Glossary

Absolute zero the lowest temperature that is theoretically possible, at which all molecular motion stops.

Absorbance the logarithm of the ratio of the light intensity incident on a sample to that transmitted through a sample.

Absorptivity a constant that is a measure of how strongly an element absorbs light at a given wavelength.

Absorbed dose (Gy) the energy per unit mass of material exposed to ionizing radiation.

Absorptivity a constant, which is a measure of how strongly a chemical species absorbs light at a given wavelength.

Accuracy the degree of agreement between a measured value of a physical quantity and the actual or true value for that quantity.

Acid-base adduct the product of a Lewis acid-base reaction.

Acid halide a class of organic compounds derived from carboxylic acids by a simple substitution of a halide atom with the hydroxyl group in the carboxylic acid with the general formula —CO_2X.

Acid ionization constant (K_a) the ratio of the concentrations of the ionized products (conjugate acid and conjugate base) to the concentration of the unionized acid in the aqueous solution at equilibrium.

Activation energy (E_a) the minimum kinetic energy that a molecule must have so that a collision between reactants will result in a chemical reaction.

Activity the rate at which a radioisotope decays ($-dN/dt$) measured in s^{-1}.

Actual yield the mass of products actually obtained from a chemical reaction.

Acyl group a group of atoms in a molecule derived by the removal of the hydroxyl group from a carboxylic acid containing a double-bonded oxygen atom and an alkyl group (>C═O).

Addition polymer are polymers formed by a free radical addition reaction, where many monomers bond together via rearrangement of bonds without the loss of any atom or molecule.

Addition reaction organic chemical reactions where part of a molecule is added to one end of a double or triple bond and the other part adds to the other end of the bond converting it to a single or double bond.

Adiabatic a process that takes place with no heat exchange.

Aerosol the heterogeneous mixture of solid particles or liquid droplets in a gas that are sufficiently large for sedimentation.

ALARA principle an acronym for "As Low As Reasonably Achievable," meaning to make every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical.

Alcohol a group of organic molecules that contain the hydroxyl (—OH) functional group.

Aldehyde a group of organic molecules containing a carbonyl group with the general formula RCH═O.

Alkane a class of organic molecules that contain only sp^3 hybridized carbon atoms with the general formula C_nH_{2n+2}.

Alkene a series of hydrocarbons that contain one double bond with the general formula C_nH_{2n}.

Alkoxy group a group of atoms in an organic molecule containing an alkyl group covalently bonded to an oxygen atom with the general formula —OR.

Alkyl group a group of atoms in an organic molecule derived from an alkane denoted by the symbol —R.

Alkyne a series of hydrocarbons that contain one triple bond with the general formula C_nH_{2n-2}.

Allotropes two or more different forms of an element in the same physical state.

Alpha particles (α) energetic helium nucleus, containing two protons and two neutrons, emitted from radioisotopes during radioactive decay.

Amide a group of organic molecules that consists of a carbonyl group bonded to a nitrogen.

Amine a class of organic compounds derived from ammonia by replacement of one or more hydrogen atoms with organic groups.

Amorphous solid a solid material whose atoms or molecules lack a long range ordered pattern.

Amount of substance a measure of the number of fundamental particles, such as atoms, molecules, or ions, that are present in a given mass of substance.

Amphoteric a compound that can act as both a Brønsted-Lowry acid and as a Brønsted-Lowry base.

Analyte a substance whose chemical constituents are being identified and measured.

Anion a negatively charged ion.

Annealing a process used to relieve internal stresses in a glass by slowly heating the glass to a temperature just below the softening point, maintaining the temperature for a period of time, and allowing it to cool slowly.

Anode the electrode in a galvanic cell where the oxidation reaction occurs.

Anthropogenic radioisotopes radioisotopes that are produced by nuclear reactors and/or high energy particle accelerators and are not normally found in the environment.

Antibonding molecular orbital a molecular orbital resulting from the combination of atomic orbitals out of phase.

Antineutrino ($\bar{\nu}_e$) a very small particle that is emitted from a radioisotope during a β^- decay process.

Aqueous solution a solution where water is the solvent.

Aromatic hydrocarbon a cyclic hydrocarbon composed of σ and π bonds in such a manner that the electrons in the π bonds become delocalized giving the molecule unusual stability.

Arrhenius equation the quantitative basis of the relationship between the activation energy, temperature, molecular orientation, and the reaction rate.

Arrhenius plot a plot of the natural logarithm of the observed rate constant as a function of 1/T in Kelvin.

Atactic a sp^3 hybridized polymer with substituent groups in a random orientation relative to the polymer chain.

Atom economy the ratio of the formula weight of the desired product(s) to the total formula weight of all the reactants multiplied by 100.

Atomic absorption spectrometer an instrument used to measure the absorption of light by atoms in a sample.

Atomic absorption spectroscopy a technique for the determination of the concentration of elements in a sample from the measurement of the intensity of light absorbed.

Atomic emission spectroscopy a technique for the identification and quantification of the elements in a sample from the measurement of the wavelength and intensity of the emitted light.

Atomic mass the average mass of the naturally occurring isotopes of an element.

Atomic mass unit (amu) The standard unit of mass on an atomic scale defined as one twelfth of the mass of a single carbon atom containing six neutrons, six protons, and six electrons.

Atomic nucleus the very small region at the center of an atom consisting of protons and neutrons.

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

Atomic radius the distance from the nucleus to the outermost occupied electron orbital in an atom.

Atomic solids solids composed of atoms connected by covalent bonds.

Atomic spectroscopy the study of the light absorbed or emitted from an atom during an electronic transition.

Atomic symbol a one or two letter code for a chemical element, usually derived from the name of the element, with numerical superscripts and subscripts to indicate the atomic number and mass number of the element.

Atoms a basic unit of matter that consists of a dense central nucleus surrounded by a cloud of negatively charged electrons.

Aufbau principle the procedure for assigning electrons to shells, subshells, and orbitals in the order of increasing energy.

Auto ionization an amphoteric compound which can react with itself.

Auto ionization constant of water (K_w) the product of the concentrations of the ionized products (conjugate acid and conjugate base).

Avogadro's law equal volumes of gases at the same temperature and pressure contain the same number of molecules regardless of their chemical nature and physical properties.

Avogadro's number ($6.022 \times 10^{23}\,mol^{-1}$) a conversion factor between the number of moles and the number of fundamental particles in a substance.

Axial the atoms that lie along the vertical axis of a molecule.

Azimuthal quantum number the number designation (l) of an electron subshell.

