МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ТЕРНОПІЛЬСЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ ІМЕНІ ІВАНА ПУЛЮЯ

ENGLISH FOR SCIENCE

Тлумачний словник сучасних природознавчих, психологічних та медичних термінів

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Тлумачний словник містить ключові терміни та поняття природознавчої, психологічної та медичної галузей, які тематично класифіковані і представлені у чотирьох розділах. Окремо винесено список тематичної літератури та Інтернет-ресурсів. Словник призначений для аудиторної, індивідуальної та самостійної роботи студентів хіміко-біологічного факультету, факультету іноземних мов освітньої програми "Англійсько-український переклад", а також для студентів стоматологічних спеціальностей, медичних працівників та психологів.

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ТНТУ ім. Івана Пулюя, протокол № 1
від 1 вересня 2025 р.

ЗМІСТ

ПЕРЕДМОВА

Тлумачний словник містить ключові терміни та поняття природознавчої, психологічної та медичної галузей, які тематично класифіковані і представлені у чотирьох розділах. Окремо винесено список тематичної літератури та Інтернет-ресурсів. Словник призначений для аудиторної, індивідуальної та самостійної роботи студентів хіміко-біологічного факультету, факультету іноземних мов освітньої програми "Англійсько-український переклад", а також для студентів стоматологічних спеціальностей, медичних працівників та психологів.

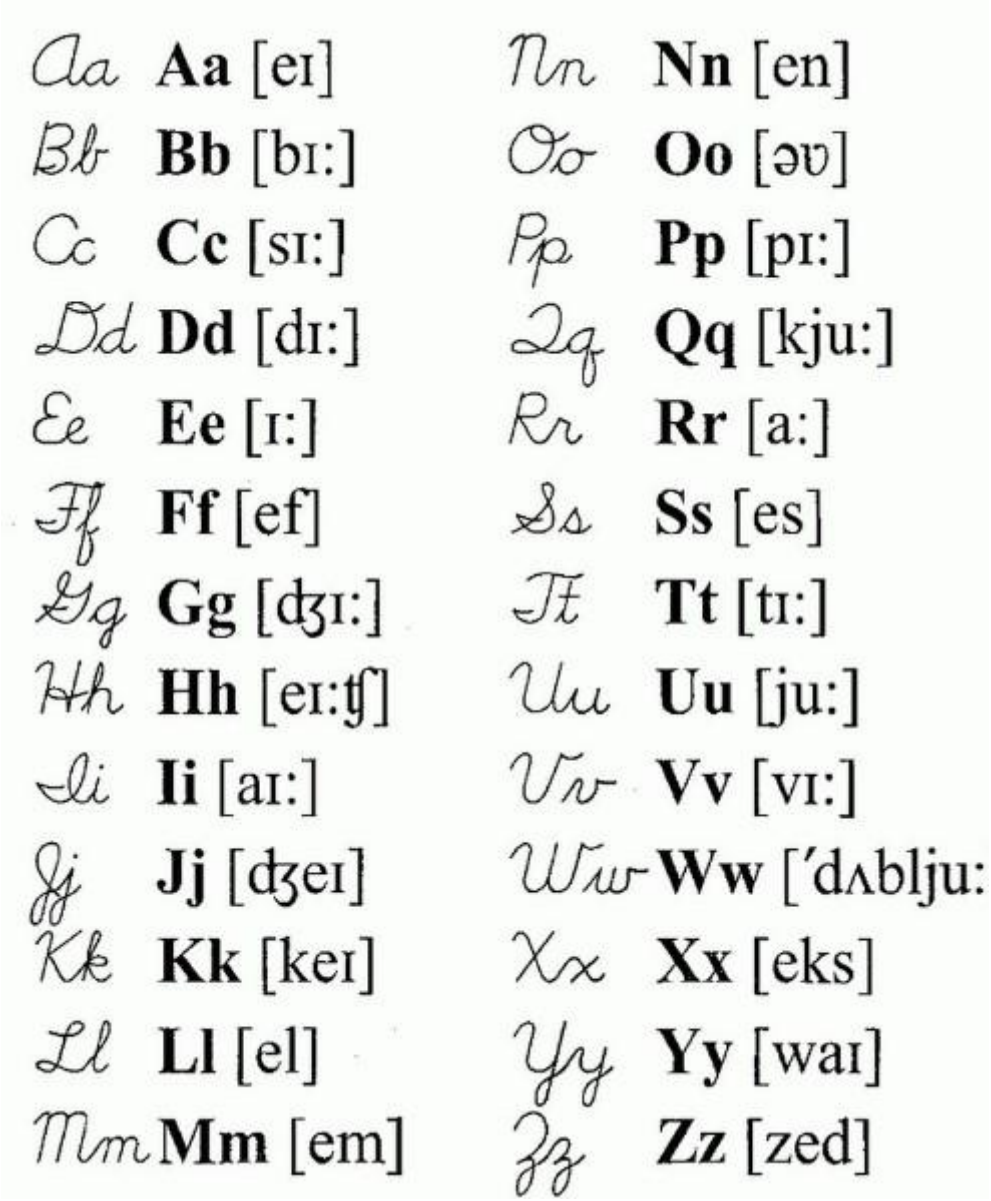
Головна мета тлумачного словника – поглиблене оволодіння фаховою англійською мовою у галузі природознавчих, психологічних та медичних дисциплін та освоєння термінологічної лексики.

Тематичний словник складається з чотирьох тематичних розділів (English for Biotechnology, English for Bioengineering, English for Ortodontic Technologies).

При роботі над словником було використано матеріали енциклопедичних словників, тлумачних словників, Інтернет- та web-ресурсів. Терміни та поняття розміщені у словнику за алфавітним порядком, що дозволяє користувачам легко орієнтуватись у виборі потрібного матеріалу.

Тлумачний словник розрахований на викладачів, аспірантів, магістрів, студентів, програмістів, а також для всіх інших, хто має стосунок до природознавчої та медичної галузей.

АНГЛІЙСЬКИЙ АЛФАВІТ



ENGLISH FOR BIOTECHNOLOGY

Bb

- **Biotechnology (or Biotech)**

Biotechnology (or Biotech) has evolved to include an array of complicated processes that utilize the natural systems found in living things. The resulting technologies are then applied to a wide range of purposes, including for the environment and health care as well as food production and food safety. For example, biotech tools called Marker Assisted Selection can provide the DNA sequence of specific traits in animals or crops without changing their DNA. Biotechnology has supported the creation of non-soil (hydroponic) methods to grow vegetables. However some have used the word "Biotech" interchangeably with "GMO", "Genetically Engineered" and "Bioengineered" to mean seeds or animals that have been changed to include DNA from another species.

To further confuse things, various organizations have created their own standards for what qualifies as GMO or for non-GMO. The criteria are varied and sometimes self-serving for the locality or industry involved. That's why, in 2016, Congress passed a law requiring a uniform nation-wide standard for disclosure (labeling) of "Bioengineered" foods. We've created the following guidance to help food retailers better respond as customers ask questions about product labels or see news reports on the topic.

- **Bioengineering/Bioengineered Food**

A mandatory labeling claim to be used on many foods and dietary supplements with at least one ingredient that has measurable DNA from another species. The law, to be implemented by 2022, does not include food made from animals that have either been fed or treated with bioengineered products. Nor does it require labeling of foods that are so highly refined that no measurable DNA is present. See also "Derived from Bioengineering."

Cc

- **Chromosome**

A strand of DNA stored in cells that can replicate itself and divide when each cell divides for growth or repair. Humans have 23 chromosomes in our genome which contains the genetic blueprint for every cell in our bodies.

- **CRISPR**

A gene editing tool that mirrors the way that cells repair damaged DNA. Was first demonstrated in 2013. CRISPR allows scientists to make edits in precise places along a DNA strand. Also known as Clustered Regularly Interspaced Short Palindromic Repeats.

- **Cross-Breeding**

Deliberately inter-breeding (crossing) related individuals to produce new varieties. For example, Pluots are the result of cross-breeding apricots with plums. Multiple generations of back-crossing are needed to obtain the desired traits with any unintended traits removed. Also called conventional, traditional or selective breeding.

Dd

- **Deoxyribonucleic Acid (DNA)**

Is a double stranded molecule that holds genetic codes and is found in all living things. DNA forms the genes that provide inherited traits. It tells cells what proteins to make for growth and metabolism.

- **Derived from Bioengineering**

A food labeling claim used voluntarily on any food or dietary supplement that does not contain DNA from another species. However, at least one ingredient in the product was made through bioengineering. Examples include dairy products from cattle treated with a bioengineered hormone (rBST) to enhance milk production or meats from animals that were fed bioengineered crops like corn, soybeans or alfalfa. This claim could also be used on products that are so highly refined that no DNA is present. Examples could include refined corn, soybean and canola oils.

Ee

- **Enzyme**

Are vital proteins that speed up the chemical reactions taking place within cells. For example, they aid in digestion, metabolism and immune function.

Gg

- **Gene**

The most basic unit of heredity. Includes a segment of a DNA strand that is able to direct a specific function in the body.

- **Gene Editing**

Involved in food production as a breeding method to improve both plants and animals. Also promising as a bio-medical tool to address inherited diseases. It starts with a clear understanding of the genetic sequence and DNA location of selected traits. Uses an enzyme system to precisely edit (turn on, turn off or add to) the DNA. Gene Editing typically does not add DNA from another species but rather works with traits that are already found in a given species, therefore labeling is not usually required.

- **Genetic Engineering**

Involves direct manipulation of the genetic material of a living thing, for example, creating a bacteria to produce human insulin and other medications. Includes a number of different technologies including Recombinant DNA (GMO) and Gene Editing. Can be used to insert genes or knock them out, either randomly or to a specific part of the genome. This term had previously been used interchangeably with Biotech or GMO. However, it is not currently a regulated food labeling term, like "Bioengineered".

- **Genetic Trait**

Characteristics of a plant or animal that are encoded within their genome and thereby inherited from generation to generation.

- **Genome**

The complete genetic blueprint of a living thing, containing all of its genes and DNA. Genome Editing

- **GMO (Genetically Modified Organism)**

A plant, animal or microorganism with new or enhanced genetic traits. A DNA sequence from another living thing, often from a different species, is introduced into the genome. Also referred to as Recombinant DNA technology, Gene Spliced, Genetic Engineered or Transgenic. See “Bioengineered” for mandatory labeling info.

Mm

- **Mutagen**

Substances such as radiation or chemicals that can create random changes in the genetic material of living things.

