^-)
 - Ammonia is a base

pH scale

- Neutral: $\text{pH} = 7$
- Acid: $\text{pH} < 7$
- Base: $\text{pH} > 7$



Acid Rain

- **Acid rain = pH well below 7**
- **Results from sulfur and nitrogen in the air.**
- **Sulfur and nitrogen in the air comes from the burning of fossil fuels such as coal, oil, and gas.**
- **Electrical power plants that burn coal produce more of these pollutants than any other single source.**

Sulfur and nitrogen in the air comes from the burning of fossil fuels



The Effect of Acid Rain

- **Lakes:**
 - most pronounced in the spring
 - Kills eggs and young fish
- **Forests:**
 - Ions bind with essential minerals needed for plant growth
 - Leaves behind toxic levels of aluminum
- **Cities:**
 - corrosion of buildings and statues

Lakes

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Corrosion of
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Cities