Band gap (E_g) the energy region between the valence band and the conductance band in a semiconductor.

Barometer an instrument measuring atmospheric pressure.

Base ionization constant (K_b) the ratio of the concentrations of the ionized products (conjugate acid and conjugate base) to the concentration of the unionized base in the aqueous solution at equilibrium.

Base peak the most intense peak in a mass spectrum, due to the ion with the greatest relative abundance.

Battery an electrical device consisting of one or more galvanic cells, with external connections provided to allow the battery to power electrical devices.

Beer's Law the absorbance of light by a sample is equal to the absorptivity of the element or compound in the sample multiplied by the path length that the light travels through the sample and the concentration of the element or compound in the sample.

Beta particles (β^+, β^-) energetic particles with the mass of an electron, emitted from radioisotopes during radioactive decay.

Bimolecular reaction an elementary reaction that involves two molecules, atoms, or ions coming together to form products.

Bomb calorimeter a constant volume calorimeter that is used to measure the heat released during a combustion reaction.

Bond dissociation energy the standard energy required to break one specific bond in a molecule in the gas phase.

Bond energy the average value of the gas phase bond dissociation energies for all bonds of the same type in the same chemical species.

Bond order the number of bonds between two atoms.

Bonding molecular orbital a molecular orbital resulting from the combination of atomic orbitals in phase.

Bonding notation a representation of the structure of a molecule using element symbols connected by lines to represent bonding electrons.

Bonding pair electrons the shared electron pair that forms a covalent bond between two atoms.

Born-Haber cycle an application of Hess's law used to calculate lattice energies.

Boyle's law the absolute pressure and the volume of a gas are inversely proportional at constant temperature and fixed mass.

British thermal unit (BTU) the amount of heat needed to raise one pound of water one degree Fahrenheit at one atmosphere pressure.

Brønsted-Lowry acid a proton donor.

Brønsted-Lowry base a proton acceptor.

Buffer capacity the amount of strong acid or strong base that a buffer solution can absorb before it ceases to function.

Buffer solution a solution which resists changes in pH when small quantities of a strong acid or a strong base are added to it.

Burette a device used for dispensing variable, accurately measured amounts of a solution.

Calibration curve a linear plot of instrument response (absorbance) versus concentration of a series of standards of known concentration.

Calorie (cal) amount of energy required to raise 1 g of water one degree Celsius at 1 atm pressure.

Calorimeter a device used to measure the heat released or absorbed from a chemical reaction or phase change.

Carbanion a negatively charged carbon atom.

Carbocation a positively charged carbon atom.

Carbonyl a functional group in an organic molecule composed of a carbon atom double-bonded to an oxygen atom with the general formula >C═O.

Carboxyl a functional group in a molecule that has the general formula —CO_2H. Compounds containing this group are called carboxylic acids.

Carboxylate an organic anion formed by the loss of the hydroxyl hydrogen ion from a carboxylic acid.

Carboxylic acid a class of compounds which have both a carbonyl and a hydroxyl group bonded to the same carbon atom with the formula RCO_2H.

Carnot cycle a four-step heat engine *cycle*, consisting of two reversible isothermal steps and two reversible adiabatic steps.

Catalyst a substance that increases the rate of a chemical reaction, but is chemically unchanged at the end of the reaction.

Cathode the electrode in a galvanic cell where the reduction reaction occurs.

Cathodic protection a method of protecting structural metal components by using a more easily oxidized metal as an anode, making the protected metal as the cathode of a galvanic cell.

Cation a positively charged ion.

Cell potential the electrical potential energy difference between two half-cells of a galvanic cell.

Centrifugation a method of increasing the rate of sedimentation by rapidly spinning the mixture increasing the effective gravitational force.

Centrifuge an apparatus that puts an object in rotation around a fixed axis resulting in an increase in the effective gravitational force.

Chain reactions a reaction that regenerates a key reactant in the reaction mechanism.

Charles' law at constant pressure, the volume of a fixed mass of any gas is directly proportional to the absolute temperature in degrees Kelvin.

Chemical equation the symbolic representation of a chemical reaction using symbols of the elements and chemical formulas.

Chemical equilibrium the state in which both reactants and products are present in concentrations which have no further tendency to change with time.

Chemical formula a way of expressing the bonding between atoms and ions in a compound using a single line of element symbols along with numeric subscripts to indicate the number of atoms of each element.

Chemical kinetics the study of the rates and mechanisms of chemical reactions.

Chemical shifts the shift in the NMR absorption frequency due to the shielding of the nucleus by the surrounding electrons.

Chemical thermodynamics the examination of the fundamental properties of the chemical species involved in reversible chemical reactions and how these properties determine their behavior in the reactions.

Chemiluminescence light emitted by an electronically excited molecule created as the product of a chemical reaction.

Chromatography an analytical method most often used for the separation of mixtures of chemical substances into their individual pure components.

Cleaving causing an ionic solid to split along the axis parallel to the planes of the ions by an application of an outside force.

Close-packed structure the most tightly packed and space efficient arrangement of ions in a crystal lattice.

Closed shell a valence shell in an atom that has the maximum number of electrons allowed by the Pauli Exclusion Principle.

Closed system one where mass cannot be exchanged between the system and the surroundings.

Coalescence the formation of a superfluid by super cooling any of the three classical states of matter (e.g., solids, liquids, or gases).

Colligative properties properties of a solution that depend upon the concentration of solute molecules or ions, but not upon the identity of the solute.

Collision theory a theory used to predict the rates of chemical reactions based on the assumption that, for a reaction to occur, it is necessary for the reacting species to collide with one another.

Colloid the heterogeneous mixture of very small solid particles in a liquid that are not readily settleable.

Combined gas law the ratio between the pressure-volume product and the absolute temperature of a fixed mass of gas measured in Kelvin remains constant.

Common ion effect the decrease of solubility of a slightly soluble ionic solid by the presence in the same solution of a highly soluble ionic solid containing one of the same ions.

Complete ionic equation a chemical equation for a reaction in aqueous solution that shows all the dissolved ionic species present during the reaction.

Complex ion a coordination complex with a metal ion at its center and a number of other neutral molecules attached to it by coordinate covalent bonds.

Compound a pure chemical substance consisting of two or more different chemical elements in a simple whole number ratio that can be separated into simpler substances by chemical reactions.

Compton scattering the inelastic scattering of a high energy radiation by an electron resulting in a decrease in energy (increase in wavelength) of the radiation.

Concentration cell a form of galvanic cell where both half-cells have the same composition with differing concentrations.