- **Mutagenesis**

A biotech tool used by plant breeders for over 75 years. NOT considered genetic engineering or bioengineering. Seeds are treated with mutagens such as ionizing radiation or strong chemicals to induce random mutations to their genetic material, aiming for a desired trait. Examples include seedless watermelon and ruby red grapefruit. Currently allowed in both conventional and organic agriculture.

Nn

- **Non-GMO**

A voluntary labeling claim promoted by a group of food companies in 2009 when they formed the Non-GMO Project Verified. Requires a paper trail of affidavits to determine that ingredients in food products have not in any way been bioengineered or fed/treated with bioengineered substances. The absence of bioengineered disclosure does not mean that a product can be labeled as non-GMO. That's because bioengineered disclosure is only required when DNA from another species is present. Many non-GMO ingredients contain no measurable DNA even though they were made from or fed bioengineered crops.

Pp

- **Polyploidy**

Both wild and cultivated plants can have entire extra sets of chromosomes. Polyploidy (such as triploid and diploid) has been a major tool for plant breeders using traditional breeding techniques over the past century. NOT considered bioengineering. Plants with polyploidy can outperform relatives in several aspects. Hybrid corn can be an example.

- **Protoplast Fusion (Somatic Fusion)**

A type of genetic engineering where cells or cellular components from two different living things are combined. Able to transfer traits between species and potentially create an entirely different variety of plant. Currently allowed in both conventional and organic agriculture. One example: Triticale, a grain first made from fusing wheat with rye in the 1950s.

Rr

- **RNA**

Ribonucleic acid (RNA) is present in all living cells and acts as a messenger to translate instructions from DNA in order to make various proteins.

Ss

- **Species**

A group of living organisms that are capable of sharing genetic information through breeding (ie, they are sexually compatible)

- **Sustainability**

The ability to maintain conditions most often referring to the environment but also to economic, social or public health systems.

Tt

- **Transgenesis**

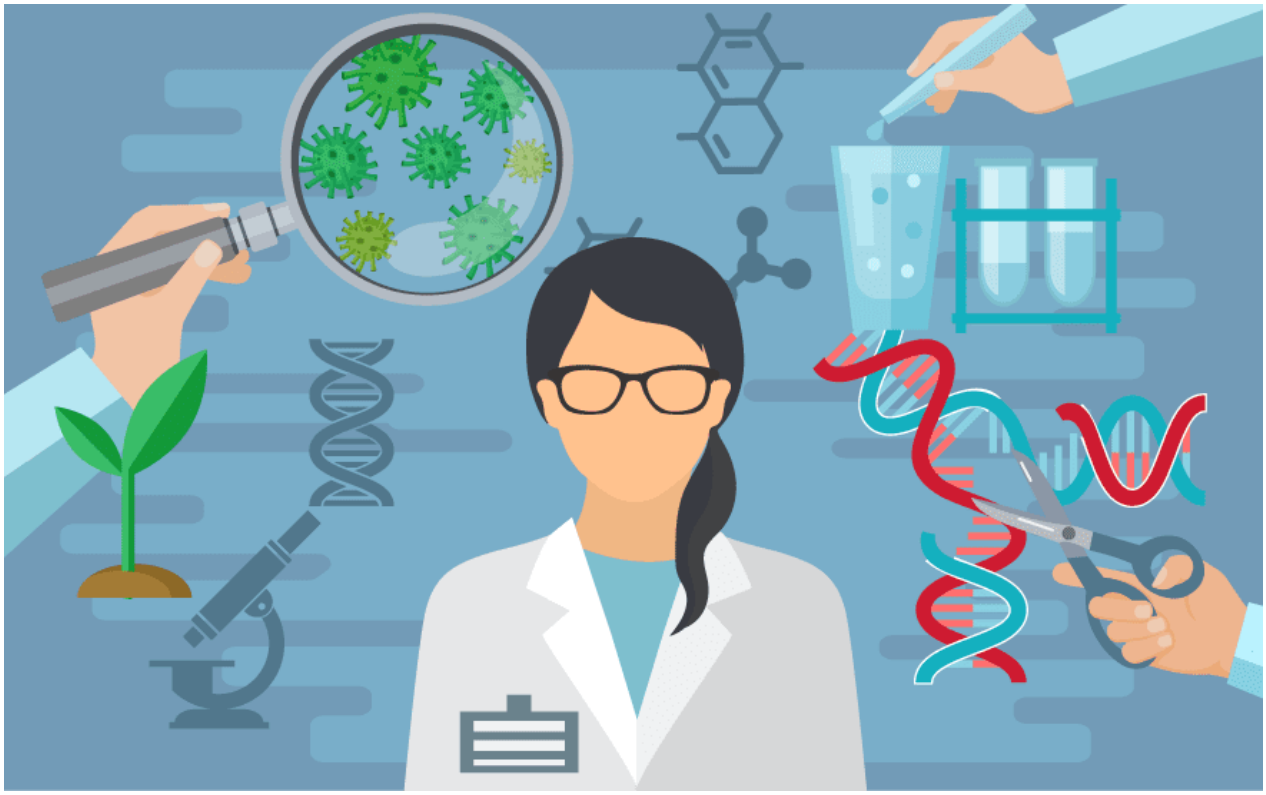
Involves addition of genetic material (DNA) from another species to create a new variety of plant or animal with desired traits. Also known as a GMO. Bioengineered labeling will be required in most food products that contain transgenic DNA.

Uu

- **USDA Certified Organic**

Does not allow several production methods common to modern agriculture. Organic products cannot be bioengineered, irradiated or be produced with antibiotics or certain pesticides. Nor can animals be fed bioengineered crops or be treated with medications produced through bioengineering. Other biotech methods, such as Mutagenesis, Marker Assisted Selection, Gene Editing, Hydroponics, Polyploidy and Protoplast Fusion have not yet been excluded from Certified Organic, however they are current topics of debate among organic stakeholders.

ENGLISH FOR BIOENGINEERING



Aa

- **Ablation**

A therapeutic procedure used to remove or destroy the function of tissue that is the source of the medical problem. It may be performed with laser energy, radiofrequency energy, or freezing.

Acoustic Radiation Force Impulse Imaging

An imaging technique that shoots short pulses of ultrasound at targeted tissues and then monitors the tissue response in the form of shear waves that can be measured, and displayed as elastography images. These measurements and images can be used to diagnose or monitor the possible presence of diseased or cancerous tissue, based on the measured stiffness properties of tissues such as breast or liver where areas of increased stiffness may indicate the presence of tumors, fibrosis, scar tissue, and other types of disease or damage.

- **Angiography**

A diagnostic X-ray imaging procedure used to see how blood flows through the blood vessels and organs of the body. This is done by injecting special dyes, known as contrast agents, into the blood vessel and using x-ray techniques such as fluoroscopy to monitor blood flow. Examples include coronary angiography (heart), cerebral angiography (brain), and peripheral angiography (hands, arms, feet and legs).

- **Artificial Intelligence (AI)**

A feature where machines learn to perform tasks, rather than simply carrying out computations that are input by human users. Early applications of AI included machines that could play games such as checkers and chess, and programs that could reproduce language.

Bb

- **Biocompatibility**

A measure of how a biomaterial interacts in the body with the surrounding cells, tissues and other factors. A biomaterial is considered to have good biocompatibility if it does not generate a vigorous immune response, resists build-up of proteins and other substances on its surface that would hinder its function, and is resistant to infection.

- **Bioengineering**

The application of concepts and methods of engineering, biology, medicine, physiology, physics, materials science, chemistry, mathematics and computer sciences to develop methods and technologies to solve health problems in humans.

- **Bioinformatics**

The branch of biology that is concerned with the acquisition, storage, display and analysis of biological information. Analysis of biological information includes statistical and computational methods to model biological processes.

- **Biomaterials**

Any matter, surface, or construct that interacts with biological systems. Biomaterials can be derived from nature or synthesized in the laboratory using metallic components, polymers , ceramics, or composite materials. Medical devices made of biomaterials are often used to replace or augment a natural function. Examples include heart valves, hip replacements, and materials used regularly in dentistry and surgery.

- **Biomedical Imaging**

The science and the branch of medicine concerned with the development and use of imaging devices and techniques to obtain internal anatomic images and to provide biochemical and physiological analysis of tissues and organs.

- **Biomimetics**

Using biological form and function seen in nature to inspire the design of solutions to engineering problems.

- **Bioreactor**

A manufactured or engineered device that provides an environment that supports biological processes. Many bioreactors are used to grow cells or tissues for use in tissue engineering..

- **Biosensors**

A device that uses biological material, such as DNA, enzymes and antibodies, to detect specific biological, chemical, or physical processes and then transmits or reports this data.

- **Blood-brain barrier**

A highly selective, semi-impermeable boundary that divides the brain from the rest of the body. It allows the passage of vital molecules through specialized transport proteins and diffusion mechanisms.

- **Brachytherapy**

A form of radiation therapy in which one or more small radioactive sources is placed in or adjacent to an area requiring treatment. The dose rate and longevity of the radiation source is chosen to reflect the treatment plan and whether the radioactive material is left in place temporarily or permanently. A key feature of brachytherapy is that the radiation affects only a very localized area around the

radiation source. Brachytherapy is commonly used to treat prostate, cervical and breast cancers.

- **Brain-Computer Interface**

A system that uses the brain's electrical signals to allow individuals with limited mobility to learn to use their thoughts to move a computer cursor or other devices like a robotic arm or a wheelchair.

Cc

- **Cell Reprogramming**

Changing the function of a cell using chemical, protein or even mechanical force. Most commonly, a cell, like a skin cell, may be treated with protein factors that reprogram it to become a stem cell that can then be reprogrammed, with various protein or chemical factors, to function as a different type of cell such as a liver, heart or nerve cell.

- **Chemical gradient**

The amount of a chemical changes over a specified distance, generally increasing from a lower to higher amount. The gradual increase in the amount of a chemical drives many processes in our body that allow cell growth.

- **chorioamnionitis**

inflammation in the placenta, usually in response to bacterial infection in the uterus

- **Clinical Decision Support System**

An interactive software-based system designed to assist physicians and other health professionals as well as patients with diagnostic and treatment decisions and reminders. The system compiles and analyzes medical information from raw data, health observations, and other medical information sources.

- **Computational Modeling**

The use of mathematics, statistics, physics and computer science to study the mechanism and behavior of complex systems by computer simulation. A computational model contains numerous variables that characterize the system being studied. Simulation is done by adjusting these variables and observing how the changes affect the outcomes predicted by the model.

