

**Vinnitsa National Pirogov Memorial Medical University**  
Biological and General Chemistry Department  
Medical chemistry course

## **CHEMISTRY DICTIONARY**



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## A

### Absolute Entropy (of a substance)

The increase in the entropy of a substance as it goes from a perfectly ordered crystalline form at 0 °K (where its entropy is zero) to the temperature in question.

### Absolute Zero

The zero point on the absolute temperature scale; -273.15°C or 0 K; theoretically, the temperature at which molecular motion ceases.

### Absorption Spectrum

Spectrum associated with absorption of electromagnetic radiation by atoms (or other species) resulting from transitions from lower to higher energy states.

### Accuracy

How closely a measured value agrees with the correct value.

### Acid

A substance that produces H<sup>+</sup>(aq) ions in aqueous solution. Strong acids ionize completely or almost completely in dilute aqueous solution. Weak acids ionize only slightly.

### Acid Anhydride

The oxide of a nonmetal that reacts with water to form an acid.

### Acid Anhydride

Compound produced by dehydration of a carbonic acid; general formula is R--C--O--C--R

### Acidic Salt

A salt containing an ionizable hydrogen atom; does not necessarily produce acidic solutions.

### Activation Energy

Amount of energy that must be absorbed by reactants in their ground states to reach the transition state so that a reaction can occur.

### Active Metal

Metal with low ionization energy that loses electrons readily to form cations.

### Activity (of a component of ideal mixture)

A dimensionless quantity whose magnitude is: equal to molar concentration in an ideal solution; equal to partial pressure in an ideal gas mixture; and defined as 1 for pure solids or liquids.

### Activity Series

A listing of metals (and hydrogen) in order of decreasing activity

### Actual Yield

Amount of a specified pure product actually obtained from a given reaction. Compare with Theoretical Yield.

### Actinides

Elements 90 to 103 (after actinium)

### Acyl Group

Compound derived from a carbonic acid by replacing the --OH group with a halogen (X), usually --Cl; general formula is O R--C--X

### Addition Reaction

A reaction in which two atoms or groups of atoms are added to a molecule, one on each side of a double or triple bond

### Adhesive Forces

Forces of attraction between a liquid and another surface.

### Adsorption

Adhesion of a species onto the surfaces of particles

### Alcohol

Hydrocarbon derivative containing an --OH group attached to a carbon atom not in an aromatic ring.

### Aldehyde

Compound in which an alkyl or aryl group and a hydrogen atom are attached to a carbonyl group and a hydrogen atom are attached to a carbonyl group; general formula, O-R-C-H

### Alkali Metals

Metals of Group IA (Na, K, Rb).

### Alkaline Battery

A dry cell in which the electrolyte contains KOH.

### Alkaline Earth Metals

Group IIA metals

### Alkenes (Olefins)

Unsaturated hydrocarbons that contain one or more carbon-carbon double bonds.

### Alkyl Group

A group of atoms derived from an alkane by the removal of one hydrogen atom.

### Alkylbenzene

A compound containing an alkyl group bonded to a benzene ring.

### Alkynes

Unsaturated hydrocarbons that contain one or more carbon-carbon triple bonds.

### Allotropes

Different forms of the same element in the same physical state.

### Allotropic Modifications (Allotropes)

Different forms of the same element in the same physical state.

### Alloying

Mixing of metal with other substances (usually other metals) to modify its properties.

### Alpha Particle

A helium nucleus.

### Alpha (α) Particle

Helium ion with  $2^+$  charge; an assembly of two protons and two neutrons.

### Alums

Hydrated sulfates of the general formula  $M^+M^{3+}(SO_4)_2 \cdot 12H_2O$ .

### Amide

Compound containing the O-C-N group.

Compound that can be considered a derivative of ammonia in which one or more hydrogens are replaced by an alkyl or aryl group.

### Amine

Derivatives of ammonia in which one or more hydrogen atoms have been replaced by organic groups.

### Amine Complexes

Complex species that contain ammonia molecules bonded to metal ions.

### Amino Acid

Compound containing both an amino and a carboxylic acid group. The  $-NH_2$  group.

### Amorphous Solid

A noncrystalline solid with no well-defined ordered structure.

### Ampere

Unit of electrical current; one ampere equals one coulomb per second.

### Amphiprotism

Ability of a substance to exhibit amphiprotism by accepting donated protons.

### Amphoterism

The ability to react with both acids and bases. Ability of substance to act as either an acid or a base.

### Anion

A negative ion; an atom or group of atoms that has gained one or more electrons.

### Anode

In a cathode ray tube, the positive electrode. Electrode at which oxidation occurs.

### Antibonding Orbital

A molecular orbital higher in energy than any of the atomic orbitals from which it is derived; lends instability to a molecule or ion when populated with electrons; denoted with a star (\*) superscript or symbol.

### Aromatic Hydrocarbons

Benzene and its derivatives.

Artificial Transmutation

An artificially induced nuclear reaction caused by the bombardment of a nucleus with subatomic particles or small nuclei.

Aryl Group

Group of atoms remaining after a hydrogen atom is removed from the aromatic system.

Associated Ions

Short-lived species formed by the collision of dissolved ions of opposite charges.

Atmosphere

A unit of pressure; the pressure that will support a column of mercury 760 mm high at 0 °C.

Atom

The smallest particle of an element

Atomic Mass Unit (amu)

One twelfth of a mass of an atom of the carbon-12 isotope; a unit used for stating atomic and formula weights; also called dalton.

Atomic Number

Integral number of protons in the nucleus; defines the identity of element.

Atomic Orbital

Region or volume in space in which the probability of finding electrons is highest.

Atomic Radius

Radius of an atom.

Atomic Weight

Weighted average of the masses of the constituent isotopes of an element; The relative masses of atoms of different elements.

Aufbau ('building up') Principle

Describes the order in which electrons fill orbitals in atoms.

Autoionization

An ionization reaction between identical molecules.

Avogadro's Law

At the same temperature and pressure, equal volumes of all gases contain the same number of molecules.

Avogadro's Number

The number ( $6.022 \times 10^{23}$ ) of atoms, molecules or particles found in exactly 1 mole of substance.

**B**

Background Radiation

Radiation extraneous to an experiment. Usually the low-level natural radiation from cosmic rays and trace radioactive substances present in our environment.

### Band

A series of very closely spaced, nearly continuous molecular orbitals that belong to the crystal as a whole.

### Band of Stability

Band containing nonradioactive nuclides in a plot of number of neutrons versus atomic number.

### Band Theory of Metals

Theory that accounts for the bonding and properties of metallic solids.

### Barometer

A device for measuring pressure.

### Base

A substance that produces OH (aq) ions in aqueous solution. Strong soluble bases are soluble in water and are completely dissociated. Weak bases ionize only slightly.

### Basic Anhydride

The oxide of a metal that reacts with water to form a base.

### Basic Salt

A salt containing an ionizable OH group.

### Beta Particle

Electron emitted from the nucleus when a neutron decays to a proton and an electron.

### Biodegradability

The ability of a substance to be broken down into simpler substances by bacteria.

### Binary Acid

A binary compound in which H is bonded to one or more of the more electronegative nonmetals.

### Binary Compound

A compound consisting of two elements; may be ionic or covalent.

### Binding Energy (nuclear binding energy)

The energy equivalent ( $E = mc^2$ ) of the mass deficiency of an atom.

where:  $E$  = is the energy in joules,  $m$  is the mass in kilograms, and  $c$  is the speed of light in  $m/s^2$

### Boiling Point

The temperature at which the vapor pressure of a liquid is equal to the applied pressure; also the condensation point

### Boiling Point Elevation

The increase in the boiling point of a solvent caused by the dissolution of a nonvolatile solute.

### Bomb Calorimeter

A device used to measure the heat transfer between system and surroundings at constant volume.

### Bond Energy

The amount of energy necessary to break one mole of bonds of a given kind (in gas phase).



The amount of energy necessary to break one mole of bonds in a substance, dissociating the substance in the gaseous state into atoms of its elements in the gaseous state.

Bond Order

Half the numbers of electrons in bonding orbitals minus half the number of electrons in antibonding orbitals.

Bonding Orbital

A molecular orbit lower in energy than any of the atomic orbitals from which it is derived; lends stability to a molecule or ion when populated with electron

Bonding Pair

Pair of electrons involved in a covalent bond.

Boron Hydrides

Binary compounds of boron and hydrogen.

Born-Haber Cycle

A series of reactions (and accompanying enthalpy changes) which, when summed, represents the hypothetical one-step reaction by which elements in their standard states are converted into crystals of ionic compounds (and the accompanying enthalpy changes.)

Boyle's Law

At constant temperature the volume occupied by a definite mass of a gas is inversely proportional to the applied pressure.

Breeder Reactor

A nuclear reactor that produces more fissionable nuclear fuel than it consumes.

Bronsted-Lowry Acid

A proton donor.

Bronsted-Lowry Base

A proton acceptor

Buffer Solution

Solution that resists change in pH; contains either a weak acid and a soluble ionic salt of the acid or a weak base and a soluble ionic salt of the base.

Buret

A piece of volumetric glassware, usually graduated in 0.1-mL intervals, that is used to deliver solutions to be used in titrations in a quantitative (dropwise) manner.

**C**

Calorie

The amount of heat required to raise the temperature of one gram of water from 14.5°C to 15.5°C. 1 calorie = 4.184 joules.

Calorimeter

A device used to measure the heat transfer between system and surroundings.

### Canal Ray

Stream of positively charged particles (cations) that moves toward the negative electrode in cathode ray tubes; observed to pass through canals in the negative electrode.

### Capillary

A tube having a very small inside diameter.

### Capillary Action

The drawing of a liquid up the inside of a small-bore tube when adhesive forces exceed cohesive forces, or the depression of the surface of the liquid when cohesive forces exceed the adhesive forces.

### Carbanion

An organic ion carrying a negative charge on a carbon atom.

### Carbonium ion

An organic ion carrying a positive charge on a carbon atom.

### Carcinogen

A substance capable of causing or producing cancer in mammals.

### Catalyst

A substance that speeds up a chemical reaction without being consumed itself in the reaction.

A substance that alters (usually increases) the rate at which a reaction occurs.

### Catenation

Bonding of atoms of the same element into chains or rings. The bonding together of atoms of the same element to form chains. The ability of an element to bond to itself.

### Cathode

Electrode at which reduction occurs. In a cathode ray tube, the negative electrode.

### Cathodic Protection

Protection of a metal (making it a cathode) against corrosion by attaching it to a sacrificial anode of a more easily oxidized metal.

### Cathode Ray Tube

Closed glass tube containing a gas under low pressure, with electrodes near the ends and a luminescent screen at the end near the positive electrode; produces cathode rays when high voltage is applied.

### Cation

A positive ion; an atom or group of atoms that has lost one or more electrons.

### Cell Potential

Potential difference,  $E_{\text{cell}}$ , between oxidation and reduction half-cells under nonstandard conditions.

### Central Atom

An atom in a molecule or polyatomic ion that is bonded to more than one other atom.

### Chain Reaction

A reaction that, once initiated, sustains itself and expands. This is a reaction in which reactive species, such as radicals, are produced in more than one step. These reactive species, radicals, propagate the chain reaction.

### Chain Termination Step

The combination of two radicals, which removes the reactive species that propagate the change reaction.

### Charle's Law

At constant pressure the volume occupied by a definite mass of gas is directly proportional to its absolute temperature.

### Chemical Bonds

The attractive forces that hold atoms together in elements or compounds.

### Chemical Change

A change in which one or more new substances are formed.

### Chemical Equation

Description of a chemical reaction by placing the formulas of the reactants on the left and the formulas of products on the right of an arrow.

### Chemical Equilibrium

A state of dynamic balance in which the rates of forward and reverse reactions are equal; there is no net change in concentrations of reactants or products while a system is at equilibrium.

### Chemical Hygiene Officer (CHO)

A person or employee who is qualified by training or experience to provide technical guidance in the development and implementations of the provisions of a Chemical Hygiene Plan (CHP)

### Chemical Hygiene Plan (CHP)

A written program developed and implemented by an employer designating procedures, equipment, personal protective equipment, and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace.

### Chemical Kinetics

The study of rates and mechanisms of chemical reactions and of the factors on which they depend.

### Chemical Periodicity

The variations in properties of elements with their position in the periodic table

Cis- The prefix used to indicate that groups are located on the same side of a bond about which rotation is restricted.

Cis-Trans Isomerism

A type of geometrical isomerism related to the angles between like ligands.

### Clay

A class of silicate and aluminosilicate minerals with sheet-like structures that have enormous surface areas that can absorb large amounts of water.

### Cloud Chamber

A device for observing the paths of speeding particles as vapor molecules condense on them to form foglike tracks.

### Coefficient of expansion

The ratio of the change in length or volume of a body to the original length or volume for a unit change in temperature.

### Cohesive Forces

All the forces of attraction among particles of a liquid.

### Coke

An impure form of carbon obtained by destructive distillation of coal or petroleum.

### Colligative Properties

Physical properties of solutions that depend upon the number but not the kind of solute particles present.

### Collision Theory

Theory of reaction rates that states that effective collisions between reactant molecules must occur in order for the reaction to occur.

### Colloid

A heterogeneous mixture in which solute-like particles do not settle out.

### Combination Reaction

Reaction in which two substances (elements or compounds) combine to form one compound.

Reaction of a substance with oxygen in a highly exothermic reaction, usually with a visible flame.

### Combustible

Classification of liquid substances that will burn on the basis of flash points. A combustible liquid means any liquid having a flash point at or above 37.8°C (100°F) but below 93.3°C (200°F), except any mixture having components with flash points of 93.3°C (200°F) or higher, the total of which makes up 99 percent or more of the total volume of the mixture.