Condensation the transition from a gas phase to a liquid phase.

Condensation polymer a polymer formed by a condensation reaction between two molecules containing two of the same reactive functional group.

Condensation reaction an organic chemical reaction in which two functional groups on two molecules combine to form a larger molecule with the loss of a small molecule.

Conduction band a group of molecular orbitals of the same energy in a crystal lattice through which electrons are free to move easily.

Conjugate acid an acid that has lost a proton.

Conjugate base a base that has gained a proton.

Conjugate pairs an acid and its conjugate base or a base and its conjugate acid.

Conjugation the overlap of molecular π orbitals in molecules with alternating single and multiple bonds resulting in a delocalization of the electrons occupying these orbitals.

Conservation of mass the principle that atoms are neither created nor destroyed in a chemical reaction.

Coordination complex the product of a Lewis acid-base reaction in which neutral molecules or anions bond to a central metal atom or ion by coordinate covalent bonds.

Coordinate covalent bond a bond where both electrons are provided lone pair on a Lewis base.

Coordination number the number of nearest neighbor ions of opposite charge surrounding any ion in a crystal structure.

Copolymer a polymer made up of two or more different monomer units bonded together.

Core electrons the electrons in all the electron shells between the nucleus and the valence shell of an atom.

Cosmogenic radioisotopes radioisotopes created by the interaction of a high energy cosmic ray with the nucleus of a naturally occurring stable atmospheric isotope causing the loss of protons and neutrons from the nucleus.

Coulomb' Law the force of the electrostatic interaction between two charged particles is proportional to the product of the charges divided by the square of the distance between them.

Covalent bond sharing of a pair of electrons between two atoms which holds them together.

Critical mass the mass of a radioisotope that is required to sustain a nuclear chain reaction.

Critical point (cp) the temperature and pressure above which the liquid and gas phases become indistinguishable and the substance becomes a supercritical fluid with properties of both gas and liquid phases.

Cryogenic distillation the separation of a mixture of liquefied gases by distillation at very low temperatures.

Crystal lattice the simplest repeating unit in a crystalline solid.

Crystalline solid a solid material with the constituent species arranged in a highly ordered microscopic structure that extends in all directions.

Crystallization the process by which a crystalline solid is formed.

Cycloalkane a class of hydrocarbons that have monocyclic alkane molecular structures.

Dalton's law of partial pressures the total pressure of a mixture of gases equals the sum of the pressures that each would exert if it were present alone.

Decanting pouring off the top fluid layer leaving the solids behind.

Degree of polymerization the number of monomers in a polymer chain.

Degree of unsaturation a measure of how far the structure of a hydrocarbon departs from the structure of a normal alkane as determined by the number of π bonds and ring structures.

Delocalized electrons electrons in a molecule, ion, or solid metal that are not associated with a single atom or a covalent bond.

Density the ratio of the mass to the volume of a material.

Deposition the transition from a gas phase to a solid phase directly without passing through the liquid state.

Detection limit the lowest amount of a chemical species that can be detected by a measurement method.

Diatomic molecule a molecule made up of two atoms.

Diamagnetic having the property of being weakly repelled by a magnetic field.

Diene a hydrocarbon that has two double bonds in the molecular structure.

Diode a device constructed of a p-n junction that allows the flow of electrical current only in one direction.

Dipole a bond (or molecule) that has a partial positive charge on one end and partial negative charge on the other.

Dipole-dipole forces an attractive force between molecules with permanent dipole moments.

Dipole moment a measure of the polarity of a covalent bond.

Diprotic acid a Brønsted-Lowry acid that can donate two protons per molecule to an aqueous solution.

Dissociation the separation of cations and anions of an ionic solute when the solute dissolves in a solvent.

Dissolution the process by which gases, liquids, or solids become dissolved in a liquid solvent.

Distillate the purified components of a liquid mixture that has been separated by distillation.

Distillation a physical method of separating liquid mixtures based on vaporization of the liquid components depending on the differences in their boiling points, followed by recondensation.

Doping the deliberate introduction of impurities into the crystal structure of a semiconductor in order to alter the electrical properties of the pure substance.

Double bond a covalent bond that results from the sharing of two electron pairs between two atoms.

Dry cell a battery that uses an electrolyte in the form of a paste or a solid.

Ductile the ability to deform under applied stress.

Dynamic equilibrium the state of a chemical reaction where the forward and reverse reactions occur at the same rate so that the concentrations of reactants and products do not change.

Effective collision a molecular collision that results in a chemical reaction between reactants.

Effusion a physical method of the separation of a mixture of gases based on the rate of flux through a porous membrane, which is dependent on the differences in mass of the gas molecules.

Electrochemistry the study of chemical processes that cause electrons to move.

Electrode a solid conductor through which an electrical current enters or leaves a galvanic cell.

Electrolysis a process which uses an external electrical current to drive a nonspontaneous oxidation-reduction reaction.

Electrolyte a substance that can conduct electricity due to its ability to dissociate into ions when dissolved.

Electromotive force (emf) a measure of the ability of a half-cell to drive the electric current from the interior to the exterior of the cell.

Electron a negatively charged particle that orbits the nucleus in all atoms.

Electron affinity the amount of energy released when an electron is added to a neutral atom in the gas phase.

Electron capture (EC) the capture of an orbital electron from the K shell nearest the nucleus to convert a proton to a neutron.

Electron capture detector (ECD) a device used to monitor the decrease in electrical current when an electronegative component of the mixture captures an electron emitted by a beta source.

Electron dot structure a diagram of the valence electrons of an element where the electrons are represented by dots placed around the chemical symbol of the element.

Electron shell a group of electron subshells all having the same value of the principal quantum number.

Electron subshell a group of electron orbitals with the same value of the principal quantum number.

Electronegativity a measure of the tendency of an atom to attract electrons from another atom in a chemical bond.

Electronic configuration the assignment of the electrons in an atom to electronic shells, subshells, and orbitals.

Electrophile a chemical species that is attracted to electrons.

Electroplating the application of electrolysis to produce a thin coating of one metal on top of another.

Element a pure chemical substance consisting of one type of atom distinguished by its atomic number.

Elementary reaction steps simple chemical reactions that expresses how molecules actually react with each other on the molecular level during an overall chemical reaction.

Elimination reaction a class of organic chemical reactions in which a pair of atoms or group of atoms is removed from a molecule, usually through the action of acids or bases.

Empirical mass the sum of the atomic masses in the empirical formula multiplied by the number of atoms of each element.

