

Fundamentals of chemistry

matter	Matter refers to anything that has mass and occupies space. It can exist in various states, including solid, liquid, and gas.
elements	Elements are the simplest form of matter that cannot be broken down into simpler substances by chemical means.
atoms	Atoms are incredibly small and are the building blocks of all matter. They consist of a nucleus containing protons and neutrons, with electrons orbiting around the nucleus.

Bonding of atoms

ion	atom or molecule that has gained or lost one or more electrons, resulting in a net electric charge.
cation	When an atom loses electrons, it becomes positively charged
anion	gains electrons, it becomes negatively charged
ionic bond	electrostatic attraction between oppositely charged ions
covalent bond	chemical bond formed by the sharing of electron pairs between atoms.
polar covalent bond	electrons are unequally shared between the two atoms creating a dipole moment
non-polar covalent bond	electrons are equally shared between the two atoms, leading to no significant difference in electronegativity.

Atomic Structure

electrons Electrons are negatively charged subatomic particles that orbit the nucleus of an atom. They determine the chemical behavior of an element and are involved in the formation of chemical bonds.

neutrons Neutrons are electrically neutral subatomic particles located in the nucleus of an atom.

protons Protons are positively charged subatomic particles found in the nucleus of an atom.

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Atomic Structure (cont)

isotopes isotope refers to variants of an element that contain the same number of protons but differ in the number of neutrons.

atomic number number of protons in the nucleus of an atom.

atomic mass determined by the sum of its protons and neutrons.

Organic Substances

Carbohydrates provide energy that cells require and also contribute to cell structure. basic building blocks are simple sugar molecules

Lipids triglycerides, phospholipids, steroids, supply energy and build cell parts.

Organic Substances (cont)

Proteins serve as structural materials, energy sources, hormones, cell surface receptors, and enzymes.

Inorganic Substances

Water solvent in which chemical reactions occur. water transport chemicals and heat.

Oxygen releases energy from glucose and drives metabolism

Carbon Dioxide produced when metabolism releases energy

Salts Inorganic elements such as iron, magnesium, phosphorus, and sulfur are essential for various cellular functions, including enzyme cofactors, structural components, and energy transfer.

Chemical Reactions

synthesis $A + B \rightarrow AB$

decomposition $AB \rightarrow A + B$

exchange reactions involves the exchange of atoms or groups of atoms between two compounds.

Cellular Transport

Facilitated Diffusion Facilitated diffusion uses membrane proteins that function as carriers to move molecules (such as glucose) across the cell membrane.

Active Transport Moves substances from an area of lower concentration to an area of higher concentration. Requires transport protein pumps and ATP



Cellular Transport (cont)

Hypertonic solution higher osmotic pressure than body fluids

isotonic A solution with the same osmotic pressure as body fluids

Hypotonic solution lower osmotic pressure

Osmosis movement of water molecules from an area of higher cont. to an area lower cont. across a selectively permeable membrane.

Filtration Pushing of molecules through a membrane containing openings of a certain size

Acids and Bases

Acid An acid is a substance that can donate a proton or accept an electron pair in reactions. Acids have a pH value less than 7.

Base substance that can accept a proton or donate an electron pair in reactions.

pH pH is a measure of the acidity or alkalinity of a solution.

Electrolytes Electrolytes are substances that dissociate into ions in solution, enabling them to conduct electricity. Both acids and bases can be electrolytes as they produce ions in solution.

Acids and Bases (cont)

Buffers A buffer is a solution that resists changes in pH when an acid or base is added to it. Buffers are typically composed of a weak acid and its conjugate base, or a weak base and its conjugate acid, and help maintain the pH of a solution within a specific range.

Endocytosis & Exocytosis

Endocytosis process by which a cell takes in substances from the external environment. It involves the formation of a small pocket or indentation in the cell membrane, which then engulfs the substance and forms a vesicle around it. This vesicle is then transported into the cell, where the substance can be processed or utilized.

Endocytosis & Exocytosis (cont)

Exocytosis process by which a cell releases substances to the external environment. It involves the fusion of a vesicle containing the substance with the cell membrane, resulting in the release of the substance outside the cell. This process is often used to secrete molecules such as hormones, enzymes, or waste products.