### Common Ion Effect

Suppression of ionization of a weak electrolyte by the presence in the same solution of a strong electrolyte containing one of the same ions as the weak electrolyte.

### Complex Ions

Ions resulting from the formation of coordinate covalent bonds between simple ions and other ions or molecules.

### Composition Stoichiometry

Describes the quantitative (mass) relationships among elements in compounds.

### Compound

A substance of two or more elements in fixed proportions. Compounds can be decomposed into their constituent elements.

### Compressed Gas

A gas or mixture of gases having, in a container an absolute pressure exceeding 40 psi at 21.1°C (70°F)

A gas or mixture having in a container, an absolute pressure exceeding 104 psi at 54.4°C (130°F) regardless of the pressure at (21.1°C (70°F)

A liquid having a vapour pressure exceeding 40 psi at 37.8°C (70°F) as determined by ASTM D-323-72.

### Concentration

Amount of solute per unit volume or mass of solvent or of solution.

### Condensation

Liquefaction of vapor.

### Condensed Phases

The liquid and solid phases; phases in which particles interact strongly.

### Condensed States

The solid and liquid states.

### Conduction Band

A partially filled band or a band of vacant energy levels just higher in energy than a filled band; a band within which, or into which, electrons must be promoted to allow electrical conduction to occur in a solid.

### Conjugate Acid-base Pair

In Bronsted-Lowry terminology, a reactant and product that differ by a proton, H<sup>+</sup>.

### Conformations

Structures of a compound that differ by the extent of rotation about a single bond.

### Continuous Spectrum

Spectrum that contains all wave-lengths in a specified region of the electromagnetic spectrum.

### Control Rods

Rods of materials such as cadmium or boron steel that act as neutron absorbers (not merely moderators) used in nuclear reactors to control neutron fluxes and therefore rates of fission.

### Conjugated Double Bonds

Double bonds that are separated from each other by one single bond -C=C-C=C-.

### Contact Process

Industrial process by which sulfur trioxide and sulfuric acid are produced from sulfur dioxide.

### Coordinate Covalent Bond

A covalent bond in which both shared electrons are donated by the same atom; a bond between a Lewis base and a Lewis acid.

### Coordination Compound or Complex

A compound containing coordinate covalent bonds.

### Coordination Isomers

Isomers involving exchanges of ligands between complex cation and complex anion of the same compound.

### Coordination Number

In describing crystals, the number of nearest neighbours of an atom or ion.  
The number of donor atoms coordinated to a metal.

### Coordination Sphere

The metal ion and its coordinating ligands but not any uncoordinated counter-ions.

### Corrosion

Oxidation of metals in the presence of air and moisture.

### Coulomb

Unit of electrical charge.

### Coulometry

The quantitative application of Faraday's Law to the analysis of materials. The current and time are the usual variables measured.

### Covalent Bond

Chemical bond formed by the sharing of one or more electron pairs between two atoms.

### Covalent Compounds

Compounds containing predominantly covalent bonds.

### Critical Mass

The minimum mass of a particular fissionable nuclide in a given volume required to sustain a nuclear chain reaction.

### Critical Point

The combination of critical temperature and critical pressure of a substance.

### Critical Pressure

The pressure required to liquefy a gas (vapor) at its critical temperature.

### Critical Temperature

The temperature above which a gas cannot be liquefied; the temperature above which a substance cannot exhibit distinct gas and liquid phases.

### Crystal Field Stabilization Energy

A measure of the net energy of stabilization gained by a metal ion's nonbonding d electrons as a result of complex formation.

### Crystal Field Theory

Theory of bonding in transition metal complexes in which ligands and metal ions are treated as point charges; a purely ionic model; ligand point charges represent the crystal (electrical) field perturbing the metal's d orbitals containing nonbonding electrons.

### Crystal Lattice

A pattern of arrangement of particles in a crystal.

### Crystal Lattice Energy

Amount of energy that holds a crystal together; the energy change when a mole of solid is formed from its constituent molecules or ions (for ionic compounds) in their gaseous state.

The energy change when one mole of formula units of a crystalline solid is formed from its ions, atoms, or molecules in the gas phase; always negative.

### Crystalline Solid

A solid characterized by a regular, ordered arrangement of particles.

### Curie (Ci)

The basic unit used to describe the intensity of radioactivity in a sample of material. One curie equals 37 billion disintegrations per second or approximately the amount of radioactivity given off by 1 gram of radium.

### Cyclotron

A device for accelerating charged particles along a spiral path.

## **D**

### Daughter Nuclide

Nuclide that is produced in a nuclear decay.

### Debye

The unit used to express dipole moments.

### Degenerate

Of the same energy.

### Delocalization

Of electrons; refers to bonding electrons that are distributed among more than two atoms that are bonded together; occurs in species that exhibit resonance.

The formation of a set of molecular orbitals that extend over more than two atoms; important in species that valence bond theory describes in terms of resonance.

### Denaturation

A process pertaining to a change in structure of a protein from regular to irregular arrangement of the polypeptide chains.

### Denatured

A commercial term used to describe ethanol that has been rendered unfit for human consumption because of the addition of harmful ingredients to make it sales tax-exempt.

### Density

Mass per unit Volume:  $D=M/V$

### Deposition

The direct solidification of a vapor by cooling; the reverse of sublimation.

### Derivative

A compound that can be imagined to arise from a parent compound by replacement of one atom with another atom or group of atoms. Used extensively in organic chemistry to assist in identifying compounds.

Dermal toxicity

Adverse health effects resulting from skin exposure of a substance.

Designated area

An area that may be used for work with carcinogens, reproductive toxins, or substances that have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood.

Detergent

A soap-like emulsifier that contains a sulfate,  $\text{SO}_3$  or a phosphate group instead of a carboxylate group.

Deuterium

An isotope of hydrogen whose atoms are twice as massive as ordinary hydrogen; deuterium atoms contain both a proton and a neutron in the nucleus.

Dextrorotatory

Refers to an optically active substance that rotates the plane of plane polarized light clockwise; also called dextro.

Diagonal Similarities

Refers to chemical similarities in the Periodic Table of elements of Period 2 to elements of Period 3 one group to the right; especially evident toward the left of the periodic table.

Diamagnetism

Weak repulsion by a magnetic field.

Differential Scanning Calorimetry (DSC)

A technique for measuring the temperature, direction, and magnitude of thermal transitions in a sample material by heating/cooling and comparing the amount of energy required to maintain its rate of temperature increase or decrease with an inert reference material under similar conditions.

Differential Thermal Analysis (DTA)

A technique for observing the temperature, direction, and magnitude of thermally induced transitions in a material by heating/cooling a sample and comparing its temperature with that of an inert reference material under similar conditions.

Differential Thermometer

A thermometer used for accurate measurement of very small changes in temperature.

Dilution

Process of reducing the concentration of a solute in solution, usually simply by mixing with more solvent.

Dimer

Molecule formed by combination of two smaller (identical) molecules.

Dipole

Refers to the separation of charge between two covalently bonded atoms



### Dipole-dipole Interactions

Attractive interactions between polar molecules, that is, between molecules with permanent dipoles.

### Dipole Moment

The product of the distance separating opposite charges of equal magnitude of the charge; a measure of the polarity of a bond or molecule; a measured dipole moment refers to the dipole moment of an entire molecule.

### Dispersing Medium

The solvent-like phase in a colloid.

### Dispersed Phase

The solute-like species in a colloid.

### Displacement Reactions

Reactions in which one element displaces another from a compound.

### Disproportionation Reactions

Redox reactions in which the oxidizing agent and the reducing agent are the same species.

### Dissociation

In aqueous solution, the process in which a solid ionic compound separates into its ions.

### Dissociation Constant

Equilibrium constant that applies to the dissociation of a complex ion into a simple ion and coordinating species (ligands).

### Distilland

The material in a distillation apparatus that is to be distilled.

### Distillate

The material in a distillation apparatus that is collected in the receiver.

### Distillation

The separation of a liquid mixture into its components on the basis of differences in boiling points.

The process in which components of a mixture are separated by boiling away the more volatile liquid.

### Domain

A cluster of atoms in a ferromagnetic substance, all of which align in the same direction in the presence of an external magnetic field.

### Donor Atom

A ligand atom whose electrons are shared with a Lewis acid.

### D-Orbitals

Beginning in the third energy level, a set of five degenerate orbitals per energy level, higher in energy than s and p orbitals of the same energy level.

### Dosimeter

A small, calibrated electroscope worn by laboratory personnel and designated to detect and measure incident ionizing radiation or chemical exposure.

### Double Bond

Covalent bond resulting from the sharing of four electrons (two pairs) between two atoms.

### Double Salt

Solid consisting of two co-crystallized salts.

### Doublet

Two peaks or bands of about equal intensity appearing close together on a spectrogram.

### Downs Cell

Electrolytic cell for the commercial electrolysis of molten sodium chloride.

### DP number

The degree of polymerization; the average number of monomer units per polymer unit.

### Dry Cells

Ordinary batteries (voltaic cells) for flashlights, radios, and so on; many are Leclanche cells.

### D-Transition elements (metals)

B Group elements except IIB in the periodic table; sometimes called simply transition elements  
EX. Fe, Ni, Cu, Ti .

### Dumas Method

A method used to determine the molecular weights of volatile liquids.

### Dynamic Equilibrium

An equilibrium in which processes occur continuously, with no net change.  
When two (or more) processes occur at the same rate so that no net change occurs.

## **E**

### Effective Collisions

Collision between molecules resulting in a reaction; one in which the molecules collide with proper relative orientations and sufficient energy to react.

### Effective Molality

The sum of the molalities of all solute particles in a solution.

### Effective Nuclear Charge

The nuclear charge experienced by the outermost electrons of an atom; the actual nuclear charge minus the effects of shielding due to inner-shell electrons.

Example: Set of  $dx^2-y^2$  and  $dz^2$  orbitals; those d orbitals within a set with lobes directed along the x-, y-, and z-axes.

### Electrical Conductivity

Ability to conduct electricity.

### Electrochemistry

Study of chemical changes produced by electrical current and the production of electricity by chemical reactions.

### Electrodes

Surfaces upon which oxidation and reduction half-reactions; occur in electrochemical cells.

### Electrode Potentials

Potentials,  $E$ , of half-reactions as reductions versus the standard hydrogen electrode.

### Electrolysis

Process that occurs in electrolytic cells.

### Electrolyte

A substance whose aqueous solutions conduct electricity.

### Electrolytic Cells

Electrochemical cells in which electrical energy causes nonspontaneous redox reactions to occur. An electrochemical cell in which chemical reactions are forced to occur by the application of an outside source of electrical energy.

### Electrolytic Conduction

Conduction of electrical current by ions through a solution or pure liquid.

### Electromagnetic Radiation

Energy that is propagated by means of electric and magnetic fields that oscillate in directions perpendicular to the direction of travel of the energy.

### Electromotive Series

The relative order of tendencies for elements and their simple ions to act as oxidizing or reducing agents; also called the activity series.

### Electron

A subatomic particle having a mass of 0.00054858 amu and a charge of  $1^-$ .

### Electron Affinity

The amount of energy absorbed in the process in which an electron is added to a neutral isolated gaseous atom to form a gaseous ion with a  $1^-$  charge; has a negative value if energy is released.

### Electron Configuration

Specific distribution of electrons in atomic orbitals of atoms or ions.

### Electron Deficient Compounds

Compounds that contain at least one atom (other than  $H^+$ ) that shares fewer than eight electrons

### Electronic Transition

The transfer of an electron from one energy level to another.

### Electronegativity

A measure of the relative tendency of an atom to attract electrons to itself when chemically combined with another atom.

### Electronic Geometry

The geometric arrangement of orbitals containing the shared and unshared electron pairs surrounding the central atom of a molecule or polyatomic ion.

### Electrophile

Positively charged or electron-deficient.

### Electrophoresis

A technique for separation of ions by rate and direction of migration in an electric field.

### Electroplating

Plating a metal onto a (cathodic) surface by electrolysis.

### Element

A substance that cannot be decomposed into simpler substances by chemical means.

### Eluant or eluent

The solvent used in the process of elution, as in liquid chromatography.

### Eluate

Solvent (or mobile phase) which passes through a chromatographic column and removes the sample components from the stationary phase.

### Emission Spectrum

Spectrum associated with emission of electromagnetic radiation by atoms (or other species) resulting from electronic transitions from higher to lower energy states.

### Emulsifying Agent

A substance that coats the particles of the dispersed phase and prevents coagulation of colloidal particles; an emulsifier.

### Emulsion

Colloidal suspension of a liquid in a liquid.

### Enantiomer

One of the two mirror-image forms of an optically active molecule.

### Endothermic

Describes processes that absorb heat energy.

### Endothermicity

The absorption of heat by a system as the process occurs.

### End Point

The point at which an indicator changes colour and a titration is stopped.

### Energy

The capacity to do work or transfer heat.

### Enthalpy

The heat content of a specific amount of substance; defined as  $E = PV$ .

### Entropy

A thermodynamic state or property that measures the degree of disorder or randomness of a system.

### Enzyme

A protein that acts as a catalyst in biological systems.

### Equation of State

An equation that describes the behavior of matter in a given state; the van der Waals equation describes the behavior of the gaseous state.

### Equilibrium or Chemical Equilibrium

A state of dynamic balance in which the rates of forward and reverse reactions are equal; the state of a system when neither forward or reverse reaction is thermodynamically favored.

### Equilibrium Constant

A quantity that characterizes the position of equilibrium for a reversible reaction; its magnitude is equal to the mass action expression at equilibrium.  $K$  varies with temperature.

### Equivalence Point

The point at which chemically equivalent amounts of reactants have reacted.