Empirical formula the simplest positive integer ratio of atoms present in the compound.

End point the point in a titration when the chemical reaction is exactly complete.

Endothermic reaction A chemical reaction that absorbs energy in the form of heat from its surroundings.

Engine efficiency the fraction of the heat energy extracted from the hot reservoir that is converted to mechanical work.

Engineering notation a method of writing or displaying numbers in terms of a decimal number multiplied by a power of 10 which is a multiple of three.

Enthalpy (*H*) the total thermal energy of a system.

Enthalpy of solution (ΔH_{soln}) the enthalpy change associated with the dissolution of a solute in a solvent at constant pressure.

Entropy (S) is the measure of the dispersal of energy or how much energy is spread out in a process and how widely spread out it becomes.

Equations of state mathematical relationships between state functions that describe the equilibrium state of a system under a given set of physical conditions.

Equatorial the atoms that lie along the horizontal plane of a molecule.

Equilibrium constant (K_{eq}) value of the chemical reaction quotient when the reaction has reached chemical equilibrium.

Equilibrium constant expression the ratio of the concentrations of the products over the reactants in a chemical reaction at equilibrium raised to the power of their stoichiometric coefficients.

Equilibrium states the states of a system where the macroscopic properties do not change.

Equivalence point the point in a titration when the equal quantities of reactants have been combined.

Equivalent (eq) the number of moles of an ion dissolved in a solution multiplied by the ionic charge.

Equivalent dose the amount of biological damage done by an absorbed dose of ionizing radiation.

Ester a chemical class of organic molecules derived from a carboxylic acid by the replacement of the hydroxyl group with an alkoxy group (—OR) with the general formula —COOR.

Ether a class of organic compounds consisting of two alkyl groups covalently bonded to an oxygen atom.

Exact numbers numbers that do not have measurement uncertainties associated with them.

Excited state higher energy state of an atom arising from the absorption of energy and the transition of electrons to higher orbitals.

Exothermic reaction a chemical reaction that releases energy in the form of heat during the reaction.

Exponential decay the decrease in any quantity "*N*" according to $N(t) = N_0\, e^{-\lambda t}$.

Extensive properties bulk properties that depend on the amount of matter present.

Faraday constant (F) the amount of electric charge produced by 1 mol of electrons.

Fast ion conductor ionic solids in which the ions are highly mobile.

Filtrate a liquid that has passed through a filter.

Filtration a mechanical method of separating solids from fluids by using a medium through which only the fluid can pass.

First law of thermodynamics energy cannot be created or destroyed, it can only be transformed from one form to another.

First order a chemical reaction whose rate is proportional to the concentration of one reactant.

Flame ionization detector (FID) a device used to detect compounds that produce ions when combusted, such as organic hydrocarbon compounds.

Flocculation a process in which the fine particles of a precipitate aggregate to form larger particles.

Fluid a subset of the states of matter that include liquids, gases, and plasmas, which continually flow under an applied shear stress.

Fluorescence the emission of light of one wavelength by an electronically excited molecule after the absorption of light of a shorter wavelength.

Formation constant the equilibrium constant for the formation of a complex ion from its components in solution.

Formula equation a chemical equation which shows all the ionic compounds and their states during an aqueous reaction, but does not specifically show their ionic forms in solution.

Forward reaction a reversible reaction in which the reactants produce products.

Fourier transform infrared (FTIR) spectroscopy an absorption spectroscopic technique that used an interferometer to create an interference pattern in the IR beam and converting the raw data into an infrared spectrum using a Fourier transform.

Fourier transform ion cyclotron resonance mass spectrometry (FTICR-MS) an advanced mass spectrometry method that uses an ion trap mass analyzer to produce a mass interferogram and processes the data using a Fourier transform to produce a mass spectrum.

Fractional distillation the separation of liquid mixtures by distillation in which the products are collected in a series of separate fractions, each with a higher boiling point than the previous fraction.

Freeze drying the separation of a mixture in water by freezing followed by sublimation of the water.

Freezing the transition from a liquid phase to a solid phase.

Frequency factor the parameter "A" in the Arrhenius equation' which is related to the number of collisions with the correct orientation for reaction.

Fuel cell an electrochemical device that produces a continuous electrical current from the chemical oxidation of a fuel with oxygen or another oxidizing agent.

Functional group a group of atoms or bonds within an organic molecule that is responsible for the characteristic properties and behavior of the class of compounds in which the group occurs.

Fusible able to be fused together at fairly low temperatures.

Galvanic cell a device that derives electrical energy from spontaneous oxidation–reduction reactions.

Gamma rays (γ) high energy light emitted by radioisotopes during radioactive decay.

Gas chromatography a type of chromatography that uses a gas as the mobile phase and a high molecular weight coating on the inside of a column as a stationary phase.

Gay-Lussac's law at constant volume, the pressure of a fixed mass of any gas is directly proportional to the absolute temperature in degrees Kelvin.

Gem-dihalide two halide atoms in an organic molecule that are attached to the same carbon atom.

Gibbs free energy, (G) the maximum work that may be performed by a system at a constant temperature and pressure. It is equal to the sum of the enthalpy minus the temperature in Kelvin times the entropy of the system.

Glass transition a reversible transition in an amorphous solid from a hard and relatively brittle glassy state into a viscous or rubbery state as the temperature is increased.

Gram equivalent weight the mass of one equivalent of an ion in a compound.

Gravimetric analysis an experimental technique that involves the quantitative determination of a substance based on the measurements of mass.

Green engineering the design, development and use of products, processes, and systems that are economically feasible while minimizing the risks to human health and the environment.

Ground state the lowest possible energy state of an atom.

Groups vertical columns in the Periodic Table of the Elements.

Half-cell one half of a galvanic cell consisting of an electrode and an electrolyte.

Half life the amount of time required for the reactant concentration to fall to half of its original value.

Heat (q) the amount of thermal energy transferred from a system to its surroundings or from one system to another due to the fact that they are at different temperatures.

Heat engine an idealized system that converts thermal energy and chemical energy to mechanical energy.

Heat of fusion (ΔH_{fus}) the change in enthalpy due to adding heat to a substance in order to change its state from a solid to a liquid at constant pressure.

Heat of vaporization (ΔH_{vap}) the change in enthalpy due to adding heat to a substance in order to change its state from a liquid to a gas constant pressure.

Henderson-Hasselbalch equation an equation that describes the relationship between the pH of a solution with the pK_a and the ratio of the concentrations of the acid and conjugate base.

Henry's law the amount of gas dissolved in a liquid solvent is directly proportional to the gas pressure above the liquid.