- **Computed Tomography**

A computerized X-ray imaging procedure in which a narrow beam of X-rays is aimed at a patient and quickly rotated around the body, producing signals that are processed by the machine's computer to generate cross-sectional images—or "slices"—of the body. These slices are called tomographic images and contain more detailed information about the internal organs than conventional X-rays.

- **Contrast agent**

A substance used to enhance the imaged appearance of structures, processes or fluids within the body in biomedical imaging.

- **COVID-19 RT-PCR Test**

The COVID-19 RT-PCR test is a real-time reverse transcription polymerase chain reaction test for the qualitative detection of nucleic acid from SARS-CoV-2.

Dd

- **Debriding**

Debridement is a process by which necrotic tissue and foreign bodies are removed from a wound to accelerate healing.

- **Deep Brain Stimulation**

A neurosurgical treatment utilizing a neurostimulator placed in the brain to deliver electrical signals to specific parts of the brain to help control unwanted movements such as in Parkinson's disease or regulate the firing of neurons in the brain to help control the symptoms of disorders such as epilepsy or depression.

- **Deep Learning (DL)**

A form of machine learning that uses many layers of computation to form what is described as a deep neural network, capable of learning from large amounts of complex, unstructured data. Deep neural networks are responsible for voice-controlled virtual assistants as well as self-driving vehicles, which learn to recognize traffic signs.

- **Digital twin**

Digital twin is a concept in the domains of science, engineering, and medicine. A digital twin couples computational models with a physical counterpart to create a system that is dynamically updated through bidirectional data flows as conditions change.

- **Drug Delivery Systems**

Engineered technologies for the targeted delivery and/or controlled release of therapeutic agents.

Ee

- **Elastography**

A medical imaging technique that measures the elasticity or stiffness of a tissue. The technique captures snapshots of shear waves, a special type of sound wave, as they move through the tissue. The stiffness of the tissue gives information about the possible presence of disease. For example tumors are harder than the surrounding normal tissue and disease livers are stiffer than healthy ones.

- **Electroencephalography (EEG)**

The recording of electrical activity along the scalp resulting from current flowing within the neurons of the brain. EEG can be used to diagnose epilepsy and other disorders associated with altered brain electrical activity.

- **Electromagnetic Radiation**

A kind of radiation including visible light, radio waves, gamma rays, and x-rays, in which electric and magnetic fields vary simultaneously. The different forms are differentiated by their wavelength and energy. For instance, visible light has relatively long wavelengths and less energy compared to x-rays or gamma rays with short wavelengths and high energy.

- **Electroporation**

Application of an external electrical field to increase the permeability of the cell membrane. It is usually used in molecular biology as a way of introducing some substance into a cell such as a drug, protein, or piece of DNA that can change the cell’s function.

- **Endoscope**

A thin illuminated flexible or rigid tube-like optical system used to examine the interior of a hollow organ or body cavity by direct insertion. Instruments can be attached for biopsy and surgery. Similar technology is used in a laparoscope.

- **Ex vivo**

A Latin phrase translating to "out of the living" that, in the medical sciences, refers to experiments conducted on tissues or organs that have been removed from a living organism.

- **Exoskeleton**

The external skeleton that supports and protects an animal’s body in contrast to the bones of an internal skeleton. Rehabilitation engineers have used this design in nature to develop exoskeletons that attach to the outside of the body and assist individuals with functions like arm and leg movement.

- **Extracellular Matrix (ECM)**

The ECM is a collection of extracellular molecules secreted by support cells that provides structural and biochemical support to the surrounding cells.

- **Extracellular Vesicles**

Extracellular vesicles (EVs) are nanosized, membrane-bound vesicles released from cells that can transport cargo--including DNA, RNA, and proteins--between cells as a form of intercellular communication. For example, EVs released from healthy cells can carry DNA, RNA or proteins that help to direct repair of damaged tissues. EVs released from tumor cells can carry DNA, RNA, and proteins that act to help the tumor to metastasize to other tissues.

Ff

- **fetal and maternal inflammatory responses**

placental inflammation by fetal or maternal white blood cells, respectively, usually in response to bacterial infection of the uterus.

- **Fluorescence**

The emission of light by a substance that has absorbed light or other electromagnetic radiation. The absorbed and emitted light are usually different wavelengths and therefore produce different colors.

- **Fluorophore**

A fluorescent chemical compound that can re-emit light upon light excitation. Fluorophores are usually bonded to a molecule serving as a marker to stain tissues, cells, or materials in methods including fluorescent imaging and spectroscopy.

- **Focused Ultrasound**

A non-invasive therapeutic technique that directs ultrasonic waves to a specific location.

- **Focused Ultrasound Blood-Brain Barrier Disruption**

A non-invasive technology that uses high-frequency sound waves and microbubbles to reversibly open the blood-brain barrier. The ultrasound waves are emitted from a device called a transducer.

- **Functional Magnetic Resonance Imaging (fMRI)**

An MRI-based technique for measuring brain activity. It works by detecting the changes in blood oxygenation and flow that occur in response to neural activity – when a brain area is more active it consumes more oxygen and to meet this increased

demand blood flow increases to the active area. fMRI can be used to produce activation maps showing which parts of the brain are involved in a particular mental process.

Gg

- **Gamma Ray**

Electromagnetic radiation of the shortest wavelength and the highest energy.

- **Gene Expression**

Gene expression is the process by which the information encoded in a gene is turned into a function. This mostly occurs via the transcription of RNA molecules that code for proteins or non-coding RNA molecules that serve other functions. Gene expression can be thought of as an “on/off switch” to control when and where RNA molecules and proteins are made and as a “volume control” to determine how much of those products are made. The process of gene expression is carefully regulated, changing substantially under different conditions and cell types. The RNA and protein products of many genes serve to regulate the expression of other genes. Where, when, and how much a gene is expressed can also be assessed by measuring the functional activity of a gene product or observing a phenotype associated with a gene. Source: National Human Genome Research Institute

- **glycosaminoglycans (GAGs)**

GAGs are a main component of the ECM and are linked to the fibrous proteins in the ECM which include collagen, elastin, fibronectin, and laminin.

Hh

- **half-life**

The time it takes for a substance to decrease to half of its original value.

- **Haptic Technology**

A technology that provides the sense of touch to the user through forces, vibrations or motions. For medical procedures, haptic interfaces can improve minimally-invasive surgery by relaying the sense of pressure and touch through the instruments used by the surgeon. Haptic technology has been introduced into the design of prosthetics to provide sensory feedback to the user.

- **harmonize**

the process of unifying data that is collected from multiple sources into a single format.

- **Human Microbiome**

The microbiome is the community of microorganisms (such as fungi, bacteria and viruses) that exists in a particular environment. In humans, the term is often used to describe the microorganisms that live in or on a particular part of the body, such as the skin or gastrointestinal tract.

- **Hydrogel**

A biomaterial made up of a network of polymer chains that are highly absorbent and as flexible as natural tissue. Hydrogels have a number of uses including as scaffolds for tissue engineering, as sustained release drug delivery systems, and as biosensors that are sensitive to specific molecules such as glucose.

- **hydrophobicity**

physical property of a substance that describes its propensity to repel water

Ii

- **Image-Guided Robotic Interventions**

Medical procedures, primarily minimally invasive surgery, performed through a small incision or natural orifice using robotic tools operated remotely by a surgeon with visualization by devices such as cameras small enough to fit into a minimal incision.

- **imaging probe**

an agent used to help visualize features or processes inside the body, used in some types of medical imaging

- **Immunofluorescence**

A biological staining technique in which the fluorescent signaling molecule is bound to an antibody to a protein of interest. When the “fluorescently tagged” antibody binds to its target protein the site or distribution of that protein can be visualized with the appropriate imaging devices.

- **Implantable Devices**

Man-made medical devices implanted in the body to replace or augment biological functions. Such devices range from those that provide structural support, such as a hip replacement to those that contain electronics, such as pacemakers. Some implants are bioactive such as a drug-eluting stent used to open a blocked artery.

- **In vitro**

A laboratory experiment or process performed in a test tube, culture dish, or elsewhere outside a living animal.

- **Induced Pluripotent Stem Cell (iPSC)**

A stem cell that is formed by the introduction of stem-cell inducing factors into a differentiated cell of the body, typically a skin cell.

- **Ionizing Radiation**

A type of electromagnetic radiation that can strip electrons from an atom or molecule – a process called ionization. Ionizing radiation has a relatively short wavelength on the electromagnetic spectrum. Examples of ionizing radiation include gamma rays, and X-rays. Lower energy ultraviolet, visible light, infrared, microwaves, and radio waves are considered non-ionizing radiation.

Ll

- **Laparoscope**

A thin, lighted telescope-like viewing instrument that is inserted through a small incision or natural orifice to examine and operate on abdominal and pelvic structures. Similar technology is used in an endoscope. “Laparo” is derived from the Greek root for abdomen and pelvis; however devices similar to laparoscopes are used for other parts of the body such as thoroscopes for chest surgery.

- **Laser Doppler Imaging**

A technique used to measure the total local microcirculatory blood perfusion including the perfusion in capillaries, arterioles, venules and shunting vessels. The technique is based on the emission of a scanning beam of laser light and the Doppler shift that occurs when light particles hit moving blood cells.

- **lipid nanoparticles**

Nanoparticles composed of lipids (fats) that can be used as a drug delivery vehicle

Mm

- **Mechanical phenomenology**

the phenomenology generated by relations between processes realized through the properties of components.

- **Machine Learning (ML)**

An approach to AI in which a computer algorithm (a set of rules and procedures) is developed to analyze and make predictions from data that is fed into the system. Machine learning-based technologies are routinely used every day, such as personalized news feeds and traffic prediction maps.

- **Magnetic Resonance Elastography (MRE)**

A special MRI technique to capture snapshots of shear waves that move through the tissue and create “elastograms” or images that show tissue stiffness. MRE is used to non-invasively detect hardening of the liver caused by chronic liver disease. MRE also has the potential to diagnose diseases in other parts of the body.

- **Magnetic Resonance Imaging (MRI)**

A non-invasive imaging technology used to investigate anatomy and function of the body in both health and disease without the use of damaging ionizing radiation. It is often used for disease detection, diagnosis, and treatment monitoring. It is based on sophisticated technology that excites and detects changes in protons found in the water that makes up living tissues.