### Equivalent Weight

An oxidizing or reducing agent, who's mass gains (oxidizing agents) or loses (reducing agents)  $6.022 \times 10^{23}$  electrons in a redox reaction.

The mass of an acid or base that furnishes or reacts with  $6.022 \times 10^{23}$   $\text{H}_3\text{O}^+$  or  $\text{OH}^-$  ions.

### Essential Oil

A plant extract that has a distinctive odour or flavour.

### Ester

A Compound of the general formula  $\text{R}-\text{C}-\text{O}-\text{R}_1$  where  $\text{R}$  and  $\text{R}_1$  may be the same or different, and may be either aliphatic or aromatic.

### Ether

Compound in which an oxygen atom is bonded to two alkyl or two aryl groups, or one alkyl and one aryl group.

### Eutrophication

The undesirable overgrowth of vegetation caused by high concentrates of plant nutrients in bodies of water.

### Evaporization

Vaporization of a liquid below its boiling point.

### Evaporation Rate

The rate at which a particular substance will vapourize (evaporate) when compared to the rate of a known substance such as ethyl ether. This term is especially useful for health and fire-hazard considerations.

### Excited State

Any state other than the ground state of an atom or molecule.

Exothermic

Describes processes that release heat energy.

Exothermicity

The release of heat by a system as a process occurs.

Explosive

A chemical or compound that causes a sudden, almost instantaneous release of pressure, gas, heat and light when subjected to sudden shock, pressure, high temperature or applied potential.

Explosive limits

The range of concentrations over which a flammable vapour mixed with proper ratios of air will ignite or explode if a source of ignitions is provided.

Extensive Property

A property that depends upon the amount of material in a sample.

Extrapolate

To estimate the value of a result outside the range of a series of known values. Technique used in standard additions calibration procedure.

**F**

Faraday

One faraday of electricity corresponds to the charge on  $6.022 \times 10^{23}$  electrons, or 96,487 coulombs.

Faraday's Law of Electrolysis

One equivalent weight of a substance is produced at each electrode during the passage of 96,487 coulombs of charge through an electrolytic cell.

Fast Neutron

A neutron ejected at high kinetic energy in a nuclear reaction.

Fat

Solid triester of glycerol and (mostly) saturated fatty acids.

Fatty Acids

An aliphatic acid; many can be obtained from animal fats.

Ferromagnetism

The ability of a substance to become permanently magnetized by exposure to an external magnetic field.

Film badge

A small patch of photographic film worn on clothing to detect and measure accumulated incident ionizing radiation.

Flammable

A liquid as defined by NFPA and DOT as having a flash point below 37.8°C (100°F).

### Flash Point

The temperature at which a liquid will yield enough flammable vapour to ignite. There are various recognized industrial testing methods; therefore the method used must be stated.

### Fluorescence

Absorption of high energy radiation by a substance and subsequent emission of visible light.

### Fossil Fuels

Substances consisting largely of hydrocarbons, derived from decay of organic materials under geological conditions of high pressure and temperature (metamorphism) include coal, petroleum, natural gas, peat and oil shale.

### Frasch Process

Method by which elemental sulfur is mined or extracted. Sulfur is melted with superheated water (at 170°C under high pressure) and forced to the surface of the earth as a slurry.

### First Law of Thermodynamics

The total amount of energy in the universe is constant (also known as the Law of Conservation of Energy) energy is neither created nor destroyed in ordinary chemical reactions and physical changes.

### Flotation

Method by which hydrophobic (water-repelling) particles of an ore are separated from hydrophilic (water-attracting) particles of a metallurgical pretreatment process.

### Fluids

Substances that flow freely; gases and liquids.

### Flotation

Flux. A substance added to react with the charge, or a product of its reduction, in metallurgy; usually added to lower a melting point.

### Foam

Colloidal suspension of a gas in a liquid.

### Forbidden Zone

A relatively large energy separation between an insulator's highest filled electron energy band and the next higher energy vacant band. Beginning in the fourth energy level, a set of seven degenerate orbitals per energy level, higher in energy than s, p, and d orbitals of the same energy level.

### Formal Charge

A method of counting electrons in a covalently bonded molecule or ion; counts bonding electrons as though they were equally shared between the two atoms.

### Formula

Combination of symbols that indicates the chemical composition of a substance.

### Formula Unit

The smallest repeating unit of a substance. The molecule for nonionic substances

### Formula Weight

The mass of one formula unit of a substance in atomic mass units.

### Fractional Distillation

The process in which a fractioning column is used in distillation apparatus to separate components of a liquid mixture that have different boiling points.

### Fractional Precipitation

Removal of some ions from solution by precipitation while leaving other ions with similar properties in solution.

### Free Energy, Gibbs Free Energy

The thermodynamic state function of a system that indicates the amount of energy available for the system to do useful work at constant T and P.

### Free Energy Change

The indicator of spontaneity of a process at constant T and P. If  $\Delta G$  is negative, the process is spontaneous.

### Free Radical

A highly reactive chemical species carrying no charge and having a single unpaired electron in an orbital.

### Freezing Point Depression

The decrease in the freezing point of a solvent caused by the presence of a solute.

### Frequency

The number of repeating corresponding points on a wave that pass a given observation point per unit time.

### Fuel Cells

Voltaic cells in which the reactants (usually gases) are supplied continuously.

A voltaic cell that converts the chemical energy of a fuel and an oxidizing agent directly into electrical energy on a continuous basis.

### Functional Group

A group of atoms that represents a potential reaction site in an organic compound.

## **G**

### Gamma Ray

High energy electromagnetic radiation.

A highly penetrating type of nuclear radiation similar to x-ray radiation, except that it comes from within the nucleus of an atom and has a higher energy. Energy wise, very similar to cosmic ray except that cosmic rays originate from outer space.

### Galvanizing

Placing a thin layer of zinc on a ferrous material to protect the underlying surface from corrosion.

### Gangue

Sand, rock, and other impurities surrounding the mineral of interest in an ore.



### Geiger counter

A gas filled tube which discharges electrically when ionizing radiation passes through it.

### Gel

Colloidal suspension of a solid dispersed in a liquid; a semirigid solid.

### Gem-dimethyl group

Two methyl groups of the same carbon atom.

### Geometrical Isomers

Compounds with different arrangements of groups on either side of a bond with restricted rotation, such as a double bond or a single bond in a ring; for example cis-trans isomers of certain alkenes.

Stereoisomers that are not mirror images of each other; also known as position isomers.

### Graham's Law

The rates of effusion of gases are inversely proportional to the square roots of their molecular weights or densities.

### Greenhouse Effect

Trapping of heat at the surface of the earth by carbon dioxide and water vapour in the atmosphere.

### Ground State

The lowest energy state or most stable state of an atom, molecule or ion.

### Group

A vertical column in the periodic table; also called a family.

## **H**

### Haber Process

A process for the catalyzed industrial production of ammonia from  $N_2$  and  $H_2$  at high temperature and pressure.

### Half-Cell

Compartment in which the oxidation or reduction half-reaction occurs in a voltaic cell.

### Half-Life

The time required for half of a reactant to be converted into product(s).

The time required for half of a given sample to undergo radioactive decay.

### Half-Reaction

Either the oxidation part or the reduction part of a redox reaction.

### Halogens

Group VIIA elements: F, Cl, Br, I

### Hard Water

Water containing  $Fe^{3+}$ ,  $Ca^{2+}$ , and  $Mg^{2+}$  ions, which forms precipitates with soap.

### Heat

A form of energy that flows between two samples of matter because of their differences in temperature.

### Heat Capacity

The amount of heat required to raise the temperature of a body (of any mass) one degree Celsius.

### Heat of Condensation

The amount of heat that must be removed from one gram of a vapor at its condensation point to condense the vapour with no change in temperature.

### Heat of Crystallization

The amount of heat that must be removed from one gram of a liquid at its freezing point to freeze it with no change in temperature.

### Heat of Fusion

The amount of heat required to melt one gram of solid at its melting point with no change in temperature. Usually expressed in J/g. The molar heat of fusion is the amount of heat required to melt one mole of a solid at its melting point with no change in temperature and is usually expressed in kJ/mol.

### Heat of Solution

The amount of heat absorbed in the formation of solution that contains one mole of solute; the value is positive if heat is absorbed (endothermic) and negative if heat is released (exothermic).

### Heat of Vaporization

The amount of heat required to vaporize one gram of a liquid at its boiling point with no change in temperature. Usually expressed in J/g. The molar heat of vaporization is the amount of heat required to vaporize one mole of liquid at its boiling point with no change in temperature and usually expressed in kJ/mol.

### Heavy Water

Water containing deuterium, a heavy isotope of hydrogen.

### Heisenberg Uncertainty Principle

It is impossible to determine accurately both the momentum and position of an electron simultaneously.

### Henry's Law

The pressure of the gas above a solution is proportional to the concentration of the gas in the solution.

### Hess' Law of Heat Summation

The enthalpy change for a reaction is the same whether it occurs in one step or a series of steps.

### Heterocyclic Amine

Amine in which the nitrogen is part of a ring.

### Heterogeneous Catalyst

A catalyst that exists in a different phase (solid, liquid or gas) from the reactants; a contact catalyst.

Heterogeneous Equilibria

Equilibria involving species in more than one phase.

Heterogeneous Mixture

A mixture that does not have uniform composition and properties throughout.

Heteronuclear

Consisting of different elements.

High Spin Complex

Crystal field designation for an outer orbital complex; all  $t^2_g$  and  $e_g$  orbitals are singly occupied before any pairing occurs.

Homogeneous Catalyst

A catalyst that exists in the same phase (solid, liquid or gas) as the reactants.

Homogeneous Equilibria

Equilibria involving only one species in a single phase. For example, all gases, all liquids or all solids.

Homogeneous Mixture

A mixture which has uniform composition and properties throughout.

Homologous Series

A series of compounds in which each member differs from the next by a specific number and kind of atoms.

Homonuclear

Consisting of only one element.

Hund's Rule

All orbitals of a given sublevel must be occupied by single electrons before pairing begins (see Aufbau Principle)

Hybridization

Mixing a set of atomic orbitals to form a new set of atomic orbitals with the same total electron capacity and with properties and energies intermediate between those of the original unhybridized orbitals.

Hydrate

A solid compound that contains a definite percentage of bound water.

Hydrate Isomers

Isomers of crystalline complexes that differ in whether water is present inside or outside the coordination sphere

Hydration

Reaction of a substance with water.

Hydration Energy

The energy change accompanying the hydration of a mole of gaseous and ions.

### Hydride

A binary compound of hydrogen.

### Hydrocarbons

Compounds that contain only carbon and hydrogen.

### Hydrogen Bond

A fairly strong dipole-dipole interaction (but still considerably weaker than the covalent or ionic bonds) between molecules containing hydrogen directly bonded to a small, highly electronegative atom, such as N, O, or F.

### Hydrogenation

The reaction in which hydrogen adds across a double or triple bond.

### Hydrogen-Oxygen Fuel Cell

Fuel cell in which hydrogen is the fuel (reducing agent) and oxygen is the oxidizing agent.

### Hydrolysis

The reaction of a substance with water or its ions.

### Hydrolysis Constant

An equilibrium constant for a hydrolysis reaction.

### Hydrometer

A device used to measure the densities of liquids and solutions.

### Hydrophilic Colloids

Colloidal particles that repel water molecules.

### Inner Orbital Complex

Valence bond designation for a complex in which the metal ion utilizes d orbitals for one shell inside the outermost occupied shell in its hybridization.

## I

### Isomers

Different substances that have the same formula.

### Ionization Isomers

Isomers that result from the interchange of ions inside and outside the coordination sphere.

### Inert s-pair Effect

Characteristic of the post-transition minerals; tendency of the outermost s electrons to remain nonionized or unshared in compounds.

### Insoluble Compound

A very slightly soluble compound.

### Indicators

For acid-base titrations, organic compounds that exhibit different colors in solutions of different acidities; used to determine the point at which reaction between two solutes is complete.

*Ionization Constant*

Equilibrium constant for the ionization of a weak electrolyte.

*Ion Product for Water*

Equilibrium constant for the ionization of water,  $K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1.00 \times 10^{-14}$  at 25 °C.

*Inhibitory Catalyst*

An inhibitor, a catalyst that decreases the rate of reaction.

*Integrated Rate Equation*

An equation giving the concentration of a reactant remaining after a specified time; has different mathematical form for different orders of reactants.

*Ionization*

The breaking up of a compound into separate ions.

*Ideal Solution*

A solution that obeys Raoult's Law exactly.

*Insulator*

Poor electric and heat conductor.

*Intermolecular Forces*

Forces between individual particles (atoms, molecules, ions) of a substance.

*Isomorphous*

Refers to crystals having the same atomic arrangement.

*Ideal Gas*

A hypothetical gas that obeys exactly all postulates of the kinetic-molecular theory.

*Ideal Gas Law*

The product of pressure and the volume of an ideal gas is directly proportional to the number of moles of the gas and the absolute temperature.

*Ionization*

In aqueous solution, the process in which a molecular compound reacts with water and forms ions.

*Ionic Bonding*

Chemical bonding resulting from the transfer of one or more electrons from one atom or a group of atoms to another.

*Ionic Compounds*

Compounds containing predominantly ionic bonding.

*Ionic Geometry*

The arrangement of atoms (not lone pairs of electrons) about the central atom of a polyatomic ion.

*Isoelectric*

Having the same electronic configurations

### Ionization Energy

The minimum amount of energy required to remove the most loosely held electron of an isolated gaseous atom or ion.

### Isotopes

Two or more forms of atoms of the same element with different masses; atoms containing the same number of protons but different numbers of neutrons.

### Ion

An atom or a group of atoms that carries an electric charge.