Hess's Law the total enthalpy change during a chemical reaction is the same whether the reaction takes place in one step or several steps.

Heterogeneous mixture one that is not thoroughly mixed and is not uniform in composition or appearance.

Heterogeneous reaction a chemical reaction that involves reactants and/or products that are present in more than one phase.

Homogeneous mixture one in which the components are thoroughly mixed so that the atoms or molecules that make up the mixture are uniformly distributed and the macroscopic properties are the same throughout the mixture.

Homogeneous reaction a chemical reaction that involves reactants and products that are all present in the same phase, usually gas phase or solution phase.

Hund's Rule electrons will occupy orbitals individually before filling them in pairs.

Hybridization a mixing of *s* and *p* atomic orbitals when molecular orbitals are formed.

Hydrocarbons compounds made up of only carbon and hydrogen.

Hydrogen bonding a type of dipole-dipole force that occurs between molecules containing a covalent

bond between a hydrogen atom and a very electronegative atom with at least one lone pair of electrons, usually fluorine, oxygen, or nitrogen.

Hydronium ion the common name for the aqueous cation H_3O^+ produced by protonation of water.

Hydroxyl group a functional group of organic molecules containing an oxygen atom covalently bonded to a hydrogen atom with the structure (—OH).

Hypervalency a molecule that contains one or more main group elements formally bearing more than eight electrons in their valence shells.

Ideal gas a theoretical gas composed of many randomly moving point particles that do not interact except when they collide elastically.

Ideal gas constant (*R*) a universal physical constant used in the equation for the ideal gas law.

Ideal gas law the product of the pressure and the volume of an ideal gas is equal to the product of the absolute temperature of the gas, the amount of the gas, and the universal gas constant.

Immiscible two liquids that do not mix in any proportions, but remain in contact with each other as separate layers.

Indicator a chemical compound that changes color at the end point of a titration.

Infinite dilution a solution that has a large enough excess of solvent that adding more will not cause heat to be released or absorbed.

Infrared (IR) spectroscopy a spectroscopic method used to identify molecules by the absorption of light in the infrared wavelength region.

Initiation reaction the first elementary step in a chain reaction that initially creates the chain propagating species.

Integrated rate law an experimentally derived equation that expresses the reaction rate as a function of the initial reactant concentration $[A]_0$ and the reactant concentration after an amount of time has passed $[A]_t$.

Intensive properties bulk properties that do not depend upon how much matter is present.

Intercalation the reversible insertion of an ion or molecule into a chemical species with a layered structure.

Intermolecular forces the forces of attraction and repulsion between molecules.

Interstitial alloy a metallic alloy where atoms of one or more different metals reside in the voids in the crystal lattice of a host metal.

Ion an atom with an unequal number of protons and electrons.

Ionic bond electrostatic attractions between oppositely charged positive and negative ions which holds the atoms together to form an ionic compound.

Ionic radius the distance from the nucleus to the outermost occupied electron orbital in an ion.

Ionic solids solids composed of positive and negative ions held together by electrostatic attractions.

Ionization the process by which an atom or a molecule acquires a negative or positive charge by gaining or losing electrons to form ions; the formation of a plasma by super heating a gas.

Ionization energy the amount of energy required to remove an electron from an atom in the gas phase.

Ionizing radiation radiation with sufficient energy to cause ionization in the medium through which it passes.

Isentropic a reversible adiabatic process, which takes place with no chance in entropy.

Isolated system a system that cannot exchange energy (heat or work) or mass with its surroundings.

Isotactic an sp^3 hybridized polymer with the substituent groups all on the same side of the polymer chain.

Isothermal a process that takes place with no change in temperature.

Isotopes atoms with the same number of protons but different numbers of neutrons in the nucleus.

Junction potential the charge buildup at a p-n junction caused by the migration of electrons into the p-type material.

Ketone a group of organic molecules containing a carbonyl group with the general formula $R_2C{=}O$ or $RR'C{=}O$.

Kinetic energy energy that a body possesses by virtue of being in motion.

Kinetic isotope effect change in the rate of a chemical reaction when one of the atoms of the reactants is substituted with one of its isotopes.

Kinetic-molecular theory of gases the view of temperature and pressure as related to the motion of the gas molecules.

Lattice energy the energy released when a crystal lattice is formed.

Lattice points the geometric points that define the shape of the unit cell, which are also the positions of the constituent species.

Law of combining volumes at a given temperature and pressure, the volumes of the gaseous species reacting are proportional to the number of moles.

Le Chatelier's principle when a chemical reaction at equilibrium is subjected to change in reaction conditions, the position of the equilibrium will shift to counteract the effect of the change until a new equilibrium is established.

Lewis acid a chemical species that can accept a lone pair of electrons to form a new covalent bond.

Lewis base a chemical species that can donate a lone pair of electrons to form a new covalent bond.

Ligands molecules or anions that bond to a central metal atom by coordinate covalent bonds.

Limiting reactant the reactant whose amount determines, or limits, the amount of the products formed.

Line emission spectrum the pattern of bright lines separated by darkness emitted by a substance in an excited state as the electrons return to the ground state.

Liquid chromatography a type of chromatography that uses a solvent or solvent mixture as the mobile phase and a solid as the stationary phase.

London dispersion force a weak attractive force arising from the formation of an induced instantaneous polarization in molecules that do not have a permanent dipole moment.

Lone pair electrons a pair of electrons surrounding an atom in a molecule that is not shared with another atom.

Madelung's Rule the order of the energy of the electron subshells, which determines the electron filling order, is determined by the sum of the $n+l$ quantum numbers.

Magic angle spinning a technique that places the sample at an angle of 54.74 degrees relative to the magnetic field in order to narrow the lines and improve the resolution of NMR spectra of solid samples.

Magnetic quantum number a number (m) that mathematically defines the shape of an electron orbital in a subshell.

Malleable can be hammered or pressed permanently out of shape without breaking or cracking.

Mass number the sum of the number of protons and neutrons in the nucleus of an atom.

Mass spectrometry an analytical technique that involves the ionization of a chemical species followed by the sorting of the ions based on their mass to charge ratio.

Material anything that is made of matter.

Matter anything that has mass.

Melting the transition from a solid phase to a liquid phase.

Metallic alloys nonstoichiometric homogeneous mixtures of metals.

Metallic solids solids composed of metal atoms that are held together by metallic bonds.

Microcrystalline solid a solid material with the constituent species arranged in an ordered microscopic structure over a limited range.