- **Magnetic Resonance Spectroscopy (MRS)**

A non-invasive analytic imaging technique used to study metabolic changes in diseases affecting the brain, including tumors, strokes, and seizures. The technique is also used to study the metabolism of other organs. MRS complements MRI as a non-

invasive means for the characterization of tissue, by providing measure of the concentration of different chemical components within the tissue.

- **Mammography**

An X-ray imaging method used to image the breast for the early detection of cancer and other breast diseases. It is used as both a diagnostic and screening tool.

- **meconium**

the first bowel movement of a newborn; passage of meconium during pregnancy and uptake into the placenta may be a sign of fetal distress.

- **Mesenchymal Stem Cells**

A term used to define non-blood adult stem cells from a variety of tissues. However, it is not clear whether mesenchymal stem cells from different tissues are the same.

- **mHealth**

An abbreviation for mobile health, which is the practice of medicine and public health supported with mobile devices such as mobile phones for health services and information.

- **Microbubbles**

Microscopic, preformed bubbles composed of varying materials that enable widespread applications. One application of microbubbles in medicine is as a contrast agent to help obtain clearer ultrasound images.

- **Microfluidics**

A multidisciplinary field including engineering, physics, chemistry and biotechnology involving the design of systems for the precise control and

manipulation of fluids on a small, sub-millimeter scale. Typically fluids are moved, mixed, separated or processed in various ways.

- **Microparticle**

Particles between 0.1 and 100 □m in size. A □m is a micrometer, which is one-millionth of a meter. Man-made microparticles include ceramics, glass, polymers and metals. In biological systems, microparticles are small membrane- bound vesicles derived from cells circulating in the bloodstream. Microparticles are generally 1000 times larger than nanoparticles.

- **Microscopy**

Using microscopes to view samples and objects that cannot be seen with the unaided eye.

- **Microvasculature**

The microvasculature is composed of networks of small blood vessels within tissues, downstream from arteries and upstream from veins, wherein blood and tissues exchange important gases, such as oxygen, and nutrients.

- **Minimally Invasive Surgery**

A surgical procedure typically utilizing one or more small incisions through which laparoscopic surgical tools are inserted and manipulated by a surgeon. Minimally invasive surgery can reduce damage to surrounding healthy tissue, decrease the need for pain medication, and reduce patient recovery time.

- **Molecular Imaging**

A discipline that involves the visualization of molecular processes and cellular functions in living organisms. With the inclusion of a biomarker, which interacts chemically with tissues and structures of interest, many imaging techniques can be used for molecular imaging including ultrasound, x-rays, magnetic resonance

imaging, optical imaging, positron emission tomography, and single photon emission computed tomography.

- **Morphometry**

The measurement of the form of living systems or their parts. In medicine, morphometry is often used to study changes in brain structure during development, aging and in response to disease. Researchers can measure anatomical features of the brain in terms of shape, mass and volume and derive various measures such as grey matter density and white matter connectivity using neuroimaging techniques and neuroinformatics.

- **Multiphoton Microscopy**

An imaging technique that uses two or three-photon excitation of a fluorophore in a specimen. Fluorescence occurs when two or more photons of excitation light are absorbed by the specimen at the same time. Because excitation occurs only where photons coincide, there is reduced phototoxicity and photobleaching and greater depth penetration. Because of the reduced toxicity, the method is ideal for imaging living specimens especially when deep imaging is required.

- **Multiscale Modeling**

Multiscale modeling uses mathematics and computation to quantitatively represent and simulate a system at more than one scale while functionally linking the mathematical models across these scales. Biological and behavioral scales include atomic, molecular, molecular complexes, sub-cellular, cellular, multi-cell systems, tissue, organ, multi-organ systems, organism/individual, group, organization, market, environment, and populations.

Nn

- **Noosphere**

A term modelled after atmosphere and biosphere signifying (a) the space occupied by the totality of information and human knowledge collectively available to man and (b) the processes operating in this space, e.g., combinatorial mating, classification, reproduction, simplification, selective decay.

- **Nanoparticles**

Ultrafine particles between 1 and 100 nanometers in size. The size is similar to that of most biological molecules and structures. Nanoparticles can be engineered for a wide variety of biomedical uses including diagnostic devices, contrast agents, physical therapy applications, and drug delivery vehicles. A nanoparticle is approximately 1/10,000 the width of a human hair. Nanoparticles are generally 1000 times smaller than microparticles.

- **Nanotechnology**

The manipulation of matter with at least one dimension sized from 1 to 100 nanometers. Research areas include surface science, molecular biology, semiconductor physics, and microfabrication. Applications are diverse and include device physics, molecular self-assembly, and precisely manipulating atoms and molecules.

- **Near Infrared Spectroscopy (NIRS)**

A spectroscopic method that uses the near-infrared region of the electromagnetic spectrum for pharmaceutical and medical diagnostics, typically measurements of blood sugar and blood oxygen levels.

- **near-infrared light**

wavelengths of light that are slightly larger than those visible to the human eye.

- **Neural Networks**

A machine learning approach modeled after the brain in which algorithms process signals via interconnected nodes called artificial neurons. Mimicking biological nervous systems, artificial neural networks have been used successfully to recognize and predict patterns of neural signals involved in brain function.

- **Neuroimaging**

Includes the use of a number of techniques to image the structure and function of the brain, spinal cord, and associated structures.

- **Neuromodulation**

An external alteration of nerve activity through delivery of a distinct stimulus, such as a magnetic field or electric current.

- **Neuroprosthetics**

A broad discipline of neuroscience and biomedical engineering concerned with developing devices that can substitute a motor, sensory or cognitive function lost due to injury or disease. Examples encompass a wide range including cochlear implants, visual prosthetics, and brain-computer interfaces for conscious control of movement in paralyzed individuals.

- **Nuclear Medicine**

A medical specialty that uses radioactive tracers (radiopharmaceuticals) to assess bodily functions and to diagnose and treat disease. Diagnostic nuclear medicine relies heavily on imaging techniques that measure cellular function and physiology.

Oo

- **Objective**

an objective is something that a decision maker seeks to accomplish or to obtain by means of his decision. A decision maker may have more than one objective (the MULTIPLE-OBJECTIVES case). An objective may be specified in a more or less general Fashion, may be quantified or not quantified, and is usually part of a hierarchy of objectives. The term goal is sometimes used to denote a very general objective(at the top of the hierarchy) and TARGET is used to mean a very definite objective. Example: "The goal of allocating money to the municipality was to increase the quality of urban life. The immediate objectives were to improve public transportation and fire services. A 10% reduction of average travel time from home to work and a 70% decrease of average alarm-to-action time taken by the fire brigades were set forth as targets.

- **Operation**

a basic process that applies to an operand and yields a transform, e.g., the multiplication of two numbers, driving a nail with a hammer, baking. A transformation describes an operation, sometimes in terms of an algorithm.

- **Oncoprotein**

A protein encoded by an oncogene which can cause the transformation of a cell into a tumor cell if introduced into it.

- **Optical Coherence Tomography (OCT)**

A technique for obtaining sub-surface images such as diseased tissue just below the skin. For example, ophthalmologists use OCT to obtain detailed images from within the retina. Cardiologists also use it to help diagnose coronary artery disease.

- **Optical Imaging**

A technique for non-invasively looking inside the body, as is done with x-rays. Unlike x-rays, which use ionizing radiation, optical imaging uses visible light and the special properties of photons to obtain detailed images of organs and tissues as well as smaller structures including cells and molecules.

Pp

- **Paradigm**

an outstandingly clear or typical example or archetype. (Webster's) (2) The total pattern of perceiving, conceptualizing, acting, validating, and valuing associated with a particular image of reality that prevails in a science or a branch of science. (Kuhn) (3) A theoretical model to explain a type of social behavior. (Dict. of Anthropology) The pattern underlying the process of constructing theories and explanations and thereby affecting the form of the body of knowledge within a social domain, e.g., within 18th century science. Paradigms carry their own source of justification and are therefore less obviously related to or challenged by empirical evidence. Kuhn describes the history of science as a succession of paradigms, transitions resulting not only from the emergence of empirical phenomena an existing paradigm is unable to explain but also from socio-political interests within the scientific community.

- **Paradox**

a tenet contrary to received opinion; a statement that is seemingly contradictory or opposed to common sense and yet perhaps is true; a self- contradictory statement that at first seems true; an argument that apparently derives self-contradictory conclusions by valid deduction from acceptable premises. (Webster's) A paradox is not the same as a contradiction. "The shirt is blue; the shirt is not blue," and "It is raining; it is not raining," are examples of contradictions. A paradox occurs when one makes an assumption and, following a logical argument, arrives at the converse. A paradox will always result when one formulates a set that contains itself.

- **Perfect information**

a characteristic of a situation in which all data relevant to a problem is known. Numbers are available for all variables necessary for a solution, through some of the

numbers may be the result of estimates rather than measurements. Perfect in this context refers to completeness with no implied judgment about quality.

- **Physical space**

the space within which the phenomenology of autopoiesis of living systems takes place.

- **Perfusable**

The movement of fluid through blood vessels to a cell tissue or an organ, generally referring to blood.

- **phenotype**

The observable traits in a cell, tissue, or organism. Phenotypes are shaped by both genetics and environmental factors.

- **Photon**

A particle of light or electromagnetic radiation. The energies of photons range from high-energy gamma rays and x-rays to low-energy radio waves.

- **Piezoelectric Crystals**

Crystals in the transducer of an ultrasound device that vibrate when an electric signal is applied, emitting high-frequency sound pressure waves. The crystals are the crucial component of an ultrasound device both producing and detecting the ultrasound waves used to image structures inside of the body.

- **Point-of-Care**

Testing and treating of patients at sites close to where they live. Rapid diagnostic tests are used to obtain immediate, on-site results. The success of the concept relies on portable, rapid diagnostic devices that provide results directly to the user, which

allows health care workers in remote areas to test and treat patients at the time of the visit.

- **Polymer**

A large molecule composed of many repeating subunits. Polymers range from familiar synthetic plastics such as polystyrene to natural biopolymers such as DNA. Polymers have unique physical properties, including strength, flexibility and elasticity.

- **Polymerase chain reaction**

Polymerase chain reaction (PCR) is a laboratory technique for rapidly producing millions to billions of copies of a specific segment of DNA, which can be used to study DNA or RNA from a cell or virus in greater detail. PCR involves using short synthetic DNA fragments called primers to select a segment of the genome to be amplified, and then multiple rounds of DNA synthesis to amplify that segment.