## **J**

### Joule

A unit of energy in the SI system. One joule is  $1 \text{ kg} \cdot \text{m}^2/\text{s}^2$  which is also 0.2390 calorie.

## **K**

### K Capture

Absorption of a K shell ( $n=1$ ) electron by a proton as it is converted to a neutron.

### Ketone

Compound in which a carbonyl group is bound to two alkyl or two aryl groups, or to one alkyl and one aryl group.

### Kinetic Energy

Energy that matter possesses by virtue of its motion.

### Kinetic-molecular Theory

A theory, that attempts to explain macroscopic observations on gases in microscopic observations on gases in microscopic observations on gases in microscopic or molecular terms.

## **L**

### Lanthanides

Elements 58 to 71 (after lanthanum)

### Lanthanide Contraction

A decrease in the radii of the elements following the lanthanides compared to what would be expected if there were no f-transition metals.

### Law of Combining Volumes (Gay-Lussac's Law)

At constant temperature and pressure, the volumes of reacting gases ( and any gaseous products) can be expressed as ratios of small whole numbers;

### Law of Conservation of Energy

Energy cannot be created or destroyed; it may be changed from one form to another.

### Law of Conservation of Matter

There is no detectable change in the quantity of matter during an ordinary chemical reaction.

### Law of Conservation of Matter and Energy

The total amount of matter and energy available in the universe is fixed.

Law of Definite Proportions (Law of Constant Composition)

Different samples of a pure compound always contain the same elements in the same proportions by mass.

Law of Partial Pressures (Dalton's Law)

The total pressure exerted by a mixture of gases is the sum of the partial pressures of the individual gases.

Lead Storage Battery

Secondary voltaic cell used in most automobiles.

Leclanche Cell

A common type of dry cell.

Le Chatelier's Principle

States that a system at equilibrium, or striving to attain equilibrium, responds in such a way as to counteract any stress placed upon it.

If a stress (change of conditions) is applied to a system at equilibrium, the system shifts in the direction that reduces stress.

Leveling Effect

Effect by which all acids stronger than the acid that is characteristic of the solvent react with solvent to produce that acid; similar statement applies to bases. The strongest acid (base) that can exist in a given solvent is the acid (base) characteristic of the solvent.

Levorotatory

Refers to an optically active substance that rotates the plane of plane polarized light counterclockwise; also called levo.

Lewis Acid

Any species that can accept a share in an electron pair.

Lewis Base

Any species that can make available a share in an electron pair.

Lewis Dot Formula (Electron Dot Formula)

Representation of a molecule, ion or formula unit by showing atomic symbols and only outer shell electrons

Ligand

A Lewis base in a coordination compound.

Limiting Reactant

Substance that stoichiometrically limits the amount of product(s) that can be formed.

Linear Accelerator

A device used for accelerating charged particles along a straight line path.

Line Spectrum

An atomic emission or absorption spectrum.

### Linkage Isomers

Isomers in which a particular ligand bonds to a metal ion through different donor atoms.

### Liquid Aerosol

Colloidal suspension of liquid in gas.

### London Forces

Very weak and very short-range attractive forces between short-lived temporary (induced) dipoles; also called dispersion Forces.

### Lone Pair

Pair of electrons residing on one atom and not shared by other atoms; unshared pair.

### Low Spin Complex

Crystal field designation for an inner orbital complex; contains electrons paired  $t^2g$  orbitals before  $e_g$  orbitals are occupied in octahedral complexes.

## **M**

### Magnetic Quantum Number ( $m_l$ )

Quantum mechanical solution to a wave equation that designates the particular orbital within a given set (s, p, d, f) in which an electron resides.

### Manometer

A two-armed barometer.

### Mass

A measure of the amount of matter in an object. Mass is usually measured in grams or kilograms.

### Mass Action Expression

For a reversible reaction,  $aA + bB \rightarrow cC + dD$  the product of the concentrations of the products (species on the right), each raised to the power that corresponds to its coefficient in the balanced chemical equation, divided by the product of the concentrations of reactants (species on the left), each raised to the power that corresponds to its coefficient in the balanced chemical equation. At equilibrium the mass action expression is equal to  $K$ ;

### Mass Deficiency

The amount of matter that would be converted into energy if an atom were formed from constituent particles.

### Mass Number

The sum of the numbers of protons and neutrons in an atom; an integer.

### Mass Spectrometer

An instrument that measures the charge-to-mass ratio of charged particles.

### Matter

Anything that has mass and occupies space.

### Mechanism

The sequence of steps by which reactants are converted into products.



### Melting Point

The temperature at which liquid and solid coexist in equilibrium; also the freezing point.

### Meniscus

The shape assumed by the surface of a liquid in a cylindrical container.

### Metal

An element below and to the left of the stepwise division (metalloids) in the upper right corner of the periodic table; about 80% of the known elements are metals.

### Metallic Bonding

Bonding within metals due to the electrical attraction of positively charged metal ions for mobile electrons that belong to the crystal as a whole.

### Metallic Conduction

Conduction of electrical current through a metal or along a metallic surface.

### Metalloids

Elements with properties intermediate between metals and nonmetals: B, Al, Si, Ge, As, Sb, Te, Po, and At.

### Metallurgy

Refers to the overall processes by which metals are extracted from ores.

### Metathesis Reactions

Reactions in which two compounds react to form two new compounds, with no changes in oxidation number. Reactions in which the ions of two compounds exchange partners.

### Method of Initial Rates

Method of determining the rate-law expression by carrying out a reaction with different initial concentrations and analyzing the resultant changes in initial rates.

### Miscibility

The ability of one liquid to mix with (dissolve in) another liquid.

### Mixture

A sample of matter composed of two or more substances, each of which retains its identity and properties.

### Moderator

A substance such as hydrogen, deuterium, oxygen or paraffin capable of slowing fast neutrons upon collision.

### Molality

Concentration expressed as number of moles of solute per kilogram of solvent.

### Molarity

Number of moles of solute per litre of solution.

### Molar Solubility

Number of moles of a solute that dissolve to produce a litre of saturated solution.

### Molecular Equation

Equation for a chemical reaction in which all formulas are written as if all substances existed as molecules; only complete formulas are used.

### Molecular Formula

Formula that indicates the actual number of atoms present in a molecule of a molecular substance.

### Molecular Geometry

The arrangement of atoms (not lone pairs of electrons) around a central atom of a molecule or polyatomic ion.

### Molecular Orbital

An orbit resulting from overlap and mixing of atomic orbitals on different atoms. An MO belongs to the molecule as a whole.

### Molecular Orbital Theory

A theory of chemical bonding based upon the postulated existence of molecular orbitals.

### Molecular Weight

The mass of one molecule of a nonionic substance in atomic mass units.

### Molecule

The smallest particle of an element or compound capable of a stable, independent existence.

### Mole Fraction

The number of moles of a component of a mixture divided by the total number of moles in the mixture.

### Monoprotic Acid

Acid that can form only one hydronium ion per molecule; may be strong or weak.

Acid that contains one ionizable hydrogen atom per formula unit.

### Mother Nuclide

Nuclide that undergoes nuclear decay.

## N

### Native State

Refers to the occurrence of an element in an uncombined or free state in nature.

### Natural Radioactivity

Spontaneous decomposition of an atom.

### Nernst Equation

Corrects standard electrode potentials for nonstandard conditions.

### Net Ionic Equation

Equation that results from canceling spectator ions and eliminating brackets from a total ionic equation.

### Neutralization

The reaction of an acid with a base to form a salt and water. Usually, the reaction of hydrogen ions with hydroxide ions to form water molecules.

### Neutron

A neutral subatomic particle having a mass of 1.0087 amu.

### Nickel-cadmium cell (Nicad battery)

A dry cell in which the anode is Cd, the cathode is NiO<sub>2</sub>, and the electrolyte is basic.

### Nitrogenases

A class of enzymes found in bacteria within root nodules in some plants, which catalyze reactions by which N<sub>2</sub> molecules from the air are converted to ammonia.

### Nitrogen Cycle

The complex series of reactions by which nitrogen is slowly but continually recycled in the atmosphere, lithosphere and hydrosphere.

### Noble Gases (Rare Gases)

Elements of the periodic Group 0; also called rare gases; formerly called inert gases, He, Ne, Ar, Kr, Xe, Rn.

### Nodal Plane

A region in which the probability of finding an electron is zero.

### Nonbonding Orbital

A molecular orbital derived only from an atomic orbital of one atom; lends neither stability nor instability to a molecule or ion when populated with electrons.

### Nonelectrolyte

A substance whose aqueous solutions do not conduct electricity.

### Nonpolar Bond

Covalent bond in which electron density is symmetrically distributed

### Nuclear Binding Energy

Energy equivalent of the mass deficiency; energy released in the formation of an atom from the subatomic particles.

### Nuclear Fission

The process in which a heavy nucleus splits into nuclei of intermediate masses and one or more protons are emitted.

### Nuclear Reaction

Involves a change in the composition of a nucleus and can evolve or absorb an extraordinarily large amount of energy

### Nuclear Reactor

A system in which controlled nuclear fission reactions generate heat energy on a large scale, which is subsequently converted into electrical energy.

### Nucleons

Particles comprising the nucleus; protons and neutrons.

### Nucleus

The very small, very dense, positively charged center of an atom containing protons and neutrons, as well as other subatomic particles.

### Nuclides

Refers to different atomic forms of all elements in contrast to isotopes, which refer only to different atomic forms of a single element.

### Nuclide Symbol

Symbol for an atom  $A/Z E$ , in which E is the symbol of an element, Z is its atomic number, and A is its mass number.

## O

### Octahedral

A term used to describe molecules and polyatomic ions that have one atom in the center and six atoms at the corners of an octahedron.

### Octane Number

A number that indicates how smoothly a gasoline burns.

### Octet Rule

Many representative elements attain at least a share of eight electrons in their valence shells when they form molecular or ionic compounds; there are some limitations.

### Oil

Liquid triester of glycerol and unsaturated fatty acids.

### Open Sextet

Refers to species that have only six electrons in the highest energy level of the central element (many Lewis acids).

### Optical Activity

The rotation of plane polarized light by one of a pair of optical isomers.

### Optical Isomers

Stereoisomers that differ only by being nonsuperimposable mirror images of each other, like right and left hands, also called enantiomers.

### Ore

A natural deposit containing a mineral of an element to be extracted.

### Organic Chemistry

The chemistry of substances that contain carbon-hydrogen bonds.

### Osmosis

The process by which solvent molecules pass through a semipermeable membrane from a dilute solution into a more concentrated solution.

### Osmotic Pressure

The hydrostatic pressure produced on the surface of a semipermeable membrane by osmosis.

### Ostwald Process

A process for the industrial production of nitrogen oxide and nitric acid from ammonia and oxygen.

### Outer Orbital Complex

Valence bond designation for a complex in which the metal ion utilizes d orbitals in the outermost (occupied) shell in hybridization.

### Overlap

The interaction of orbitals on different atoms in the same region of space.

### Oxidation

An algebraic increase in the oxidation number; may correspond to a loss of electrons.

### Oxidation Numbers

Arbitrary numbers that can be used as mechanical aids in writing formulas and balancing equations; for single-atom ions they correspond to the charge on the ion; more electronegative atoms are assigned negative oxidation numbers (also called Oxidation states).

### Oxidation-reduction Reactions

Reactions in which oxidation and reduction occur; also called redox reactions.

### Oxide

A binary compound of oxygen.

### Oxidizing Agent

The substance that oxidizes another substance and is reduced.

## **P**

### Pairing

A favourable interaction of two electrons with opposite  $m_l$  values in the same orbital.

### Pairing Energy

Energy required to pair two electrons in the same orbital.

### Paramagnetism

Attraction toward a magnetic field, stronger than diamagnetism, but still weak compared to ferromagnetism.

### Partial Pressure

The pressure exerted by one gas in a mixture of gases.

### Particulate Matter

Fine divided solid particles suspended in polluted air.

### Pauli Exclusion Principle

No two electrons in the same atom may have identical sets of four quantum numbers.

### Percentage Ionization

The percentage of the weak electrolyte that ionizes in a solution of given concentration.

Percent by Mass

100% times the actual yield divided by theoretical yield.

Percent Composition

The mass percent of each element in a compound.

Percent Purity

The percent of a specified compound or element in an impure sample.

Period

The elements in a horizontal row of the periodic table.

Periodicity

Regular periodic variations of properties of elements with atomic number (and position in the periodic table).

Periodic Law

The properties of the elements are periodic functions of their atomic numbers.

Periodic Table

An arrangement of elements in order of increasing atomic numbers that also emphasizes periodicity.

Peroxide

A compound containing oxygen in the -1 oxidation state. Metal peroxides contain the peroxide ion,  $O_2^{2-}$ . pH Negative logarithm of the concentration (mol/L) of the  $H_3O^+$  ion; scale is commonly used over a range 0 to 14.

Phase Diagram

Diagram that shows equilibrium temperature-pressure relationships for different phases of a substance.

Phenol

Hydrocarbon derivative containing an  $[OH^-]$  group bound to an aromatic ring.

Photochemical Oxidants

Photochemically produced oxidizing agents capable of causing damage to plants and animals.

Photochemical Smog

A brownish smog occurring in urban areas receiving large amounts of sunlight; caused by photochemical (light-induced) reactions among nitrogen oxides, hydrocarbons and other components of polluted air that produce photochemical oxidants.

Photoelectric Effect

Emission of an electron from the surface of a metal caused by impinging electromagnetic radiation of certain minimum energy; current increases with increasing intensity of radiation.

Photon

A packet of light or electromagnetic radiation; also called quantum of light

Physical Change

A change in which a substance changes from one physical state to another but no substances with different composition are formed. Example Gas to Liquid - Solid.