Miscible liquids that can be mixed together to form a homogeneous mixture in any proportions.

Molar heat capacity the amount of heat needed to increase the temperature of 1 mol of a substance 1 K.

Molar mass the mass of 1 mol of a substance.

molar volume the volume occupied by 1 mol of an ideal gas at standard temperature and pressure. It is equal to 22.41 L.

Molarity the number of moles of solute per liter of solution.

Mole (mol) the mass of any substance which contains the same number of fundamental particles as there are atoms in exactly 12.000 g of ^{12}C.

Mole fraction (X_A) the ratio of the amount of gas A to the total amount of gas in the mixture.

Molecular formula the chemical formula for a covalent compound.

Molecular mass the mass of a molecule calculated as the sum of the atomic masses multiplied by the number of atoms of each element in the molecule.

Molecular orbitals orbitals formed when the atomic orbitals overlap during covalent bonding.

Molecular solids solids composed of atoms or molecules held together by London dispersion forces, dipole-dipole forces, or hydrogen bonds.

Molecularity the number of molecules, ions, or atoms that come together to react in an elementary reaction step.

Molecules an electrically neutral group of two or more atoms held together by chemical bonds.

Monomer the repeating subunit in a polymer molecule.

Monoprotic acid a Brønsted-Lowry acid that can donate only one proton per molecule to an aqueous solution.

n-type semiconductor a semiconductor formed by the addition of an element with one more valence electron than the host element creating an excess of electrons in the crystal lattice.

Natural radioisotopes radioisotopes that are found on the present day Earth under normal conditions.

Nernst equation a mathematical equation that relates the cell potential of a galvanic cell to the standard cell potential and the concentrations of the chemical species in the oxidation-reduction reaction.

Net ionic equation a chemical equation for a reaction in aqueous solution that omits the spectator ions and only shows those chemical species participating in the chemical reaction.

Neutralization is a type of chemical reaction in which an acid and base react completely with each other.

Neutrino (υ_e) a very small particle that is emitted from a radioisotope during a β^+ decay process.

Neutron an uncharged particle present in all atomic nuclei.

Noble gas notation a shorthand method for writing the electron configuration of an atom that uses the symbol for the preceding noble gas in brackets to represent the core electrons.

Nodal plane a region in the shape of a plane where the probability of finding an electron is zero.

Nonpolar covalent bond a covalent bond where electrons are shared equally between two atoms.

Normal alkane a saturated hydrocarbon forming one continuous chain of carbon atoms bonded together in a straight line where each carbon atom is bonded to no more than two other carbon atoms.

Nuclear binding energy the energy that would be required to disassemble the nucleus of an atom into protons and neutrons.

Nuclear chain reaction the process where one nuclear reaction results in an average of one or more subsequent nuclear reactions, resulting in a self-propagating series of reactions.

Nuclear fission a nuclear process in which a heavy unstable nucleus splits into two smaller nuclei either spontaneously or on impact with another particle, with the release of a large amount of energy.

Nuclear fusion a nuclear process in which atomic nuclei of low atomic number fuse to form a heavier nucleus with the release of a large amount of energy.

Nuclear magnetic resonance (NMR) spectroscopy a type of absorption spectroscopy based on the ability of atomic nuclei to absorb electromagnetic radiation when placed in a magnetic field.

Nuclear medicine a branch of medicine that deals with the application of radioactive substances in the diagnosis and treatment of disease.

Nuclear reactor a device used to initiate and control a sustained nuclear chain reaction.

Nuclear spallation the process in which a heavy nucleus emits a large number of protons and neutrons as a result of being hit by a high energy particle resulting in a large reduction in the atomic weight.

Nucleophile a chemical species that donates an electron pair to an electrophile to form a chemical bond.

Neutron moderator materials used to reflect neutrons back into the nuclear fuel rods in nuclear fission reactors.

Octahedral voids spaces in a close-packed ionic crystal structure that are surrounded by six ions of like charge.

Octet rule atoms in the *s*- and *p*-blocks of the periodic table tend to combine in such a way that each atom acquires eight electrons in its valence shell, giving it the same electronic configuration as a noble gas.

Open system a system that can readily exchange matter with its surroundings.

Orbital diagram a method for describing the electronic configuration of an atom that uses boxes to represent the subshells and arrows inside the boxes to represent the electrons. The direction of the arrow represents the electron spin.

Organohalide a class of organic compounds containing one or more halogen atom substituted for a hydrogen atom.

Osmosis the process in which a liquid passes through a membrane with pores small enough to permit the flow of the small solvent molecules, but too small for the larger solute molecules to pass through.

Oxidation the loss of electrons from a reactant in an oxidation-reduction reaction.

Oxidation-reduction (redox) a chemical reaction that involves the loss of electrons by one reactant and the gain of electrons by another reactant.

Oxidation state a number assigned to an atom that represents the number of electrons lost or gained by that atom.

Oxidizing agent the reactant in an oxidation-reduction reaction that accepts electrons from a reactant being oxidized.

p-n junction a boundary between a p-type semiconductor and an n-type semiconductor.

p-type semiconductor a semiconductor formed by the addition of an element with one less valence electron than the host element creating an deficit of electrons and vacant molecular orbitals in the crystal lattice.

Paper chromatography a chromatography method that uses cellulose paper as the stationary phase and a polar solution such as water as the mobile phase.

Paramagnetic having the property of being strongly attracted by a magnetic field.

Parent peak the peak in the mass spectrum arising from the molecular ion.

Partial pressure the pressure the gas would exert if it alone occupied the same volume as the mixture at the same temperature.

Partition coefficient the molar concentration of the component in the stationary phase divided by the molar concentration of the component in the mobile phase.

Pauli Exclusion Principle no two electrons in the same atom can have the same four quantum numbers.

Pauling Scale a dimensionless number on a relative scale used to measure electronegativity.

Percent yield the ratio of the actual yield of a chemical reaction to the theoretical yield multiplied by 100.

Periodic Law the physical and chemical properties of the elements recur periodically in a systematic manner when arranged in the order of increasing atomic number.

Periods horizontal rows in the Periodic Table of the Elements.

pH indicator a chemical substance which changes color at a particular hydronium ion concentration.

pH scale the negative of the base-10 logarithm (log) of the hydronium ion concentration in an aqueous solution.

Phosphorescence the emission of light of one wavelength by an electronically excited molecule occurring a period of time after the absorption of light of a shorter wavelength.

Photolysis the decomposition of molecules after the absorption of light.