- **Positron Emission Tomography (PET)**

PET scans use radiopharmaceuticals to create 3 dimensional images. The decay of the radiotracers used with PET scans produce small particles called positrons. When positrons react with electrons in the body they annihilate each other. This annihilation produces two photons that shoot off in opposite directions. The detectors in the PET scanner measure these photons and use this information to create images of internal organs.

- **Precision medicine**

In contrast to a one-size-fits-all approach, in which disease treatment and prevention strategies are developed for the average person, precision medicine can give doctors and researchers the ability to predict more accurately which treatment and prevention strategies will work best in an individual.

- **Progenitor Cells**

Progenitor cells are cells that are similar to stem cells but instead of the ability to become any type of cell, they are already predisposed to develop into a particular type of cell.

- **Prosthetics**

The design, fabrication, and fitting of artificial body parts.

Rr

- **Radiation**

The emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles that cause ionization.

- **Radiopharmaceuticals/radioactive tracers**

Radioactive tracers are made up of carrier molecules that are bonded tightly to a radioactive atom. The carrier molecule is designed to bind to the tissue being examined so that the radioactive atom can be scanned to produce an image from inside the body.

- **Raman Spectroscopy**

This technique relies on inelastic scattering of visible, near-infrared, or near-ultraviolet light that is delivered by a laser. The laser light interacts with molecular vibrations in the material being examined, and shifts in energy are measured that reveal information about the properties of the material. The technique has a wide variety of applications including identifying chemical compounds and characterizing the structure of materials and crystals. In medicine, Raman gas analyzers are used to monitor anesthetic gas mixtures during surgery.

- **Rapid diagnostic test**

Rapid diagnostic tests (RDTs) are medical diagnostic tests that provide quick results and can be used in various settings. Results are typically indicated in an hour or less. Pregnancy testing is one example of an RDT, producing results within several

minutes. RDTs have become a widely used method to detect a range of infections using blood, saliva, or urine samples. Examples of infections for which RDTs have been developed include malaria, strep throat, STDs, and HIV. Reliable and accurate COVID-19 RDTs are a goal of NIBIB's Rapid Acceleration of Diagnostics Tech (RADx Tech) initiative.

- **Regenerative Medicine**

A broad field that includes tissue engineering but also incorporates research on self-healing – where the body uses its own systems, sometimes with the help of foreign biological material to rebuild tissues and organs.

- **Rehabilitation Engineering**

The use of engineering science and principles to develop technological solutions and devices to assist individuals with disabilities, and aid the recovery of physical and cognitive functions lost because of disease or injury.

- **Robotic Surgery**

Surgery performed through very small incisions or natural orifices using thin finger-like robotic tools controlled remotely by the surgeon through a telemanipulator or computer interface.

Ss

- **Scientific method**

a sequence of procedures intended to produce agreement among a set of observers, for example: 1. Define a problem, 2. Gather pertinent data, 3. Form a working hypothesis or explanation, 4. Do experiments to test the hypothesis, 5. Interpret the results, 6. Draw a conclusion and modify the hypothesis as needed.

- **Sensitivity analysis**

a procedure to determine the sensitivity of the outcomes of an alternative to changes in its parameters (as opposed to changes in the environment); If a small change in a parameter results in relatively large changes in the outcomes, the outcomes are said to be sensitive to that parameter. This may mean that the parameter has to be determined very accurately or that the alternative has to be redesigned for low sensitivity.

- **Statistical entropy**

a measure or variation or diversity defined on the probability distribution of observed events. Specifically, if P is the probability of an event a, the entropy H(A) for all events a in A is: H(A) = -SUM_a P_a log_2 P_a The quantity is zero when all events are of the same kind, p =1 for any one a of A and is positive otherwise. Its upper limit is log_2 N where N is the number of categories available and the distribution is uniform over these, p = 1/N for all a of A The statistical entropy measure is the most basic measure of information theory.

- **Systems analysis**

this term has many different meanings. In the sense adopted for the Handbook, systems analysis is an explicit formal inquiry carried out to help someone (referred to as the decision maker) identify a better course of action and make a better decision

than he might otherwise have made. The characteristic attributes of a problem situation where systems analysis is called upon are complexity of the issue and uncertainty of the outcome of any course of action that might reasonably be taken. Systems analysis usually has some combination of the following: identification and re-identification) of objectives, constraintS, and alternative courses of action; examination of the probable consequences of the alternatives in terms of costs, benefits, and risks; presentation of the results in a comparative framework so that the decision maker can make an informed choice from among the alternatives. The typical use of systems analysis is to guide decisions on issues such as national or corporate plans and programs, resource use and protection policies, research and development in technology, regional and urban development, educational systems, and?alth and other social services. Clearly, the nature of these problems requires an interdisciplinary approach. There are several specific kinds or focuses of systems analysis for which different terms are used: A systems analysis related to public decisions is often referred to as a POLICY ANALYSIS (in the United States the terms are used interchangeably). A systems analysis that concentrates on comparison and ranking of alternatives on basis of their known characteristics is referred to as decision analysis.

- **Scaffold**

A structure of artificial or natural materials on which tissue is grown to mimic a biological process outside the body or to replace a disease or damaged tissue inside the body.

- **Sensors**

In medicine and biotechnology, sensors are tools that detect specific biological, chemical, or physical processes and then transmit or report this data. Some sensors work outside the body while others are designed to be implanted within the body. Sensors help health care providers and patients monitor health conditions. Sensors are

also used to monitor the safety of medicines, foods and other environmental substances we may encounter.

- **sepsis**

a life-threatening response to a bloodstream infection.

- **Single Photon Emission Computed Tomography (SPECT)**

A nuclear medicine imaging technique using gamma rays. SPECT imaging instruments provide 3 dimensional images of the distribution of radioactive tracer molecules that have been introduced into the patient's body. The 3D images are computer generated from a large number of images of the body recorded at different angles by cameras that rotate around the patient.

- **Spatial resolution**

The ability to distinguish between objects that are close to one another.

- **Spectroscopy**

the branch of science concerned with the investigation and measurement of spectra produced when matter interacts with or emits electromagnetic radiation.

- **Stem Cell**

An undifferentiated cell of a multicellular organism that is capable of giving rise to more of the same cell type indefinitely, and has the ability to differentiate into many other types of cells that form the structures of the body.

- **Structural Biology**

The study of the structure of large biomolecules like proteins and nucleic acids, how the structure relates to the function of the molecule, and how alterations in structure affect function. Various methods such as crystallography are used to gain

information about the structure of a molecule. This information is often analyzed with bioinformatics techniques to obtain or solve the structure of the molecule.

- **Structured Illumination Microscopy (SIM)**

A form of super high resolution microscopy designed to capture extremely clear images of cells and molecules, even when they are moving quickly. The sophisticated technique uses a number of filters and other light processors to rapidly scan images, combine multiple images, and eliminate out of focus light in order to obtain super-resolution images of cells and subcellular structures in motion.

- **Synchrotron**

A large circular facility/device that accelerates sub-atomic particles in a magnetic field in a circular path that generates electromagnetic radiation with a defined exit (beam line). One type of synchrotron (a synchrotron light source) converts a high-energy beam of electrons into high-energy x-rays that can be used in a number of applications including biomedical imaging.

Tt

- **Technical assessment**

assessment (analysis and normative evaluation) of a particular technical device, system, or procedure with regard to a defined set of criteria, goals or objectives (e.g. technical security assessment according to the standards of the Orange Book).

- **Technological determinism**

the belief that technology develops by its own laws, that it realizes its own potential, limited only by the material resources available, and must therefore be regarded as an autonomous system controlling and ultimately permeating all other subsystems of society. Evidence for the first proposition is largely taken from the natural history of technology, its progressive character and the cooccurance of independent inventions. Evidence for the second proposition stems from the unwarranted generalization that everything that is invented is ultimately installed and ignores human playfulness, individual and collective interests and man's cognitive limitations. The conclusion is nevertheless supported by the fact that technology has indeed penetrated all spheres of human existence from interpersonal communication, to definitions of the quality of life in technological terms.

- **Telehealth**

The use of communications technologies to provide and support health care at a distance.

- **Tesla**

An international unit to describe the strength of a magnetic field.

- **Theranostics**

The relatively experimental science of combining therapy and diagnosis into a single procedure or molecule. Towards this end, bioengineers are building multi-functional nanoparticles that can be introduced into a patient, find the site of disease, diagnose the condition, and deliver the appropriate, personalized therapy.

- **Tissue Engineering**

An interdisciplinary and multidisciplinary field that aims at the development of biological substitutes that restore, maintain, or improve tissue function.

- **tumor spheroids**

Three-dimensional models of cancer cells which exhibit tumor characteristics

Uu

- **Ultrastability**

the ability to modify internal relationships and/or to influence environmental conditions in the interests of neutralizing actual or potential obstacles to the maintenance of stability. The ability of a system to change its internal organization or structure in response to environmental conditions that threaten to disturb a desired behavior or value of an essential variable. The changes such systems are capable of are qualitative in the sense of changing the mode of interaction with an environment in steps or jumps, not along a continuum, and they are purposeful because such systems seek a behavior that is disturbance defying. Ultrastability is stability of a logical level higher than the stability to which a system converges without change of its internal organization or structure. Ashby's homeostat was the first mechanical demonstration of this form of stability heretofore reserved to living organisms.

- **Unity**

that which is distinguishable from a background, the sole condition necessary for existence in a given domain. The nature of a unity and the domain in which the unity exists are specified by the process of its distinction and determination; this is so regardless of whether this process is conceptual or physical.

- **Ultrasound**

A form of acoustic energy, or sound, that has a frequency that is higher than the level of human hearing. As a medical diagnostic technique, high frequency sound waves are used to provide real-time medical imaging image inside the body without exposure to ionizing radiation. As a therapeutic technique, high frequency sound waves interact with tissues to destroy diseased tissue such as tumors, or to modify tissues, or target drugs to specific locations in the body.

Vv

- **Validation**

the process of determining how well one system replicates properties of some other system or, more generally, any comparison between the representation of a system and specified criteria. The validation of an operating model cannot be separated from the purpose for which it is designed and used. Validation is the process of increasing the confidence that the outputs of the model conform to reality in the required range. In some cases, the model's output can be compared to data from historical sources or from an experiment conducted for validation. A model can never be completely validated. We can never prove that its results conform to reality in all respects. It can only be invalidated. Predictive models be validated only by judgment, since a model may fit past data well without having good predictive qualities.