Plasma

A physical state of matter which exists at extremely high temperatures in which all molecules are dissociated and most atoms are ionized.

Polar Bond

Covalent bond in which there is an unsymmetrical distribution of electron density.

Polarimeter

A device used to measure optical activity.

Polarization

The buildup of a product of oxidation or a reduction of an electrode, preventing further reaction.

Polydentate

Refers to ligands with more than one donor atom.

Polyene

A compound that contains more than one double bond per molecule.

Polymerization

The combination of many small molecules to form large molecules.

Polymer

A large molecule consisting of chains or rings of linked monomer units, usually characterized by high melting and boiling points.

Polymorphous

Refers to substances that crystallize in more than one crystalline arrangement.

Polyprotic Acid

An Acid that can form two or more hydronium ions per molecule; often a least one step of ionization is weak.

Positron

A Nuclear particle with the mass of an electron but opposite charge.

Potential Energy

Energy that matter possesses by virtue of its position, condition or composition.

Precipitate

An insoluble solid formed by mixing in solution the constituent ions of a slightly soluble solution.

Primary Standard

A substance of a known high degree of purity that undergoes one invariable reaction with the other reactant of interest.

### Primary Voltaic Cells

Voltaic cells that cannot be recharged; no further chemical reaction is possible once the reactants are consumed.

### Proton

A subatomic particle having a mass of 1.0073 amu and a charge of +1, found in the nuclei of atoms.

### Pseudobinary Ionic Compounds

Compounds that contain more than two elements but are named like binary compounds.

## Q

### Quantum Mechanics

Mathematical method of treating particles on the basis of quantum theory, which assumes that energy (of small particles) is not infinitely divisible.

### Quantum Numbers

Numbers that describe the energies of electrons in atoms; derived from quantum mechanical treatment.

## R

### Radiation

High energy particles or rays emitted during the nuclear decay processes.

### Radical

An atom or group of atoms that contains one or more unpaired electrons (usually very reactive species)

### Radioactive Dating

Method of dating ancient objects by determining the ratio of amounts of mother and daughter nuclides present in an object and relating the ratio to the object's age via half-life calculations.

### Radioactive Tracer

A small amount of radioisotope replacing a nonradioactive isotope of the element in a compound whose path (for example, in the body) or whose decomposition products are to be monitored by detection of radioactivity; also called a radioactive label.

### Radioactivity

The spontaneous disintegration of atomic nuclei.

### Raoult's Law

The vapor pressure of a solvent in an ideal solution decreases as its mole fraction decreases.

### Rate-determining Step

The slowest step in a mechanism; the step that determines the overall rate of reaction.

### Rate-law Expression

Equation relating the rate of a reaction to the concentrations of the reactants and the specific rate of the constant.

### Rate of Reaction

Change in the concentration of a reactant or product per unit time.



### Reactants

Substances consumed in a chemical reaction.

### Reaction Quotient

The mass action expression under any set of conditions (not necessarily equilibrium); its magnitude relative to K determines the direction in which the reaction must occur to establish equilibrium.

### Reaction Ratio

The relative amounts of reactants and products involved in a reaction; maybe the ratio of moles, millimoles, or masses.

### Reaction Stoichiometry

Description of the quantitative relationships among substances as they participate in chemical reactions.

### Reducing Agent

The substance that reduces another substance and is oxidized.

### Resonance

The concept in which two or more equivalent dot formulas for the same arrangement of atoms (resonance structures) are necessary to describe the bonding in a molecule or ion.

### Reverse Osmosis

Forcing solvent molecules to flow through a semipermeable membrane from a concentrated solution into a dilute solution by the application of greater hydrostatic pressure on concentrated side than the osmotic pressure opposing it.

### Reversible Reaction

Reactions that do not go to completion and occur in both the forward and reverse direction.

## S

### Salt Bridge

A U-shaped tube containing electrolyte, which connects two half-cells of a voltaic cell.

### Saponification

Hydrolysis of esters in the presence of strong soluble bases.

### Saturated Hydrocarbons

Hydrocarbons that contain only single bonds. They are also called alkanes or paraffin hydrocarbons.

### Saturated Solution

Solution in which no more solute will dissolve.

### Second Law of Thermodynamics

The universe tends toward a state of greater disorder in spontaneous processes.

### Secondary Standard

a solution that has been titrated against a primary standard. A standard solution is a secondary standard.

### Secondary Voltaic Cells

Voltaic cells that can be recharged; original reactants can be regenerated by reversing the direction of the current flow.

### Semiconductor

A substance that does not conduct electricity at low temperatures but does so at higher temperatures.

### Semipermeable Membrane

A thin partition between two solutions through which certain molecules can pass but others cannot.

### Shielding Effect

Electrons in filled sets of s, p orbitals between the nucleus and outer shell electrons shield the outer shell electrons somewhat from the effect of protons in the nucleus; also called screening effect.

### Sigma Bonds

Bonds resulting from the head-on overlap of atomic orbitals, in which the region of electron sharing is along and (cylindrically) symmetrical to the imaginary line connecting the bonded atoms.

### Sigma Orbital

Molecular orbital resulting from head-on overlap of two atomic orbitals.

### Silicones

Polymeric organosilicon compounds; contain individual or cross-linked Si-O chains or rings in which some oxygens of SiO<sub>4</sub> tetrahedra are replaced by other groups.

### Single Bond

Covalent bond resulting from the sharing of two electrons (one pair) between two atoms.

### Solubility Product Constant

Equilibrium constant that applies to the dissolution of a slightly soluble compound.

### Solubility Product Principle

The solubility product constant expression for a slightly soluble compound is the product of the concentrations of the constituent ions, each raised to the power that corresponds to the number of ions in one formula unit.

### Solute

The dispersed (dissolved) phase of a solution.

### Solution

Homogeneous mixture of two or more substances.

### Solvation

The process by which solvent molecules surround and interact with solute ions or molecules.

### Solvent

The dispersing medium of a solution.

### Solvolysis

The reaction of a substance with the solvent in which it is dissolved.

### S Orbital

A spherically symmetrical atomic orbital; one per energy level.

### Specific Gravity

The ratio of the density of a substance to the density of water.

### Specific Heat

The amount of heat required to raise the temperature of one gram of substance one degree Celsius.

### Specific Rate Constant

An experimentally determined (proportionality) constant, which is different for different reactions and which changes only with temperature;  $k$  in the rate-law expression:  $\text{Rate} = k [\text{A}]^x [\text{B}]^y$ .

### Spectator Ions

Ions in a solution that do not participate in a chemical reaction.

### Spectral Line

Any of a number of lines corresponding to definite wavelengths of an atomic emission or absorption spectrum; represents the energy difference between two energy levels.

### Spectrochemical Series

Arrangement of ligands in order of increasing ligand field strength.

### Spectrum

Display of component wavelengths (colours) of electromagnetic radiation.

### Square Planar

A term used to describe molecules and polyatomic ions that have one atom in the center and four atoms at the corners of a square.

### Square Planar Complex

Complex in which the metal is in the center of a square plane, with ligand donor atoms at each of the four corners

### Standard Electrodes

Half-cells in which the oxidized and reduced forms of a species are present at unit activity; 1.0M solutions of dissolved ions, 1.0atm partial pressure of gases, and pure solids and liquids.

### Standard Electrode Potential

By convention, potential,  $E_0$ , of a half-reaction as a reduction relative to the standard hydrogen electrode when all species are present at unit activity.

### Standard Entropy

The absolute entropy of a substance in its standard state at 298 K.

### Standard Molar Enthalpy of Formation

The amount of heat absorbed in the formation of one mole of a substance in a specified state from its elements in their standard states.

### Standard Molar Volume

The volume occupied by one mole of an ideal gas under standard conditions; 22.4liters.

### Standard Reaction

A reaction in which the numbers of moles of reactants shown in the balanced equation, all in their standard states, are completely converted to the numbers of moles of products shown in the balanced equation, also all at their standard state.

### Stereoisomers

Isomers that differ only in the way that atoms are oriented in space; consist of geometrical and optical isomers.

### Stoichiometry

Description of the quantitative relationships among elements and compounds as they undergo chemical changes.

### Strong Electrolyte

A substance that conducts electricity well in a dilute aqueous solution.

### Strong Field Ligand

Ligand that exerts a strong crystal or ligand electrical field and generally forms low spin complexes with metal ions when possible.

### Structural Isomers

Compounds that contain the same number of the same kinds of atoms in different geometric arrangements.

### Sublimation

The direct vaporization of a solid by heating without passing through the liquid state.

### Substance

Any kind of matter all specimens of which have the same chemical composition and physical properties.

### Substitution Reaction

A reaction in which an atom or a group of atoms is replaced by another atom or group of atoms.

### Supercooled Liquids

Liquids that, when cooled, apparently solidify but actually continue to flow very slowly under the influence of gravity.

### Supercritical Fluid

A substance at temperature above its critical temperature.

### Supersaturated Solution

A solution that contains a higher than saturation concentration of solute; slight disturbance or seeding causes crystallization of excess solute.

### Suspension

A heterogeneous mixture in which solute-like particles settle out of solvent-like phase some time after their introduction.

## T

### Temperature

A measure of the intensity of heat, i.e. the hotness or coldness of a sample. or object.

### Ternary Acid

A ternary compound containing H, O, and another element, often a nonmetal.

### Ternary Compound

A compound consisting of three elements; may be ionic or covalent.

### Tetrahedral

A term used to describe molecules and polyatomic ions that have one atom in center and four atoms at the corners of a tetrahedron.

### Theoretical Yield

Maximum amount of a specified product that could be obtained from specified amounts of reactants, assuming complete consumption of limiting reactant according to only one reaction and complete recovery of product. (Compare with Actual Yield)

### Thermal Cracking

Decomposition by heating a substance in the presence of a catalyst and in the absence of air.

### Thermodynamics

The study of the energy transfers accompanying physical and chemical processes.

### Thermonuclear Energy

Energy from nuclear fusion reactions.

### Third Law of Thermodynamics

The entropy of a hypothetical pure, perfect, crystalline substance at absolute zero temperature is zero.

### Titration

A Procedure in which one solution is added to another solution until the chemical reaction between the two solutes is complete; the concentration of one solution is known and that of the other is unknown.

### Total Ionic Equation

Equation for a chemical reaction written to show the predominant form of all species in aqueous solution or in contact with water.

### Transition State Theory

Theory of reaction rates that states that reactants pass through high-energy transition states before forming products.

### Tyndall Effect

The scattering of light by colloidal particles.

## U

### Unsaturated Hydrocarbons

Hydrocarbons that contain double or triple carbon-carbon bonds.

## V

### Valence Bond Theory

Assumes that covalent bonds are formed when atomic orbitals on different atoms overlap and the electrons are shared.

### Valence Electrons

Outermost electrons of atoms; usually those involved in bonding.

### Valence Shell Electron Pair Repulsion Theory

Assumes that electron pairs are arranged around the central element of a molecule or polyatomic ion so that there is maximum separation (and minimum repulsion) among regions of high electron density.

### van der Waals' Equation

An equation of state that extends the ideal gas law to real gases by inclusion of two empirically determined parameters, which are different for different gases.

### Vapor

A gas formed by boiling or evaporating a liquid.

### Vapor Pressure

The particle pressure of a vapor at the surface of its parent liquid.

### Voltage

Potential difference between two electrodes; a measure of the chemical potential for a redox reaction to occur.

### Voltaic Cells

Electrochemical cells in which spontaneous chemical reactions produce electricity; also called galvanic cells.

## W

### Water Equivalent

The amount of water that would absorb the same amount of heat as the calorimeter per degree temperature increase.

### Weak Electrolyte

A substance that conducts electricity poorly in a dilute aqueous solution.

### Weak Field Ligand

A Ligand that exerts a weak crystal or ligand field and generally forms high spin complexes with metals.

## Z

### Zone Refining

A method of purifying a bar of metal by passing it through an induction heater; this causes impurities to move along a melted portion.

