Chemistry of a living cell

Cell Components

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The living cell consists of mass of protoplasm surrounded by a plasma membrane (P.M). The protoplasm is the living material of the cell and it is considered as the life itself, has two compartments, cytoplasm and nucleoplasm. The protoplasm is colloid (material made up of chemical molecules (**inorganic and organic**).

Inorganic Substances

There are 4 key inorganic substances common in cells:

1-water

2-carbon dioxide

3- oxygen

4-salts

The Importance of the Water

Water is the most abundant compound in the body (70–90%). Water carries substances to and from the cells and makes possible the essential processes of absorption, exchange, secretion, and excretion.

The properties of water are:

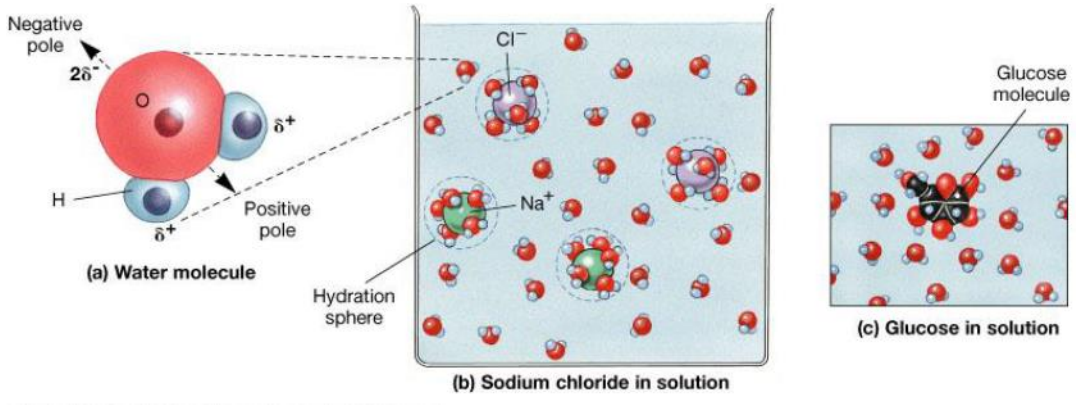
1.Water has a high heat capacity

2.Water has a high heat of evaporation

3.Water is a solvent.95% of the cellular water found free

Water molecules and solutions

Water molecules and solutions



Acids, Bases and Salts

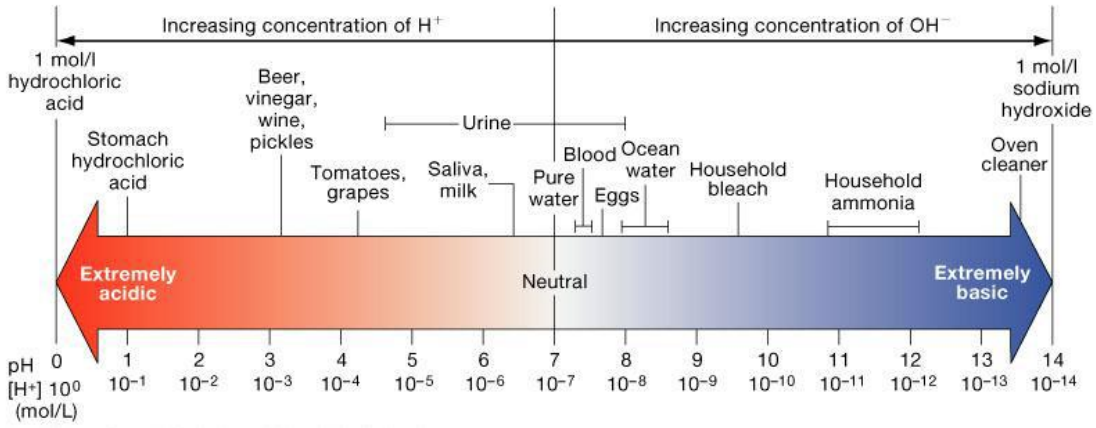
An acid is a chemical substance capable of donating a hydrogen ion (H+) to another substance. A common example is hydrochloric acid (HCl), the acid found in stomach juices.

A base is a chemical substance, usually containing a hydroxide ion (OH−), that can accept a hydrogen ion. A base is also called an alkali and bases are described as alkaline. Sodium hydroxide, which releases hydroxide ions in solution.

A reaction between an acid and a base produces a salt and also water. In the reaction, the hydrogen of the acid is replaced by the positive ion of the base.

pH Scale

The pH scale is used to indicate the acidity or basicity (alkalinity) of a solution. pH scale ranges from 0 to 14. A pH of 7 represents a neutral state in which the hydrogen ion and hydroxide ion concentrations are equal. A pH below 7 is an acidic solution because the hydrogen ion concentration is greater than the hydroxide concentration. The pH of the arterial plasma is normally 7.40 and that of venous plasma slightly lower. Acidity and alkalinity are indicated by pH units, which represent the relative concentrations of hydrogen and hydroxide ions in a solution. The pH units are listed on a scale from 0 to 14, with 0 being the most acidic and 14 being the most basic.



Buffers and Salts

A buffer is a chemical or a combination of chemicals that keeps pH within normal limits. In living things, the pH of body fluids is maintained within a narrow range, or else health suffers. The pH of our blood when we are healthy is always about 7.4 that is, just slightly basic (alkaline).

If the blood pH drops to about 7, become acidosis. If the blood pH rises to about 7.8, become alkalosis. Buffers remove or replace hydrogen ions in solution.

Salt = an electrolyte whose cation is not hydrogen and whose anion is not hydroxide. Salts are actually a group of inorganic compounds provide many ions for important metabolic processes, including transport of substances into and out of the cell, muscle contraction, and nerve impulses.

Salts dissociated into anions (e.g., Cl − OH) and cations (e.g., Na+ and K+), these are important in maintaining osmotic pressure and acid-base equilibrium of the cell.

The concentration of various ions in the intracellular fluid differs from that in the interstitial fluid (extracellular). The cell has a high concentration of K+ and Mg++(intracellular), while Na+ and Cl^- are mainly localized in the interstitial fluid. H+ ions is more excreted extracellular while the $HCO3^-$ is more intracellular.