- **Verification**

a (computer) model is said to be verified if it behaves in the way that the model builder wanted it to behave. This means that the instructions are correct and have been properly programmed. One check for verification is to hold some of the variables constant to determine whether the output changes in anticipated ways as other variables are changed. Another typical check is to test how the model behaves in limit situations.

- **Virion**

A complete, infectious virus particle that exists outside of the host cell.

Xx

- **X-rays**

A form of high energy electromagnetic radiation that can pass through most objects, including the body. X-rays travel through the body and strike an x-ray detector (such as radiographic film, or a digital x-ray detector) on the other side of the patient, forming an image that represents the “shadows” of objects inside the body.

ENGLISH FOR CHEMISTRY

Aa

- **α-carbon**

An alpha carbon is the carbon in a molecule bonded to an atom or moiety of interest. α-carbon is the most common notation for the alpha carbon.

- **α-hydrogen**

An alpha hydrogen is a hydrogen atom bonded to the α-carbon in a molecule. α-hydrogen is the most common notation for alpha hydrogen.

- **Abegg's rule**

Abegg's rule states the sum of the absolute values of the maximum positive and negative valence of an atom is often equal to eight.

- **abhesive**

An abhesive is a material that prevents two surfaces from sticking together. Antonym: adhesive. Example: Teflon is an abhesive material used to make frying pans non-stick.

- **ab initio**

Ab initio is Latin for "from first principles". Ab initio refers to predictions or calculations which are based entirely on theory as opposed to experimentation.

- **ablation**

Ablation is the process of transferring heat by removing material by melting, vaporization or other erosive processes.

- **abrasive**

An abrasive is a material that is used to polish surfaces or smooth rough edges. Most abrasives are very hard, brittle, and heat-resistant.
Examples: Diamond, corundum, sandpaper are all abrasive materials.

- **absolute alcohol**

Absolute alcohol is a common name for the chemical compound ethanol. Ethanol is a colorless liquid with molecular formula C_2H_2OH. It is the alcohol found in alcoholic beverages. Also known as: ethanol, ethyl alcohol, pure alcohol, grain alcohol
Alternate Spellings: EtOH

- **absolute error**

Absolute error or absolute uncertainty is the uncertainty in a measurement, which is expressed using the relevant units. Also, absolute error may be used to express the inaccuracy in a measurement.
Examples: If a measurement is recorded to be 1.12 and the true value is known to be 1.00 then the absolute error is 1.12 – 1.00 = 0.12. If the mass of an object is measured three times with values recorded to be 1.00 g, 0.95 g, and 1.05 g, then the absolute error could be expressed as ± 0.05 g.
Also known as: Absolute uncertainty

- **absolute pressure**

Absolute pressure is a measurement of pressure equal to the gauge pressure plus atmospheric pressure.

- **absolute temperature**

Absolute temperature is the temperature measured using the Kelvin temperature scale where zero is absolute zero.

- **absolute uncertainty**

Absolute uncertainty is another term for absolute error. See definition above.

- **absolute vacuum**

An absolute vacuum is a volume of space containing no matter. Also known as: perfect vacuum

- **absolute zero**

Absolute zero the lowest possible temperature at which matter can exist, 0 K or -273.15°C.

- **absorbance**

Absorbance is a measure of the quantity of light absorbed by a sample. Also known as: Optical Density, Extinction, Decadic Absorbance.

- **absorbed dose**

Absorbed dose is the amount of energy from radiation deposited or absorbed by an object per unit mass. The SI unit of absorbed dose is the Gray (Gy) or J/kg.

- **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+(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.

- **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.

- **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 (a) Particle**

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

- **Alums**

Hydrated sulfates of the general formula M+M3+(SO4)2 *12H2).

- **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 a alkyl or aryl groups.

- **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 --NH2 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 goup 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 particiles or small nucei.

- **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 (6.022x1023) of atoms, molecules or particles found in exactly 1 mole of substance.

Bb

- **Background Radiation**

Ratiation extraneous to an experiment. Usually the low-level natural radiation form 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 soluable 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 neuton 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 = mc2) 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/s2

- **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 sustance 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.

Cc

- **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 orgainic 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 ir a cathode) against corrosion by attaching it to a sacrifical 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, Ecell, 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 proceedures, equipment, personal protective equipment, and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals usid 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 bon 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 particiles as vapor molecules condense on them to form foglike tracks.

- **Coefficient of expansion**

The ratio of the change in length or volumen of a body to the original lengthor 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**

Descibes 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 gass 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+.

- **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 obsorbers (not merely moderaters) used in nuclear reactors to control neutron fluxes and therfore 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 metals 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 charge 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 radioactivty given off by 1 gram of radium.

- **Cyclotron**

A device for accelerating charged particles along a spiral path.

Dd

- **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 form 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-expempt.

- **Density**

Mass per unit Volume: D=MV

- **Deposition**

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

- **Derivative**

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

- **Dermal toxicity**

Adverse health effects resulting from skin exposure ot 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 loboratory hood.

- **Detergent**

A soap-like emulsifer that contains a sulfate, SO3 or a phosphate group instead of a carboxylate group.

- **Deuterium**

An isotope of hydrogen whose atoms are twice as massive as ordinary hydrogen;deuterion 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 comples 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, aset 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.

Ee

- **Effective Collisons**

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 dx2-y2 and dz2 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 nospontaneous 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 sustance 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 x 1023 electrons in a redox reaction. The mass of an acid or base that furnishes or reacts with 6.022 x 1023 H3O+ or OH- ions.

- **Essential Oil**

A plant extract that has a distinctive odour or flavour.

- **Ester**

A Compound of the general formula R-C-O-R1 where R and R1 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 or 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.

Ff

- **Faraday**

One faraday of electricity corresponds to the charge on 6.022 x 1023 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 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 NFPD and DOT as having a flash point below 37.8°C (100°F).

- **Flash Point**

The temperature at which a liquid will yield enough flamable 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 constnt 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 electriacl energy on a continuous basis.

- **Functional Group**

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

Gg

- **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 electriaclly 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.

Hh

- **Haber Process**

A process for the catalyzed industrial production of ammonia from N2 and H2 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 Fe3+, Ca2+, and Mg2+ ions, which forms precipates 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 it's 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 ion 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 t2g and eg 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 gase 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.

Ii

- **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 un shared 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, Kw = [H3O+][OH-] =1.00 x 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.

- **Ioniztion**

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 Compunds**

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.

Jj

- **Joule**

A unit of energy in the SI system. One joule is 1 kg. m2/s2 which is also 0.2390 calorie.

Kk

- **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 processes 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.

Ll

- **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 mixature 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 t2g orbitals before eg orbitals are occupied in octahedral complexes.

Mm

- **Magnetic Quantum Number (mc)**

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

Nn

- **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 hydrogen 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 NiO2, and the electrolyte is basic.

- **Nitrogenases**

A class of enzymes found in bacteria within root nodules in some plants, which catalyze reactions by which N2 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 fisson 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.

Oo

- **Octahedral**

A term used to describe molecules and polyatomic ions that have one atom in the center and six atoms at the corners of a 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 semipermable membrane from a dilute solution into a more concentrated solution.

- **Osmotic Pressure**

The hydrostatic pressure produced on the surface of a semipermable 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.

Pp

- **Pairing**

A favourable interaction of two electrons with opposite m , 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, O22- pH Negative logarithm of the concentration (mol/L) of the H3O+[H+] 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 raing.

- **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.

Rr

- **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 objects 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 radioctivity; also called a radioactive label.

- **Radioactivity**

The spontaneous disintegration of atomic nuclei.

- **Reactants**

Substances consumed in a chemical reaction.

- **Reaction Quotient**

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

Ss

- **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 soluable 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 diorder in spontaneous processes.

- **Silicones**

Polymeric organosilicon compounds; contain individual or cross-linked Si-O chains or rings in which some oxygens of SiO4 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

Tt

- **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.

- **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.

Uu

- **Unsaturated Hydrocarbons**

Hydrocarbons that contain double or triple carbon-carbon bonds.

Vv

- **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.

Ww

- **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 ge- nerally forms high spin complexes with metals.

Zz

- **Zone Refining**

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

ENGLISH FOR ORTODONTIC TECHNOLOGIES

Aa

- **Active Treatment**

The stage of orthodontic treatment is when teeth are being moved and/or jaws aligned.

- **Advanced periodontitis**

The most severe form of gum (periodontal) disease. It is a chronic infection of the gums caused by accumulation of plaque under the gum line. The plaque contains bacteria that produce toxins that destroy the soft tissue and bone that hold teeth in place. Pockets (spaces between the gum and the teeth) appear and deepen. Gums recede, and bone dissolves. Teeth can become loose and may have to be removed.

- **Aligners**

Clear, thin, removable trays that are formed to fit an individual's teeth and are used to straighten teeth. Patients are responsible for insertion and removal.

- **American Association of Orthodontists (AAO)**

The AAO is a professional association of educationally qualified orthodontic specialists who create healthy, beautiful smiles for their patients. The AAO only admits orthodontists as members. Orthodontists first graduate from dental school and then complete an additional two to three years of education in the orthodontic specialty at accredited orthodontic residency programs. Selecting an AAO member for orthodontic care is your assurance that the doctor is an orthodontist.

- **Anterior**

Front.

- **Appliances**

Any device used by an orthodontist, attached to the teeth or removable, designed to move the teeth, change the position of the jaw, or hold the teeth.

- **Arch**

Upper or lower jaw. The “dental arch.”

- **Archwire**

The metal wire that is attached to the braces and used to move the teeth.

- **Attachments**

The tooth-colored “bumps” are placed on teeth during clear aligner treatment. They help move the teeth while a patient wears aligners. They are removed once treatment is complete.

Bb

- **Band**

A metal ring, usually on a back tooth, that is cemented to a tooth for strength and anchorage.

- **Bite**

How top and bottom teeth come together. Ideally, each tooth meets its opposite tooth in a way that promotes functions such as biting, chewing and speaking. A bad bite is called a malocclusion. The goal of orthodontic treatment is to create an individualized healthy bite (ability to bite, chew, speak). Additionally, when teeth and jaws are in proper positions, it creates a pleasing appearance.

- **Blue Grass Appliance**

Used to help in the correction of a tongue thrust. Helps the patient retrain the tongue when swallowing, and can help correct an open bite.