## Products: A series

Compound	Formula
Aluminum arsenide	AlAs
Aluminum bromide	AlBr <sub>3</sub>
Aluminum bromide, hexahydrate	AlBr <sub>3</sub> ·6H <sub>2</sub> O
Aluminum chloride	AlCl <sub>3</sub>
Aluminum chloride, hexahydrate	AlCl <sub>3</sub> ·6H <sub>2</sub> O
Aluminum iodide	AlI <sub>3</sub>
Aluminum oxide	Al <sub>2</sub> O <sub>3</sub>
Aluminum phosphate	AlPO <sub>4</sub>
Aluminum selenate	Al <sub>2</sub> (SeO <sub>4</sub> ) <sub>3</sub>
Aluminum selenite	Al <sub>2</sub> (SeO <sub>3</sub> ) <sub>3</sub>
Aluminum tellurate	Al <sub>2</sub> (TeO <sub>4</sub> ) <sub>3</sub>
Aluminum tellurite	Al <sub>2</sub> (TeO <sub>3</sub> ) <sub>3</sub>
Aluminum titanate	Al <sub>2</sub> (TiO <sub>3</sub> ) <sub>3</sub>
Ammonium dihydrogen arsenate	(NH <sub>4</sub> )H <sub>2</sub> AsO <sub>4</sub>
Antimony (III) bromide	SbBr <sub>3</sub>
Antimony (III) chloride	SbCl <sub>3</sub>
Antimony (V) chloride	SbCl <sub>5</sub>
Antimony (III) iodide	SbI <sub>3</sub>
Antimony (III) oxide	Sb <sub>2</sub> O <sub>3</sub>
Antimony (V) oxide	Sb <sub>2</sub> O <sub>5</sub>
Antimony (III) phosphate	SbPO <sub>4</sub>
Antimony (III) selenide	Sb <sub>2</sub> Se <sub>3</sub>
Antimony (V) selenide	Sb <sub>2</sub> Se <sub>5</sub>
Antimony (III) sulfide	Sb <sub>2</sub> S <sub>3</sub>
Antimony (III) telluride	Sb <sub>2</sub> Te <sub>3</sub>
Arsenic (III) bromide	AsBr <sub>3</sub>
Arsenic (III) chloride	AsCl <sub>3</sub>
Arsenic (III) iodide	AsI <sub>3</sub>
Arsenic (III) oxide	As <sub>2</sub> O <sub>3</sub>
Arsenic (V) oxide	As <sub>2</sub> O <sub>5</sub>
Arsenic (V) oxide, hydrate	As <sub>2</sub> O <sub>5</sub> ·H <sub>2</sub> O
Arsenic (III) selenide	As <sub>2</sub> Se <sub>3</sub>
Arsenic (V) selenide	As <sub>2</sub> Se <sub>5</sub>
Arsenic (II) sulfide	AsS
Arsenic (III) sulfide	As <sub>2</sub> S <sub>3</sub>
Arsenic (V) sulfide	As <sub>2</sub> S <sub>5</sub>
Arsenic (III) telluride	As <sub>2</sub> Te <sub>3</sub>
Arsenic (V) telluride	As <sub>2</sub> Te <sub>5</sub>

## B series

Barium aluminate	Ba(AlO <sub>2</sub> ) <sub>2</sub>
Barium arsenate	Ba(AsO <sub>4</sub> ) <sub>2</sub>
Barium bromate, dihydrate	Ba(BrO <sub>3</sub> ) <sub>2</sub> ·2H <sub>2</sub> O
Barium bromate, monohydrate	Ba(BrO <sub>3</sub> ) <sub>2</sub> ·H <sub>2</sub> O
Barium bromide	BaBr <sub>2</sub>

Barium chromate	BaCrO <sub>4</sub>
Barium iodide	BaI <sub>2</sub>
Barium molybdate	BaMoO <sub>4</sub>
Barium metaniobate	BaNb <sub>2</sub> O <sub>6</sub>
Barium Oxide	BaO
Barium orthophosphate	Ba <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>
Barium selenate	BaSeO <sub>4</sub>
Barium selenite	BaSeO <sub>3</sub>
Barium metasilicate	BaSiO <sub>3</sub>
Barium tellurate, trihydrate	BaTeO <sub>4</sub> ·3H <sub>2</sub> O
Barium tellurite	BaTeO <sub>3</sub>
Barium thiocyanate, monohydrate	Ba(SCN) <sub>2</sub> ·H <sub>2</sub> O
Barium metatitanate	BaTiO <sub>3</sub>
Barium orthotungstate	BaWO <sub>4</sub>
Barium pyrovanadate	Ba <sub>2</sub> V <sub>2</sub> O <sub>7</sub>

Bismuth (III) acetate	Bi(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>3</sub>
Bismuth (III) orthoborate	BiBO <sub>3</sub>
Bismuth (III) bromide	BiBr <sub>3</sub>
Bismuth (III) chloride	BiCl <sub>3</sub>
Bismuth (III) iodide	BiI <sub>3</sub>
Bismuth (III) molybdate	Bi <sub>2</sub> (MoO <sub>4</sub> ) <sub>3</sub>
Bismuth (III) nitrate, pentahydrate	Bi(NO <sub>3</sub> ) <sub>3</sub> ·5H <sub>2</sub> O
Bismuth (III) oxide	Bi <sub>2</sub> O <sub>3</sub>
Bismuth (III) oxychloride	BiOCl
Bismuth (III) oxyiodide	BiOI
Bismuth (III) orthophosphate	BiPO <sub>4</sub>
Bismuth (III) selenide	Bi <sub>2</sub> Se <sub>3</sub>
Bismuth (III) sulfide	Bi <sub>2</sub> S <sub>3</sub>
Bismuth (III) telluride	Bi <sub>2</sub> Te <sub>3</sub>
Bismuth (III) orthotungstite	Bi <sub>2</sub> (WO <sub>4</sub> ) <sub>3</sub>
Bismuth (III) metavanadate	Bi(VO <sub>3</sub> ) <sub>3</sub>

Boron (III) arsenate	BAsO <sub>4</sub>
Boron (III) bromide	BBr <sub>3</sub>
Boron (III) oxide	B <sub>2</sub> O <sub>3</sub>
Boron (III) orthophosphate	BPO <sub>4</sub>
Boron (III) phosphide	BP

### C series

Cadmium arsenide	Cd <sub>3</sub> As <sub>2</sub>
Cadmium bromide	CdBr <sub>2</sub>
Cadmium bromide, dihydrate	CdBr <sub>2</sub> ·2H <sub>2</sub> O
Cadmium bromide, tetrahydrate	CdBr <sub>2</sub> ·4H <sub>2</sub> O
Cadmium carbonate	CdCO <sub>3</sub>
Cadmium perchlorate, hydrate	Cd(ClO <sub>4</sub> ) <sub>2</sub> ·H <sub>2</sub> O
Cadmium chloride	CdCl <sub>2</sub>
Cadmium chloride, dihemihydrate	CdCl <sub>2</sub> ·2H <sub>2</sub> O
Cadmium fluoride	CdF <sub>2</sub>
Cadmium formate, dihydrate	Cd(CHO <sub>2</sub> ) <sub>2</sub> ·2H <sub>2</sub> O
Cadmium hydroxide	Cd(OH) <sub>2</sub>
Cadmium iodide	CdI



Cadmium molybdate	$\text{CdMoO}_4$
Cadmium pyroniobate	$\text{Cd}_2\text{Nb}_2\text{O}_7$
Cadmium nitrate, tetrahydrate	$\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$
Cadmium oxalate	$\text{CdC}_2\text{O}_4$
Cadmium oxide	$\text{CdO}$
Cadmium orthophosphate	$\text{Cd}_3(\text{PO}_4)_2$
Cadmium selenate, dihydrate	$\text{CdSeO}_4 \cdot 2\text{H}_2\text{O}$
Cadmium selenide	$\text{CdSe}$
Cadmium selenite	$\text{CdSeO}_3$
Cadmium sulfide	$\text{CdS}$
Cadmium sulfite	$\text{CdSO}_3$
Cadmium metatantalate	$\text{Cd}(\text{TaO}_3)_2$
Cadmium tellurate	$\text{CdTeO}_4$
Cadmium telluride	$\text{CdTe}$
Cadmium orthotungstate	$\text{CdWO}_4$
Cadmium metazirconate	$\text{CdZrO}_3$

Calcium bromide	$\text{CaBr}_2$
Calcium bromide, dihydrate	$\text{CaBr}_2 \cdot 2\text{H}_2\text{O}$
Calcium bromide, hexahydrate	$\text{CaBr}_2 \cdot 6\text{H}_2\text{O}$
Calcium fluoride	$\text{CaF}_2$
Calcium molybdate	$\text{CaMoO}_4$
Calcium metaniobate	$\text{Ca}(\text{NbO}_3)_2$
Calcium orthophosphate, dihydrate	$\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$
Calcium selenate	$\text{CaSeO}_4$
Calcium selenite	$\text{CaSeO}_3$
Calcium metasilicate	$\text{CaSiO}_3$
Calcium orthosilicate	$\text{Ca}_2\text{SiO}_4$
Calcium tellurate	$\text{CaTeO}_4$
Calcium tellurite	$\text{CaTeO}_3$
Calcium thiocyanate, trihydrate	$\text{Ca}(\text{SCN})_2 \cdot 3\text{H}_2\text{O}$
Calcium metatitanate	$\text{CaTiO}_3$
Calcium orthotungstate	$\text{CaWO}_4$
Calcium metavanadate	$\text{Ca}(\text{VO}_3)_2$
Calcium orthovanadate	$\text{Ca}(\text{VO}_4)_2$
Calcium sulfate, whiskers crystal	$\text{CaSO}_4$

Cesium acetate	$\text{CsC}_2\text{H}_3\text{O}_2$
Cesium bromate	$\text{CsBrO}_3$
Cesium bromide	$\text{CsBr}$
Cesium tribromide	$\text{CsBr}_3$
Cesium carbonate	$\text{Cs}_2\text{CO}_3$
Cesium chlorate	$\text{CsClO}_3$
Cesium chloride	$\text{CsCl}$
Cesium chromate	$\text{Cs}_2\text{CrO}_4$
Cesium dichromate	$\text{Cs}_2\text{Cr}_2\text{O}_7$
Cesium iodide	$\text{CsI}$
Cesium triiodide	$\text{CsI}_3$
Cesium molybdate	$\text{Cs}_2\text{MoO}_4$
Cesium metaniobate	$\text{CsNbO}_3$
Cesium nitrate	$\text{CsNO}_3$
Cesium oxalate	$\text{Cs}_2\text{C}_2\text{O}_4$

Cesium orthophosphate	$\text{Cs}_3\text{PO}_4$
Cesium dihydrogen orthophosphate	$\text{CsH}_2\text{PO}_4$
Cesium hydrogen orthophosphate	$\text{Cs}_2\text{HPO}_4$
Cesium selenate	$\text{CsSeO}_4$
Cesium metasilicate	$\text{Cs}_2\text{SiO}_3$
Cesium sulfate	$\text{Cs}_2\text{SO}_4$
Cesium sulfite	$\text{Cs}_2\text{SO}_3$
Cesium metatantalate	$\text{CsTaO}_3$
Cesium tellurate	$\text{Cs}_2\text{TeO}_4$
Cesium thiocyanate	$\text{CsSCN}$
Cesium metatitanate	$\text{Cs}_2\text{TiO}_3$
Cesium orthotungstate	$\text{Cs}_2\text{WO}_4$
Cesium orthovanadate	$\text{Cs}_3\text{VO}_4$
Chromium (II) antimonide	$\text{Cr}_3\text{Sb}_2$
Chromium (III) antimonide	$\text{CrSb}$
Chromium (II) arsenide	$\text{Cr}_3\text{As}_2$
Chromium (III) arsenide	$\text{CrAs}$
Chromium (III) bromide, hexahydrate	$\text{CrBr}_3 \cdot 6\text{H}_2\text{O}$
Chromium (II) chloride	$\text{CrCl}_2$
Chromium (III) chloride	$\text{CrCl}_3$
Chromium (III) oxalate, hexahydrate	$\text{Cr}_2(\text{C}_2\text{O}_4)_3 \cdot 6\text{H}_2\text{O}$
Chromium (III) oxide	$\text{Cr}_2\text{O}_3$
Chromium (VI) oxychloride	$\text{CrO}_2\text{Cl}_2$
Chromium (III) selenide	$\text{Cr}_2\text{Se}_3$
Chromium (III) silicide	$\text{Cr}_3\text{Si}_2$
Chromium (III) tellurate	$\text{Cr}_2(\text{TeO}_4)_3$
Chromium (III) telluride	$\text{Cr}_2\text{Te}_3$
Chromium (III) orthovanadate	$\text{CrVO}_4$
Cobalt (II) bromide	$\text{CoBr}_2$
Cobalt (II) chloride	$\text{CoCl}_2$
Cobalt (II) fluoride, dihydrate	$\text{CoF}_2 \cdot 2\text{H}_2\text{O}$
Cobalt (II) fluoride, hydrate	$\text{CoF}_2 \cdot \text{H}_2\text{O}$
Cobalt (II) fluosilicate, hexahydrate	$\text{CoSiF}_6 \cdot 6\text{H}_2\text{O}$
Cobalt (II) iodate, hexahydrate	$\text{Co}(\text{IO}_3)_2 \cdot 6\text{H}_2\text{O}$
Cobalt (II) iodide	$\text{CoI}_2$
Cobalt (II) iron (II) oxide	$\text{CoFe}_2\text{O}_4$
Cobalt (II) nitrate, hexahydrate	$\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$
Cobalt (II) oxalate, dihydrate	$\text{CoC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$
Cobalt (II) oxide	$\text{CoO}$
Cobalt (II) selenide	$\text{CoSe}$
Cobalt (II) selenite	$\text{CoSeO}_3$
Cobalt (II) orthosilicate	$\text{Co}_2\text{SiO}_4$
Cobalt (II) orthotungstate	$\text{CoWO}_4$
Copper (I) antimonide	$\text{Cu}_3\text{Sb}$
Copper (I) arsenide	$\text{Cu}_3\text{As}$
Copper (II) bromate, hexahydrate	$\text{Cu}(\text{BrO}_3)_2 \cdot 6\text{H}_2\text{O}$
Copper (I) bromide	$\text{CuBr}$
Copper (II) bromide	$\text{CuBr}_2$
Copper (II) chlorate, hexahydrate	$\text{Cu}(\text{ClO}_3)_2 \cdot 6\text{H}_2\text{O}$

Copper (I) chloride	CuCl
Copper (II) chloride	CuCl <sub>2</sub>
Copper (II) hydroxide	Cu(OH) <sub>2</sub>
Copper (II) iodate	Cu(IO <sub>3</sub> ) <sub>2</sub>
Copper (I) iodide	CuI
Copper (II) iron (II) oxide	CuFe <sub>2</sub> O <sub>4</sub>
Copper (II) orthomolybdate	CuMoO <sub>4</sub>
Copper (II) orthoniobate	Cu(NbO <sub>3</sub> ) <sub>2</sub>
Copper (II) nitrate, trihydrate	Cu(NO <sub>3</sub> ) <sub>2</sub> ·3H <sub>2</sub> O
Copper (II) oxide	CuO
Copper (I) phosphide	Cu <sub>3</sub> P
Copper (II) selenate, pentahydrate	CuSeO <sub>4</sub> ·5H <sub>2</sub> O
Copper (I) selenide	Cu <sub>2</sub> Se
Copper (II) selenide	CuSe
Copper (II) selenite, dihydrate	CuSeO <sub>3</sub> ·2H <sub>2</sub> O
Copper (II) metasilicate	CuSiO <sub>3</sub>
Copper (II) sulfate, pentahydrate	CuSO <sub>4</sub> ·5H <sub>2</sub> O
Copper (I) sulfide	Cu <sub>2</sub> S
Copper (I) telluride	Cu <sub>2</sub> Te
Copper (II) telluride	CuTe
Copper (II) tellurite	CuTeO <sub>3</sub>
Copper (I) thiocyanate	CuSCN
Copper (II) metatitanate	CuTiO <sub>3</sub>
Copper (II) orthotungstate	CuWO <sub>4</sub>
Copper (II) metavanadate	Cu(VO <sub>3</sub> ) <sub>2</sub>