Plasma an ionized gas consisting of positive ions and free electrons, occurring typically at low pressures or at very high temperatures.

Polar covalent bond a covalent bond where electrons are shared unequally between two atoms.

Polarizability the ability for a molecule to be polarized.

Polymer a large molecule made up of carbon chains or rings with linked repeating subunits, which are called monomers.

Polyprotic acid a Brønsted-Lowry acid that can donate more than one proton per molecule to an aqueous solution.

Positron (β^+) a positively charged beta particle, with the mass of an electron, that is emitted from a radioisotope during a radioactive decay processes.

Precipitate the insoluble product of a chemical reaction.

Precision the degree to which repeated measurements of a physical quantity made by the same method give the same value.

Primary battery a battery that cannot be returned to its original state by recharging.

Primordial radioisotopes radioisotopes found on Earth that have existed in their current form since before the Earth was formed.

Principal energy level the energy level or electron shell denoted by the principal quantum number.

Principal quantum number the number designation (n) of an electron shell.

Products the species formed from a chemical reaction.

Proton a positively charged particle present in all atomic nuclei.

Pseudo solids amorphous solids that are capable of flowing like a fluid under large stresses.

Quadrupole mass spectrometer a type of electric field mass analyzer that uses four metallic rods placed opposite of each other to produce a direct current voltage coupled to a radio frequency voltage.

Qualitative dealing with the properties of a system without numerical measurements.

Quantitative dealing with numerical measurements of the amount of a material or its properties.

Quantized a quantity that is restricted to certain allowed values.

Radioactive an element with an unstable nucleus that achieves stability by the emission of very high energy ionizing radiation.

Radioactive decay the process by which an unstable atomic nucleus loses energy in the form of ionizing radiation.

Radioisotope an atom that has excess nuclear energy causing it to be unstable.

Random error fluctuations in a measurement method that produces both positive and negative variations from an average value of the measured quantity.

Raoult's law the vapor pressure of the solvent is directly proportional to the mole fraction of solvent in the solution.

Reactants the substances that are present before the chemical reaction takes place.

Reaction quotient (Q) the ratio of the product to reactant concentrations raised to the power of their stoichiometric coefficients for a reversible chemical reaction at any point in the reaction.

Recombination the transition from a plasma to a classical gas phase.

Recrystallization a procedure for purifying an impure compound based on the principle that the solubility of most solids increases with increased temperature.

Reducing agent the reactant in an oxidation-reduction reaction that loses electrons.

Reduction the gain of electrons by a reactant in an oxidation-reduction reaction.

Relative centrifugal force (RCF) the ratio of the force generated by a centrifuge to Earth's gravitational force.

Resolution the ability of a measurement method to detect small changes in the measurement signal.

Resonance structures two or more equivalent chemical structures which differ only in the position of their electrons (not the position of the atoms).

Retention time the time that it takes for a compound to travel the length of the column from the injection point to the detector in gas or liquid chromatography.

Reverse osmosis (RO) the application of a pressure higher than the osmotic pressure to the solution side of a semipermeable membrane to cause the solvent to flow from the solution into the pure solvent.

Reverse reaction a reversible reaction in which the products react to form the original reactants.

Reversible reaction a chemical reaction where the reactants form products, which react together to reform the reactants.

Roentgen a measure ionizing radiation exposure equal to $2.58 \times 10^{-4}\ \mathrm{C\,kg^{-1}}$.

Salt bridge a device used to connect the half-cells of a galvanic cell in order to provide electrical contact between the two cells.

Sample blank a sample containing a zero concentration of the analyte.

Saponification a reaction in which an ester is heated with a strong base to produce a free alcohol and an acid salt such as the alkaline hydrolysis of a fatty acid ester contained in animal fat to make soap.

Saturated hydrocarbon a hydrocarbon containing only sp^3 hybridized σ bonds where each carbon is bonded to the maximum number of four neighboring carbon or hydrogen atoms.

Saturated solution a solution that contains the maximum possible amount of solute under its current conditions.

Scientific notation a method of writing or displaying numbers in terms of a decimal number between 1 and 10 multiplied by a power of 10.

Second law of thermodynamics the entropy of any isolated system always increases.

Secondary battery a battery that can be returned to its original state by the application of an external electric current that reverses the oxidation-reduction reactions.

Sedimentation the tendency for particles in a suspension to settle out of the fluid in which they are mixed, based on the differences in densities between the particles and the fluid phase.

Semiconductor a crystalline solid that possesses electrical conductivities that lie between the metals and other types of solids.

Semipermeable membrane a type of membrane that will allow certain molecules or ions to pass through but not others.

Sensitivity the ratio of the change in the measurement to the change in the concentration or amount of the species being measured.

Significant figures the number of digits in a measured value that are known with some degree of reliability.

Single bond a covalent bond that results from the sharing of one electron pair between two atoms.

Solubility the relative ability of a solute to dissolve in a particular solvent and form a solution measured as the maximum concentration of solute that can be obtained under a particular set of conditions.

Solubility product constant (K_{sp}) an equilibrium constant that describes the equilibrium between an ionic solid and its ions in an aqueous solution.

Solute a substance that is dissolved in a solvent, resulting in a solution.

Solvation the process of attraction and association of the molecules of a solvent with the molecules of a solute.

Solvation shell water molecules surrounding ions in solution.

Solvent a substance that dissolves a solute, resulting in a solution.

Solvent extraction a method of separation of compounds based on their relative solubilities in two different immiscible liquids.

Solution a homogeneous mixture composed of only one phase formed by solvation of the solute by the solvent.

Specific activity (S_A) the activity of a radioisotope per amount of isotope.

Specific heat capacity the amount of heat needed to increase the temperature of 1 g of a substance 1 K.

Spectator ions ions that are present but unchanged during a chemical reaction.

Spin quantum number a value (s) of +½ or –½ that describes the spin of an electron.

Spin-spin coupling the interactions between the spin magnetic moments of adjacent ^1H nuclei that give rise to peak multiplet patterns in NMR spectra.

Spontaneity when a chemical reaction occurs without being driven by some outside force.

Standard cell potential (E^0) a cell potential measured under standard state conditions.

Standard enthalpy of formation (ΔH_f°) the change in enthalpy that occurs during the formation of 1 mol of a compound from its elements, with all substances in their standard states.

Standard free energy of formation (ΔG_f°) change in Gibbs free energy that occurs during the formation of 1 mol of the compound from its elements with all substances in their standard states.

Standard half-cell potential the difference between the potential of the half-cell and the potential of the standard hydrogen electrode.