- **Board-Certified Orthodontist**

An orthodontist who has completed the American Board of Orthodontics Specialty Certification exams. A board-certified orthodontist is known as a Diplomate of the American Board of Orthodontics. The American Board of Orthodontics is the only orthodontic specialty certifying board that is recognized by the American Dental Association. Board certification is voluntary for orthodontists.

- **Braces**

A word commonly used to describe a fixed orthodontic appliance, usually consisting of brackets, bands and wires.

- **Bracket**

The small metal, ceramic, or plastic attachment is bonded to each tooth with a tooth-colored adhesive. The bracket has a slot that the orthodontic wire fits into. Also known as a "brace."

- **Bridge**

A replacement for a missing natural tooth/teeth that fills the opening between adjacent teeth. Most often, the existing adjacent teeth receive crowns and a prosthetic (false) tooth is attached to the crowns. This restores function, provides a good appearance, and maintains the shape of the face. Bridges do not last forever, eventually this will require replacement.

- **Brushing**

Brushing the teeth is part of an individual's daily home dental care. Patients with braces should follow the orthodontist's instruction on how often to brush.

- **Bruxism**

Grinding of the teeth, usually during sleep. Bruxism can cause abnormal tooth wear and may lead to pain in the jaw joints, facial and/or neck muscles and difficulty opening and closing the mouth.

- **Buccal**

A term orthodontists use to describe the cheek side of the back teeth in both jaws

.

- **Buccal Tube**

A small metal part of the bracket is welded to the cheek side of the molar band. The tube may hold an archwire, lip bumper, headgear, facebow or other type of appliance an orthodontist may use to move the teeth.

Cc

- **Cephalometric Radiograph**

A side view x-ray of the head.

- **Chain**

A stretchable series of elastic o-rings connected together and placed around each bracket to hold the archwire in place and close the spaces between teeth. Also known as a “power chain.”

- **Class I Malocclusion**

A malocclusion in which the back molars meet properly, but the front teeth may appear to be crowded together or spaced apart. There may be an overbite, an openbite, a posterior (back) crossbite or an anterior (front) crossbite with a Class I Malocclusion.

- **Class II Malocclusion**

A malocclusion the lower teeth and/or jaw is positioned back relative to the upper teeth and/or jaw. This results the upper front teeth protruding forward.

- **Class III Malocclusion**

A malocclusion where the lower teeth and/or jaw is positioned ahead relative to the upper teeth and/or jaw.

- **Closed Bite/Deep Bite**

Also known as deep overbite, this occurs when the upper front teeth overlap the bottom front teeth an excessive amount.

- **Comprehensive Treatment**

Complete orthodontic treatment is performed to correct a malocclusion.

- **Cone Beam CT/CBCT**

A 3D x-ray.

- **Congenitally Missing Teeth**

A genetic occurrence in which permanent teeth do not develop.

- **Crossbite**

Upper back teeth are in crossbite if they erupt and contact inside or outside of the lower back teeth. Lower front teeth are in crossbite if they erupt in front of the upper front teeth. A crossbite can be a single tooth or groups of teeth.

- **Crown**

The part of the tooth that is visible above the gums; OR, A tooth restoration placed by a dentist. A crown restoration covers a tooth that may have had severe decay, was badly discolored, or was broken or otherwise misshapen. The crown covers the entire tooth and functions as a replacement for the natural tooth. Crowns placed by dentists can last for many years, but they are not permanent.

Dd

- **DDS or DMD**

DDS (Doctor of Dental Surgery) and DMD (Doctor of Dental Medicine) are degrees awarded to dental school graduates. Some dental schools award DDS, and some dental schools award DMD. The American Dental Association considers them equivalent degrees. All orthodontists educated in the U.S. or Canada will have either a DDS or DMD after their names. Orthodontists, who are also known as “orthodontic specialists,” are required to follow their dental school education with the completion of two to three years of orthodontic specialty education in an accredited orthodontic residency program. This additional education makes orthodontists specialists in the field of orthodontics.

- **Decalcification**

White marks on the teeth that can become cavities in the future. They are caused by poor brushing, and the consumption of sugary and acidic drinks.

- **Dentist**

Practicing general dentists are healthcare professionals concerned with overall oral health. Dentists diagnose oral diseases, treat decayed teeth (fillings) and remove failed teeth (extractions). They usually provide services such as crowns, veneers or bonding to improve the appearance and function of teeth that have extensive decay, or are misshapen or broken. Dentists look for abnormalities in the mouth and teach patients how to prevent dental disease.

- **Diagnostic Records**

The materials and information that the orthodontist needs to properly diagnose a malocclusion and plan a patient’s treatment. Diagnostic records may include a thorough patient health history, a visual examination of the teeth and supporting structures, an electronic scan or plaster models of the teeth, extraoral and intraoral photographs, as well as a panoramic and cephalometric x-rays.

Ee

- **Ectopic Eruption**

Term used to describe a tooth or teeth that erupt in an abnormal position.

- **Elastics**

Rubber bands. During certain stages of treatment, small elastics or rubber bands are worn to provide individual tooth movement or jaw alignment.

- **Enamel**

The hard, white outer layer of a tooth, and the hardest substance in the human body. Enamel makes it possible to bite and chew. If enamel breaks away from a tooth, or is worn away due to abnormal forces generated by a bad bite (or malocclusion), it is gone forever. Enamel does not regenerate.

- **Eruption**

The process by which teeth enter into the mouth.

- **Essix Retainer**

A removable retainer made of a clear, plastic-like material.

- **Expander**

An orthodontic appliance that can widen the jaws.

- **Extraction**

The removal of a tooth.

- **Extraoral Photographs**

Photographs taken of the face from the front and side views.

Ff

- **Facebow**

An orthodontic appliance worn with orthodontic headgear, used primarily to move the upper first molars back, creating room for crowded or protrusive front teeth. The facebow has an internal wire bow and an external wire bow.

- **Fiberotomy**

A surgical procedure designed to cut part of the gum tissue around teeth, usually performed to reduce the chance of relapse or post-orthodontic tooth movement.

- **Fixed Appliances**

An orthodontic appliance that is bonded or cemented to the teeth and cannot be or should not be removed by the patient.

- **Flossing**

An important part of daily home dental care. Flossing removes plaque and food debris from between the teeth, brackets and wires. Flossing keeps teeth and gums clean and healthy during orthodontic treatment.

- **Forsus Spring**

An orthodontic appliance made of a fixed spring mechanism that moves the lower jaw forward, usually to correct an overjet (protruding upper teeth). It can also be used as an anchor for other types of movements.

- **Frenum**

The tissue attachment between the lip and the tongue or the lip and the upper jaw. A large frenum can cause spacing between the front teeth or cause the tongue to be "tied." A large frenum can also cause the gum tissue on the lower front teeth to be pulled down.

- **Frenectomy**

The surgical removal or repositioning of the frenum.

- **Function**

Refers to biting, chewing and speaking. Teeth and jaws in their correct positions facilitate proper function.

- **Functional Appliances**

A type of orthodontic appliance that uses jaw movement and muscle action to place selective force on the teeth and jaws. They are usually removable. They are also known as orthopedic appliances with names such as orthopedic corrector, activator, bionator, Frankel, Herbst or twin block appliances.

Gg

- **Gingiva**

Soft tissue around the teeth, also known as the gums.

- **Gingivitis**

The mildest type of gum (periodontal) disease, usually caused by poor dental hygiene that allows a build-up of plaque and subsequent inflammation in the gums . Symptoms include red and/or swollen gums, and bleeding when you brush or floss. Gingivitis can be reversed with professional treatment and good dental care at home. If left untreated it may progress to periodontitis.

- **Growth Modification**

Placing braces or appliances to help modify and correct the growth of the jaws and teeth.

- **Gum disease**

Another name for periodontitis. A chronic infection of the gums that stems from a build-up of plaque (link to glossary). Also called periodontal disease. Untreated gum disease can lead to tooth loss. Patients having orthodontic treatment need to remove plaque frequently by brushing their teeth after meals/snacks and before bed, and by flossing at least once a day. There are three stages of gum disease: gingivitis, periodontitis and advanced periodontitis. Many people are unaware that they have gum disease because there is little or no pain.

- **Gummy Smile**

Showing an excessive amount of gingival (gum) tissue above the front teeth when smiling.

Hh

- **Hawley Retainer**

A removable retainer made of wire and a hard plastic-like material.

- **Headgear**

An appliance worn outside of the mouth to provide traction for growth modification and tooth movement.

- **Herbst Appliance**

This appliance is used to move the lower jaw forward. It can be fixed or removable. When it is fixed, it is cemented to teeth in one or both arches using stainless steel crowns. An expansion screw may be used to widen the upper jaw at the same time.

- **Holding/Lingual Arch**

Bands on the upper or lower molars are connected using a bar behind teeth; used to maintain space.

Ii

- **Impaction**

A tooth that does not erupt into the mouth or only erupts partially is considered impacted.

- **Implant**

An artificial replacement for a missing tooth/teeth. The process involves placing a metal post in the jawbone. A crown is placed on the implant so that the patient is able to bite, chew and speak. Implants can be used to anchor a single tooth or multiple teeth. An orthodontist can create space or hold space open in the mouths of patients who may need implants to achieve good dental function. Dental implants cannot be moved by conventional orthodontic forces.

- **Interceptive Treatment**

Orthodontic treatment is performed to intercept or correct a developing problem. Usually performed on younger patients that have a mixture of primary (baby) teeth and permanent teeth. Sometimes called Preventive or Phase I treatment.

- **Intraoral Photographs**

Photographs taken of the inside of the mouth, usually showing the biting surfaces of the teeth and sides of the mouth while biting down.

- **Interproximal Brush**

A tiny brush used to reach between teeth, and between teeth and braces, to remove plaque and food debris.

- **Interproximal Reduction**

Removal of a small amount of enamel from between the teeth to reduce their width. Also known as reproximation, slenderizing, stripping, polishing, enamel reduction or selective reduction.

Ll

- **Labial**

The surface of the teeth in both jaws that faces the lips.

- **Ligating Modules**

A small elastic o-ring, shaped like a donut, used to hold the archwire in the bracket. Also called “o-rings” or “o-ties.”

- **Ligature**

A tiny rubber band, or sometimes a very thin wire, that holds the orthodontic wire in the bracket slot/brace.

- **Lingual**

The tongue side of the teeth in both jaws.

- **Lip Bumper**

An orthodontic appliance used to move the lower molars back and the lower front teeth forward, creating room for crowded front teeth. The lower lip muscles apply pressure to the bumper creating a force that moves the molars back.