### F series

Fremy's salt (Potassium nitrosodisulfonate) (KSO<sub>3</sub>)<sub>2</sub>NO

### G series

Gallium (III) acetate	Ga(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>3</sub>
Gallium (III) antimonide	GaSb
Gallium (III) orthoarsenate	GaAsO <sub>4</sub>
Gallium (III) arsenide	GaAs
Gallium (II) bromide	GaBr <sub>2</sub>
Gallium (III) bromide	GaBr <sub>3</sub>
Gallium (II) chloride	GaCl <sub>2</sub>
Gallium (III) chloride	GaCl <sub>3</sub>
Gallium (III) hydroxide	Ga(OH) <sub>3</sub>
Gallium (II) iodide	GaI <sub>2</sub>
Gallium (III) iodide	GaI <sub>3</sub>
Gallium (III) nitride	GaN
Gallium (III) oxide	Ga <sub>2</sub> O <sub>3</sub>
Gallium (III) orthophosphate	GaPO <sub>4</sub>
Gallium (III) sulfate, octadecahydrate	Ga <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ·18H <sub>2</sub> O
Gallium (III) sulfide	Ga <sub>2</sub> S <sub>3</sub>
Gallium (II) telluride	GaTe
Gallium (III) telluride	Ga <sub>2</sub> Te <sub>3</sub>
Germanium (IV) bromide	GeBr <sub>4</sub>
Germanium (II) iodide	GeI <sub>2</sub>
Germanium (IV) iodide	GeI <sub>4</sub>

### H series

Hafnium (IV) acetate, basic	$\text{HfOH}(\text{C}_2\text{H}_3\text{O}_2)_3$
Hafnium (IV) bromide	$\text{HfBr}_4$
Hafnium (IV) oxychloride, octahydrate	$\text{HfOCl}_2 \cdot 8\text{H}_2\text{O}$
Hafnium (IV) fluoride	$\text{HfF}_4$
Hafnium (IV) sulfate	$\text{Hf}(\text{SO}_4)_2$

### I series

Indium (III) antimonide	$\text{InSb}$
Indium (III) arsenide	$\text{InAs}$
Indium (I) bromide	$\text{InBr}$
Indium (III) bromide	$\text{InBr}_3$
Indium (III) bromodiodide	$\text{InBrI}_2$
Indium (III) dibromiodide	$\text{InBr}_2\text{I}$
Indium (I) chloride	$\text{InCl}$
Indium (II) chloride	$\text{InCl}_2$
Indium (III) chloride	$\text{InCl}_3$
Indium (III) chloride, tetrahydrate	$\text{InCl}_3 \cdot 4\text{H}_2\text{O}$
Indium (III) hydroxide	$\text{In}(\text{OH})_3$
Indium (III) iodate	$\text{In}(\text{IO}_3)_3$
Indium (I) iodide	$\text{InI}$
Indium (II) iodide	$\text{InI}_2$
Indium (III) iodide	$\text{InI}_3$
Indium (III) nitrate, tetrahemihydrate	$\text{In}(\text{NO}_3)_3 \cdot 4\text{H}_2\text{O}$
Indium (III) oxide	$\text{In}_2\text{O}_3$
Indium (III) orthophosphate	$\text{InPO}_4$
Indium (III) phosphide	$\text{InP}$
Indium (III) selenide	$\text{In}_2\text{Se}_3$
Indium (III) sulfate, hydrate	$\text{In}_2(\text{SO}_4)_3 \cdot x\text{H}_2\text{O}$
Indium (II) sulfide	$\text{InS}$
Indium (III) sulfide	$\text{In}_2\text{S}_3$
Indium (II) telluride	$\text{InTe}$
Indium (III) telluride	$\text{In}_2\text{Te}_3$
Iodine (I) bromide	$\text{IBr}$
Iodine (III) bromide	$\text{IBr}_3$
Iodine (I) chloride	$\text{ICl}$
Iodine (III) chloride	$\text{ICl}_3$
Iron (II) bromide	$\text{FeBr}_2$
Iron (III) bromide	$\text{FeBr}_3$
Iron (III) bromide, hexahydrate	$\text{FeBr}_3 \cdot 6\text{H}_2\text{O}$
Iron (III) chloride	$\text{FeCl}_3$
Iron (II) fluoride, tetrahydrate	$\text{FeF}_2 \cdot 4\text{H}_2\text{O}$
Iron (II) iodide	$\text{FeI}_2$
Iron (II) iodide, tetrahydrate	$\text{FeI}_2 \cdot 4\text{H}_2\text{O}$
Iron (II) orthomolybdate	$\text{FeMoO}_4$
Iron (II) oxide	$\text{FeO}$
Iron (II) iron (III) oxide	$\text{Fe}_3\text{O}_4$
Iron (III) oxide	$\text{Fe}_2\text{O}_3$
Iron (III) phosphide	$\text{FeP}$
Iron(di) phosphide	$\text{Fe}_2\text{P}$

Iron(tri) phosphide	Fe <sub>3</sub> P
Iron (II) selenide	FeSe
Iron (II) sulfide	FeS
Iron sulfide, iron rich	FeS
Iron (II) telluride	FeTe
Iron (II) metatitanate	FeTiO <sub>3</sub>
Iron (II) orthotungstate	FeWO <sub>4</sub>
Iron (III) orthotungstate	Fe <sub>2</sub> (WO <sub>4</sub> ) <sub>3</sub>
Iron (III) orthovanadate	FeVO <sub>4</sub>
Iron (II) metazirconate	FeZrO <sub>3</sub>

### L series

Lithium tetraborate, pentahydrate	Li <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·5H <sub>2</sub> O
Lithium bromate	LiBrO <sub>3</sub>
Lithium bromide	LiBr
Lithium bromide, dihydrate	LiBr·2H <sub>2</sub> O
Lithium chromate	Li <sub>2</sub> CrO <sub>4</sub>
Lithium chromate, dihydrate	Li <sub>2</sub> CrO <sub>4</sub> ·2H <sub>2</sub> O
Lithium cyanide	LiCN
Lithium dichromate	Li <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
Lithium ethoxide	LiC <sub>2</sub> H <sub>5</sub> O
Lithium iodate	LiIO <sub>3</sub>
Lithium orthomolybdate	Li <sub>2</sub> MoO <sub>4</sub>
Lithium metaniobate	Li <sub>2</sub> NbO <sub>3</sub>
Lithium nitrate	LiNO <sub>3</sub>
Lithium nitrate, hydrate	LiNO <sub>3</sub> ·xH <sub>2</sub> O
Lithium selenate	Li <sub>2</sub> SeO <sub>4</sub>
Lithium selenite	Li <sub>2</sub> SeO <sub>3</sub>
Lithium metasilicate	Li <sub>2</sub> SiO <sub>3</sub>
Lithium orthosilicate	Li <sub>2</sub> SiO <sub>3</sub>
Lithium hydrogen sulfate	LiHSO <sub>4</sub>
Lithium metatantalate	LiTaO <sub>3</sub>
Lithium tellurate	Li <sub>2</sub> TeO <sub>4</sub>
Lithium tellurite	Li <sub>2</sub> TeO <sub>3</sub>
Lithium metatitanate	Li <sub>2</sub> TiO <sub>3</sub>
Lithium orthotungstate	Li <sub>2</sub> WO <sub>4</sub>
Lithium metavanadate, dihydrate	LiVO <sub>3</sub> ·2H <sub>2</sub> O
Lithium metazirconate	Li <sub>2</sub> ZrO <sub>3</sub>

### M series

Magnesium aluminate	Mg(AlO <sub>2</sub> ) <sub>2</sub>
Magnesium arsenide	Mg <sub>3</sub> As <sub>2</sub>
Magnesium bismuthide	Mg <sub>3</sub> Bi <sub>2</sub>
Magnesium chlorate, hydrate	Mg(ClO <sub>3</sub> ) <sub>2</sub> ·H <sub>2</sub> O
Magnesium chloride	MgCl <sub>2</sub>
Magnesium chromate, pentahydrate	MgCrO <sub>4</sub> ·5H <sub>2</sub> O
Magnesium iodide	MgI <sub>2</sub>
Magnesium molybdate	MgMoO <sub>4</sub>
Magnesium nitrate, hexahydrate	Mg(NO <sub>3</sub> ) <sub>2</sub> ·6H <sub>2</sub> O
Magnesium oxide	MgO
Magnesium phosphide	Mg <sub>3</sub> P <sub>2</sub>
Magnesium pyrophosphate	Mg <sub>2</sub> P <sub>2</sub> O <sub>7</sub>

Magnesium selenate	$\text{MgSeO}_4$
Magnesium selenide	$\text{MgSe}$
Magnesium selenite	$\text{MgSeO}_3$
Magnesium metasilicate	$\text{MgSiO}_3$
Magnesium sulfide	$\text{MgS}$
Magnesium metatitanate	$\text{MgTiO}_3$
Magnesium tungstate	$\text{MgWO}_4$
Magnesium metavanadate	$\text{Mg}(\text{VO}_3)_2$
Magnesium orthovanadate	$\text{Mg}_3(\text{VO}_4)_2$
Manganese (II) antimonide	$\text{Mn}_3\text{Sb}_2$
Manganese (II) arsenide	$\text{Mn}_3\text{As}_2$
Manganese (III) arsenide	$\text{MnAs}$
Manganese (III) bisulfide	$\text{MnBi}$
Manganese (II) bromide	$\text{MnBr}_2$
Manganese (II) bromide, tetrahydrate	$\text{MnBr}_2 \cdot 4\text{H}_2\text{O}$
Manganese (II) carbonate	$\text{MnCO}_3$
Manganese (II) chloride	$\text{MnCl}_2$
Manganese (II) formate, dihydrate	$\text{Mn}(\text{CHO}_2)_2 \cdot 2\text{H}_2\text{O}$
Manganese (II) fluoride	$\text{MnF}_2$
Manganese (II) iodide	$\text{MnI}_2$
Manganese (II) orthomolybdate	$\text{MnMoO}_4$
Manganese (II) nitrate, tetrahydrate	$\text{Mn}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$
Manganese (II) oxide	$\text{MnO}$
Manganese (II) manganese (III) oxide	$\text{Mn}_2\text{O}_4$
Manganese (III) oxide	$\text{Mn}_2\text{O}_3$
Manganese (II) phosphide	$\text{Mn}_3\text{P}_2$
Manganese (II) telluride	$\text{MnTe}$
Manganese (II) metazirconate	$\text{MnZrO}_3$
Mercury (II) acetate	$\text{Hg}(\text{C}_2\text{H}_3\text{O}_2)_2$
Mercury (II) ammonium thiocyanate	$(\text{NH}_4)_2\text{Hg}(\text{SCN})_4$
Mercury (II) orthoarsenate	$\text{Hg}_3(\text{AsO}_4)_2$
Mercury (II) benzoate, hydrate	$\text{Hg}(\text{C}_7\text{H}_5\text{O}_2)_2 \cdot x\text{H}_2\text{O}$
Mercury (II) bromate, dihydrate	$\text{Hg}(\text{BrO}_3)_2 \cdot 2\text{H}_2\text{O}$
Mercury (I) bromide	$\text{Hg}_2\text{Br}_2$
Mercury (II) bromide	$\text{HgBr}_2$
Mercury (I) perchlorate, tetrahydrate	$\text{HgClO}_4 \cdot 4\text{H}_2\text{O}$
Mercury (II) perchlorate, trihydrate	$\text{Hg}(\text{ClO}_4)_2 \cdot 3\text{H}_2\text{O}$
Mercury (II) chloride	$\text{HgCl}_2$
Mercury (II) iodate	$\text{Hg}(\text{IO}_3)_2$
Mercury (II) iodide	$\text{HgI}_2$
Mercury (II) nitrate, hydrate	$\text{Hg}(\text{NO}_3)_2 \cdot x\text{H}_2\text{O}$
Mercury (II) selenide	$\text{HgSe}$
Mercury (II) selenite	$\text{HgSeO}_3$
Mercury (II) sulfide	$\text{HgS}$
Mercury (II) telluride	$\text{HgTe}$
Mercury (II) tellurite	$\text{HgTeO}_3$
Mercury (II) thiocyanate	$\text{Hg}(\text{SCN})_2$
Mercury (II) tungstate	$\text{HgWO}_4$
Molybdenum (II) bromide	$\text{MoBr}_2$

Molybdenum (III) bromide	MoBr <sub>3</sub>
Molybdenum (II) chloride	MoCl <sub>2</sub>
Molybdenum (III) chloride	MoCl <sub>3</sub>
Molybdenum (V) chloride	MoCl <sub>5</sub>
Molybdenum (IV) oxide	MoO <sub>2</sub>