Standard hydrogen electrode (SHE) the half-cell that is used as a reference, with an assigned potential of 0 V, against which all other half-cell potentials are measured.

Standard molar entropy (S^o) the entropy gained when converting 1 mol of a substance from a perfect crystal at 0 K to 1 atm and a specified temperature.

Standard oxidation potentials the standard half-cell potential for the oxidation half-cell.

Standard reduction potentials the standard half-cell potential for the reduction half-cell.

Standard state an element or compound in the most stable form of the physical state that exists at 1 atm and 298 K.

Standard temperature and pressure (STP) 1 atm of pressure and a temperature of 273 K.

State functions macroscopic properties that define the equilibrium state of a system, which depend only on the initial and final states of a system and not on the way the state changed from the initial to the final state.

Stereochemistry the study of the three-dimensional arrangement of atoms in a molecule and the effect on chemical reactions.

Steric hindrance the interference of a reaction mechanism caused by the interaction of a reactant with other large groups near the functional group taking part in the reaction.

Stock number a system of naming cations that uses the name of the element followed by a Roman numeral in parentheses to indicate the charge of the ion.

Stoichiometric coefficients the coefficients in a balanced chemical equation.

Stoichiometry the relationship between the amounts of reactants and products in a chemical reaction.

Strong acid a Brønsted-Lowry acid with very strong ability to donate its proton to water converting entirely to the conjugate acid and the conjugate base.

Strong base a Brønsted-Lowry base that will completely ionize in aqueous solution.

Structural isomers molecules that have the same molecular formula, but have different bonding patterns and atomic arrangement.

Sublimation the transition from a solid phase directly to a gas phase without passing through the liquid state.

Subshell notation a method for writing the electron configuration of an atom which lists the principal quantum number of the electron shell, the subshell type, and the number of electrons in each subshell.

Substitution reaction an organic chemical reaction involving the displacement of one functional group by another functional group in a molecule.

Substitutional alloy a metallic alloy where some of the host metal atoms in the crystal lattice are replaced by other atoms of the same size.

Supercritical fluid a substance at a temperature and pressure above its critical point where distinct liquid and gas phases do not exist.

Superfluid a state of matter which behaves like a fluid with zero viscosity.

Supernate the liquid phase above a precipitate in a chemical reaction.

Supersaturated solution a solution that is more concentrated than a saturated solution.

Surfactants compounds that lower the surface tension between two liquids or the interfacial tension between a liquid and a solid.

Surroundings everything outside of the system, essentially the universe.

Suspension the heterogeneous mixture of solid particles in a liquid that are sufficiently large for sedimentation.

Syndiotactic an sp^3 hybridized polymer with the substituent group on alternate sides of the polymer chain.

System the part of the universe being studied.

Systematic error a bias in a measurement method that leads to the situation where the average of many separate measurements differs significantly from the actual value of the measured quantity.

Tacticity the order of the branched alkyl groups on the backbone of sp^3 hybridized polymer molecule.

Tautomers two or more isomers of a compound that exist together in equilibrium and are readily interchanged by migration of an atom or group within the molecule, usually a hydrogen atom.

Terpolymer a polymer forms from three different monomers bonding together.

Tetrahedral voids spaces in a close-packed ionic crystal structure that are surrounded by four ions of like charge.

Theoretical yield the maximum mass of products that can be produced from a chemical reaction.

Thermal conductivity detector (TCD) gas chromatography detector that uses the thermal conductivity differences of the gas relative to the carrier gas for detection of the compound.

Thermal equilibrium the condition between two systems where no heat flows between them when they are connected by a path which can transfer heat.

Thermal mass the ability of a material to absorb and store heat.

Thermoplastic materials that become pliable or moldable above a specific temperature and solidify upon cooling.

Thermosetting polymers or plastics that set permanently when heated.

Thin layer chromatography (TLC) a chromatography method that uses a stationary phase of a thin layer of silica gel or alumina placed onto a flat inert substrate such as a glass slide.

Time of flight (TOF) mass spectrometer a mass spectrometer that separates ions based on the time that it takes them to travel a known distance without the influence of an external field.

Titrant a solution of known concentration used in a titration.

Titration a common laboratory method used to determine the unknown concentration of an analyte by measuring the volume of a solution of known concentration required to completely react with the analyte.

Titration curve a graphical plot of pH of solution versus volume of titrant added.

Triene a hydrocarbon that has three double bonds in the molecular structure.

Triple bond a covalent bond that results from the sharing of three electron pairs between two atoms.

Triple point (tp) the temperature and pressure where all three classical phases, solid, liquid, and gas, can coexist simultaneously.

Triprotic acid a Brønsted-Lowry acid that can donate three protons per molecule to an aqueous solution.

ultraviolet (UV)-visible absorption spectroscopy a spectroscopic method for the determination of the concentration of a molecular species in a solution by the absorption of light in the ultraviolet to visible wavelength range.

Unit cell the symmetrical three-dimensional arrangement of the constituent species inside a crystalline solid.

Unsaturated hydrocarbon a hydrocarbon that has at least two less hydrogens than a saturated hydrocarbon including compounds with double and triple bonds, as well as cyclic structures.

Unsaturated solution a solution that contains less than the maximum amount of solute under its current conditions.

Vacuum distillation separation of a liquid mixture by distillation under reduced pressure.

Valence band a region of molecular orbitals in a crystalline solid where the electrons reside in traditional covalent bonds between two atoms.

Valence bond theory the description of covalent bonds as involving shared pairs of electrons which are localized in a bond between two atoms.

Valence electrons the electrons in the outermost occupied electron shell of an atom.

Valence shell the outermost occupied electron shell of an atom.

Van der Waals constants experimentally derived constants characteristic of each individual gas, which correct the pressure and volume of a gas for nonideal behavior.

Van der Waals equation an equation that corrects for the deviations of a gas from ideal behavior at low temperatures and high pressures.

Van der Waals forces the forces of attraction between molecules.

Vapor pressure the partial pressure of a gas in contact with its liquid form.

Vaporization the transition from a liquid phase to a gas phase.

Viscosity the extent to which a fluid resists a tendency to flow.

Volumetric analysis an experimental technique that involves the quantitative determination of a substance based on the measurements of volumes.

Vulcanization a chemical process that improves the durability of polymers, such as natural rubber, by adding sulfur which forms crosslinks between the individual polymer chains.

Wet cell a battery that uses a liquid electrolyte, usually an aqueous salt.

X-ray crystallography a technique used to determine the structure of a crystalline solid, by diffraction of X-rays.