### N series

Nickel (II) antimonide	Ni <sub>3</sub> Sb <sub>2</sub>
Nickel (III) arsenide	NiAs
Nickel (II) bromide	NiBr <sub>2</sub>
Nickel (II) bromide, trihydrate	NiBr <sub>2</sub> ·3H <sub>2</sub> O
Nickel (II) bromide, hexahydrate	NiBr <sub>2</sub> ·6H <sub>2</sub> O
Nickel (II) chloride	NiCl <sub>2</sub>
Nickel (II) hydroxide	Ni(OH) <sub>2</sub>
Nickel (II) iodide	NiI <sub>2</sub>
Nickel (II) iron (III) oxide	NiFe <sub>2</sub> O <sub>4</sub>
Nickel (II) orthomolybdate	NiMoO <sub>4</sub>
Nickel (II) nitrate, hexahydrate	Ni(NO <sub>3</sub> ) <sub>2</sub> ·6H <sub>2</sub> O
Nickel (II) oxalate, dihydrate	NiC <sub>2</sub> O <sub>4</sub> ·2H <sub>2</sub> O
Nickel (II) oxide	NiO
Nickel (II) orthophosphate	Ni <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>
Nickel (II) hypophosphite, hexahydrate	Ni(H <sub>2</sub> PO) <sub>2</sub> ·6H <sub>2</sub> O
Nickel (II) selenide	NiSe
Nickel (II) orthosilicate	Ni <sub>2</sub> SiO <sub>4</sub>
Nickel sulfide	NiS <sub>2</sub>
Nickel (II) sulfide	NiS
Nickel (II) metatitanate	NiTiO <sub>3</sub>
Nickel (II) orthotungstate	NiWO <sub>4</sub>
Nickel (II) metavanadate	Ni(VO <sub>3</sub> ) <sub>2</sub>

Niobium (V) bromide	NbBr <sub>5</sub>
Niobium (III) chloride	NbCl <sub>3</sub>
Niobium (V) chloride	NbCl <sub>5</sub>
Niobium (V) iodide	NbI <sub>5</sub>
Niobium (III) oxide	Nb <sub>2</sub> O <sub>3</sub>

### P series

Phosphorus (II) iodide	P <sub>2</sub> I <sub>4</sub>
Phosphorus (V) nitride	P <sub>3</sub> N <sub>5</sub>
Phosphorus (III) selenide	P <sub>2</sub> Se <sub>3</sub>
Phosphorus (V) selenide	P <sub>2</sub> Se <sub>5</sub>
Phosphorus (III) sulfide	P <sub>2</sub> S <sub>3</sub>
Phosphorus (III) telluride	P <sub>2</sub> Te <sub>3</sub>
Potassium ethoxide	KC <sub>2</sub> H <sub>5</sub> O
Potassium fluostannate, hydrate	K <sub>2</sub> SnF <sub>4</sub> ·xH <sub>2</sub> O
Potassium orthomolybdate	K <sub>2</sub> MoO <sub>4</sub>
Potassium nitrosodisulfonate(Fremys salt)	(KSO <sub>3</sub> ) <sub>2</sub> NO
Potassium selenate	K <sub>2</sub> SeO <sub>4</sub>
Potassium selenite	K <sub>2</sub> SeO <sub>3</sub>
Potassium selenocyanate	KSeCN
Potassium tantalate	KTaO <sub>3</sub>

Potassium tellurate	$K_2TeO_4$
Potassium tellurite	$K_2TeO_3$
Potassium thiomolybdate	$K_2MoS_4$
Potassium metatitanate	$K_2TiO_3$
Potassium orthovanadate	$K_2VO_4$
Potassium metazirconate	$K_2ZrO_3$

### R series

Rare Earth (RE) Compounds La, Ce, Pr, Nd, Sm, Tm, Yb and Lu.

RE (III) acetate, hydrate	$RE(C_2H_3O_2)_3 \cdot xH_2O$
RE (IV) aluminate	$REAl_2O_3$
RE (III) hydrogen arsenate, hydrate	$RE(HAsO_4)_3 \cdot xH_2O$
RE (III) benzoate, trihydrate	$RE(C_7H_5O_2)_3 \cdot 3H_2O$
RE (III) bromate, hydrate	$RE(BrO_3)_3 \cdot xH_2O$
RE (III) bromide	$REBr_3$
RE (III) bromide, hydrate	$REBr_3 \cdot xH_2O$
RE (III) chlorate, hydrate	$RE(ClO_3)_3 \cdot xH_2O$
RE (III) chloride	$RECl_3$
RE (III) chloride, hydrate	$RECl_3 \cdot xH_2O$
RE (III) chromate, hydrate	$RE_2(CrO_4)_3 \cdot xH_2O$
RE (III) orthomolybdate	$RE_2(MoO_4)_3$
RE (III) metaniobate	$RE(NbO_3)_3$
RE (III) nitrate, hydrate	$RE(NO_3)_3 \cdot xH_2O$
RE (III) oxalate, hydrate	$RE_2(C_2O_4)_3 \cdot xH_2O$
RE (III) orthophosphate	$REPO_4$
RE (III) selenate, hydrate	$RE(SeO_4)_3 \cdot xH_2O$
RE (III) selenite	$RE(SeO_3)_3$
RE (IV) orthosilicate	$RESiO_4$
RE (III) sulfate, hydrate	$RE_2(SO_4)_3 \cdot xH_2O$
RE (III) metatantalate	$RE(TaO_3)_3$
RE (III) tellurate	$RE_2(TeO_4)_3$
RE (III) tellurite	$RE_2(TeO_3)_3$
RE (IV) metatitanate	$RE_2(TiO_3)_3$
RE (III) orthotungstate	$RE_2(WO_4)_3$
RE (III) orthovanadate	$REVO_4$
RE (III) metazirconate	$RE_2(ZrO_3)_3$
Rubidium actate	$RbC_2H_3O_2$
Rubidium aluminum sulfate, dodecahydrate	$RbAl(SO_4)_2 \cdot 12H_2O$
Rubidium bromide	$RbBr$
Rubidium perchlorate	$RbClO_4$
Rubidium chloride	$RbCl$
Rubidium chromate	$Rb_2CrO_4$
Rubidium citrate, monohydrate	$Rb_3C_6H_5O_7 \cdot H_2O$
Rubidium fluoride	$RbF$
Rubidium nitrate	$RbNO_3$
Rubidium oxalate	$Rb_2C_2O_4$
Rubidium orthophosphate	$Rb_2PO_4$
Rubidium selenate	$Rb_2SeO_4$
Rubidium selenite	$Rb_2SeO_3$



## S series

Selenic acid, 40%	$\text{H}_2\text{SeO}_4$
Selenium (IV) bromide	$\text{SeBr}_4$
Selenium (I) chloride	$\text{SeCl}$
Selenium (IV) chloride	$\text{SeCl}_4$
Selenium (IV) oxide	$\text{SeO}_2$
Selenium (IV) oxychloride	$\text{SeOCl}_2$
Selenium (IV) telluride	$\text{SeTe}$
Silicon (IV) acetate	$\text{Si}(\text{C}_2\text{H}_3\text{O}_2)_4$
Silicon (IV) bromide	$\text{SiBr}_4$
Silicon (IV) chloride	$\text{SiCl}_4$
Silicon (IV) iodide	$\text{SiI}_4$
Silicon (IV) oxide	$\text{SiO}_2$
Silver (I) antimony (III) selenide	$\text{AgSbSe}_2$
Silver (I) antimony (III) sulfide	$\text{AgSbS}_2$
Silver (I) antimony (III) telluride	$\text{AgSbTe}_2$
Silver (I) arsenic (III) selenide	$\text{AgAsSe}_2$
Silver (I) arsenic (III) sulfide	$\text{AgAsS}_2$
Silver (I) arsenic (III) telluride	$\text{AgAsTe}_2$
Silver (I) bismuth (III) selenide	$\text{AgBiSe}_2$
Silver (I) bismuth (III) sulfide	$\text{AgBiS}_2$
Silver (I) bismuth (III) telluride	$\text{AgBiTe}_2$
Silver (I) bromide	$\text{AgBr}$
Silver (I) chloride	$\text{AgCl}$
Silver (I) iodide	$\text{AgI}$
Silver (I) oxide	$\text{Ag}_2\text{O}$
Silver (I) selenide	$\text{Ag}_2\text{Se}$
Silver (I) telluride	$\text{Ag}_2\text{Te}$
Silver (I) orthotungstate	$\text{Ag}_2\text{WO}_4$
Silver (I) metavanadate	$\text{AgVO}_3$
Silver (I) metazirconate	$\text{Ag}_2\text{ZrO}_3$
Sodium metaarsenite	$\text{NaAsO}_2$
Sodium metaniobate	$\text{NaNbO}_3$
Sodium metaniobate, heptahydrate	$\text{NaNbO}_3 \cdot 7\text{H}_2\text{O}$
Sodium selenate	$\text{Na}_2\text{SeO}_4$
Sodium selenite	$\text{NaSeO}_3$
Sodium monosulfide	$\text{Na}_2\text{S}$
Sodium tetrasulfide	$\text{Na}_2\text{S}_4$
Sodium metatantalate	$\text{NaTaO}_3$
Sodium tellurate	$\text{Na}_2\text{TeO}_4$
Sodium tellurite	$\text{Na}_2\text{TeO}_3$
Sodium thiomolybdate	$\text{Na}_2\text{MoS}_4$
Sodium metatitanate	$\text{Na}_2\text{TiO}_3$
Sodium metavanadate	$\text{NaVO}_3$
Sodium orthovanadate	$\text{Na}_3\text{VO}_4$
Sodium pyrovanadate	$\text{Na}_4\text{V}_2\text{O}_7$
Sodium zincate	$\text{Na}_2\text{ZnO}_2$
Sodium metazirconate	$\text{Na}_2\text{ZrO}_3$



Tin (IV) bromotrichloride	$\text{SnBrCl}_3$
Tin (IV) dibromodichloride	$\text{SnBr}_2\text{Cl}_2$
Tin (IV) tribromochloride	$\text{SnBr}_3\text{Cl}$
Tin (II) chloride	$\text{SnCl}_2$
Tin (IV) chloride	$\text{SnCl}_4$
Tin (IV) dichlorodiiiodide	$\text{SnCl}_2\text{I}_2$
Tin (IV) chromate	$\text{Sn}(\text{CrO}_4)_2$
Tin (IV) iodide	$\text{SnI}_4$
Tin (IV) oxide	$\text{SnO}_2$
Tin (II) selenide	$\text{SnSe}$
Tin (IV) selenide	$\text{SnSe}_2$
Tin (IV) sulfate, dihydrate	$\text{Sn}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$
Tin (II) telluride	$\text{SnTe}$
Tin (IV) telluride	$\text{SnTe}_4$
Tin (II) metavanadate	$\text{Sn}(\text{VO}_3)_2$

Titanic acid	$\text{H}_2\text{TiO}_3$
Titanium (IV) bromide	$\text{TiBr}_4$
Titanium (IV) bromotrichloride	$\text{TiBrCl}_3$
Titanium (IV) tribromochloride	$\text{TiBr}_3\text{Cl}$
Titanium (IV) dichlorodiiiodide	$\text{TiCl}_2\text{I}_2$
Titanium (IV) trichloroiodide	$\text{TiCl}_3\text{I}$
Titanium (IV) iodide	$\text{TiI}_4$
Titanium (IV) oxynitrate, hydrate	$\text{TiO}(\text{NO}_3)_2 \cdot x\text{H}_2\text{O}$

### V series

Vanadium (II) bromide	$\text{VBr}_2$
Vanadium (III) bromide	$\text{VBr}_3$
Vanadium (II) chloride	$\text{VCl}_2$
Vanadium (III) chloride	$\text{VCl}_3$
Vanadium (III) chloride, hexahydrate	$\text{VCl}_3 \cdot 6\text{H}_2\text{O}$
Vanadium (III) oxide	$\text{V}_2\text{O}_3$

### Z series

Zinc (II) aluminate	$\text{Zn}(\text{AlO}_2)_2$
Zinc (II) antimonide	$\text{Zn}_3\text{Sb}_2$
Zinc (II) arsenide	$\text{Zn}_3\text{As}_2$
Zinc (II) bromide	$\text{ZnBr}_2$
Zinc (II) chlorate	$\text{Zn}(\text{ClO}_3)_2$
Zinc (II) chloride	$\text{ZnCl}_2$
Zinc (II) hydroxide	$\text{Zn}(\text{OH})_2$
Zinc (II) iron (III) oxide	$\text{ZnFe}_2\text{O}_4$
Zinc (II) iodate, dihydrate	$\text{Zn}(\text{IO}_3)_2 \cdot 2\text{H}_2\text{O}$
Zinc (II) iodide	$\text{ZnI}_2$
Zinc (II) orthomolybdate	$\text{ZnMoO}_4$
Zinc (II) metaniobate	$\text{Zn}(\text{NbO}_3)_2$
Zinc (II) oxide	$\text{ZnO}$
Zinc (II) selenate, pentahydrate	$\text{ZnSeO}_4 \cdot 5\text{H}_2\text{O}$
Zinc (II) selenite	$\text{ZnSeO}_3$
Zinc (II) stannate	$\text{ZnSnO}_3$
Zinc (II) metatantalate	$\text{Zn}(\text{TaO}^3)_2$
Zinc (II) tellurate	$\text{ZnTeO}_4$

Zinc (II) tellurite	$\text{ZnTeO}_3$
Zinc (II) metatitanate	$\text{ZnTiO}_3$
Zinc (II) orthotungstate	$\text{ZnWO}_4$
Zinc (II) metavanadate	$\text{Zn}(\text{VO}_3)_2$
Zinc (II) metazirconate	$\text{ZnZrO}_3$
Zirconium (IV) bromide	$\text{ZrBr}_4$
Zirconium (IV) iodide	$\text{ZrI}_4$
Zirconium (IV) phosphate	$\text{Zr}_3(\text{PO}_4)_4$