- **Lip Incompetence**

The inability to close the lips together at rest, usually due to protrusive front teeth or an excessively long face.

Mm

- **Malocclusion**

Latin for “bad bite.” The term used in orthodontics to describe teeth that do not fit together properly.

- **Mandible**

The lower jaw.

- **MARA Appliance**

A type of functional appliance used to bring the lower jaw forward to correct an overjet.

- **Maxilla**

The upper jaw.

- **Mixed Dentition**

The dental developmental stage in children (approximately ages 6-12) when they have a mix of primary (baby) and permanent teeth.

- **Mouthguard**

A removable device used to protect the teeth and mouth from injury caused by sporting activities. The use of a mouthguard is especially important for orthodontic patients.

Nn

- **Nightguard**

A removable appliance worn at night to help an individual minimize the damage or wear that occurs while clenching or grinding teeth during sleep.

Oo

- **Orthodontic treatments**

Orthodontic treatments are a branch of dentistry aimed at correcting irregularities in the teeth and jaw structure. These treatments help resolve both aesthetic and functional problems. Proper alignment of the teeth is crucial not only for maintaining oral health but also for boosting an individual's self-confidence.

- **Objectives of Orthodontic Treatment**

1. Aesthetic Improvement: Correcting crooked, misaligned, or irregular teeth.
2. Improved Chewing Function: Addressing jaw misalignments to ensure proper chewing of food.
3. Preservation of Dental Health: Misaligned teeth are harder to clean, increasing the risk of tooth decay and gum disease. Orthodontic treatment reduces these risks.
4. Correction of Speech Problems: Jaw structure or tooth alignment issues can lead to certain speech difficulties.

- **Orthodontic Treatment Process**

Orthodontic treatment typically occurs in several stages:

1. Evaluation and Planning: X-rays are taken, dental impressions are made, and a treatment plan is prepared.
2. Treatment Application: Braces or aligners are placed.
3. Follow-Up and Adjustments:** Regular check-ups are conducted throughout the treatment.
4. Post-Treatment: Retainers are used to ensure teeth remain in their correct positions permanently.

- **Advantages of Orthodontic Treatment**

1. A more aesthetic smile.
2. Reduction of pain and discomfort in the jaw and teeth structure.
3. Improved chewing and speech functions.
4. Long-term healthier teeth and gums.

- **Occlusion**

Latin for “bite.” In orthodontics, occlusion describes how the upper and lower teeth meet.

- **Open Bite**

A malocclusion in which teeth do not make contact with each other. With an anterior open bite, the front teeth do not touch when the back teeth are closed together. With a posterior open bite, the back teeth do not touch when the front teeth are closed together.

- **O-ring**

A tiny, o-shaped rubber band that is used as a ligature and holds the archwire to bracket slots. O-rings come in a variety of colors, and are generally changed at each adjustment appointment.

- **Orthodontics**

The specialty area of dentistry concerned with the diagnosis, supervision, guidance and correction of malocclusions. The formal name of the specialty is orthodontics and dentofacial orthopedics.

- **Orthodontist**

A specialist in the diagnosis, prevention and treatment of dental and facial irregularities. Orthodontists are required to complete college requirements, graduate from an accredited dental school and then successfully complete a minimum of two years of full-time study at an accredited orthodontic residency program. Only those who have completed this education may call themselves "orthodontists." Orthodontists limit their scope of practice to orthodontic treatment. Only orthodontists may be members of the American Association of Orthodontists (AAO).

- **Orthognathic surgery**

Also called surgical orthodontics, orthognathic surgery is corrective jaw surgery performed to remedy skeletal problems that affect the ability to bite, chew and speak. Orthodontic treatment is done before and after surgery so that upper and lower teeth meet appropriately.

- **Orthopedic Appliance**

A removable functional appliance designed to guide the growth of the jaws and face.

- **Overbite**

The upper front teeth excessively overlap the bottom front teeth when back teeth are closed. Also called a closed bite or deep bite.

- **Overjet**

The upper front teeth protrude in front of the bottom front teeth when back teeth are closed. Sometimes called buck teeth.

Pp

- **Panoramic Radiograph**

An x-ray that shows all the teeth and both jaws at once.

- **Palatal Expander**

A fixed or removable orthodontic appliance used to make the upper jaw wider.

- **Periodontal Disease**

A chronic infection of the gums and jaw bones that stems from a build-up of plaque; many times there is little or no pain. Untreated periodontal disease can lead to tooth loss. There are three stages of periodontal disease: gingivitis, periodontitis and advanced periodontitis.

- **Periodontal Tissue**

Refers to the hard and soft tissue, or supporting structures, around the teeth.

- **Periodontitis**

A more serious form of gum (periodontal) disease as compared to gingivitis. It is a chronic infection caused by an accumulation of plaque under the gum line. The bacteria in plaque produce toxins that lead to destruction of the soft tissue and bone that hold teeth in place. Pockets (spaces between the gum and the teeth) form. Unless

treated professionally in conjunction with careful home care, the disease process will continue to break down tissues.

- **Phase One (Phase I) Treatment**

Orthodontic treatment performed to intercept or correct a developing problem. Usually performed on younger patients that have a mixture of primary (baby) teeth and permanent teeth. Sometimes called Preventive or Interceptive treatment.

- **Plaque**

Plaque is a colorless, sticky film which is a mixture of bacteria, food particles and saliva that constantly forms in the mouth. Plaque combines with sugars to form an acid that endangers teeth and gums. Plaque causes cavities, white marks (decalcification) and gum disease. Plaque is removed by brushing and flossing.

- **Posterior**

Back.

- **Power chain**

Interconnected elastic ligatures that are stretched across multiple teeth, holding the archwire to bracket slots. Orthodontists use power chains for some patients during specific times during their treatment to apply additional forces to move teeth.

- **Preventive Treatment**

Orthodontic treatment to prevent or reduce the severity of a developing malocclusion (bad bite). Also called Interceptive or Phase I treatment.

- **Primary Teeth**

Baby teeth. Also called deciduous or milk teeth.

Rr

- **Radiograph**

Also called an x-ray, a radiograph is a diagnostic tool that is used to see inside the body. Orthodontists take panoramic radiographs to see a complete horizontal image of a patient's upper and lower teeth. A cephalometric radiograph is a side view of a patient's head.

- **Removable Appliance**

An orthodontic appliance that can be removed from the mouth by the patient. Removable appliances are used to move teeth, align jaws and/or to keep teeth in their new positions when the braces are removed (retainers).

- **Retainer**

A fixed or removable appliance worn after braces are removed or aligner therapy is complete. A retainer is fitted to upper and/or lower teeth to hold them in their finished positions. When worn as prescribed, retainers are the best tool available to minimize unwanted tooth movement after active treatment ends.

- **Rubber Bands**

During certain stages of treatment, small elastics (rubber bands) are worn to provide individual tooth movement or jaw alignment.

Ss

- **Surgical Orthodontics**

Supported by surgical interventions in cases of severe problems in jaw and facial structure.

- **Separators**

An elastic o-ring or small wire loop is placed between the teeth to create space for placement of orthodontic bands. Separators are usually placed between the teeth a week before bands are scheduled to be placed on the teeth.

- **Self-Ligating Brackets**

Brackets that have a “door” on the front that holds the orthodontic wire to the bracket. With self-ligating brackets, an elastic ring is not needed to hold the orthodontic wire to the bracket.

- **Serial Extraction**

Selective or guided removal of certain primary (baby) teeth and/or permanent teeth over a period of time to create room, reduce crowding and create a better environment for the permanent teeth to erupt.

- **Skeletal maturity**

A time when an individual has stopped growing, and bones have reached their full development.

- **Spacers**

Tiny elastics (rubber bands) that are inserted between molars. Spacers are placed one or two weeks before getting braces to create space between molars if molar bands will be used as part of the orthodontic appliance. Occasionally, spacers fall out before braces are placed.

- **Space Maintainer**

A fixed appliance used to hold space for an unerupted permanent tooth after a primary (baby) tooth has been lost prematurely, due to accident or decay.

- **Specialist**

In dentistry, being a specialist usually requires:
General education – Completing college requirements (usually four years)
Dental School Education: Four-year program leading to a DDS or DMD in dentistry
Specialty education – Successful completion of two or more years (usually) of additional education in an accredited program in the chosen specialty area (such orthodontics in dentistry).
Thus the doctor's experience is focused on the area of specialization
Orthodontists are the dental profession's specialists in the field of orthodontics and dentofacial orthopedics. Nine dental specialties are recognized by the National Commission on Recognition of Dental Specialties and Certifying Boards. After dental school, those who intend to be orthodontists must be accepted by, and successfully complete, an accredited orthodontic residency program lasting two years or longer (minimum of 3,700 hours). There are about 15 applications for each opening in an accredited orthodontic program. Those who attain this level of formal education may call himself/herself an orthodontist. Only orthodontists are admitted for membership in the American Association of Orthodontists.

- **Supernumerary Teeth**

An occurrence in which there are more teeth than the usual number. These teeth can be malformed or erupt abnormally. These teeth can also interfere with the normal pattern of tooth eruption and contribute to an orthodontic problem. Supernumerary teeth often need to be removed.

Tt

- **Types of Orthodontic Treatment**

1. Fixed Orthodontic Treatments (Braces):

- Metal Braces: The most commonly used method, known for its durability.
- Clear Braces: Provide a more aesthetic appearance.
- Lingual Braces: Attached to the back of the teeth, making them invisible from the front.

2. Removable Orthodontic Treatments:

- Clear Aligners (Invisalign): Removable and nearly invisible.
- Jaw Appliances: Used to correct jaw structure.

3. Functional Orthodontic Treatments:

- Special appliances used during jaw development to guide growth and development.

- **Temporary Anchorage Device (TAD)**

A miniature surgical screw that resembles an earring stud when it is in place. Positioned in gum and bone tissue, a TAD is used as an anchor – a fixed point from which to apply the force needed to move teeth in a direction that braces alone cannot move them. The TAD is removed when it is no longer needed.

- **Tongue Crib**

A fixed orthodontic appliance used to help a patient stop habits or undesirable tongue forces exerted on the teeth and bone that supports the teeth.

- **Tongue Thrust**

A habit where an individual's tongue pushes against the teeth when swallowing. This type of force generated by the tongue can move the teeth and bone and may lead to an anterior or posterior open bite.

Uu

- **Underbite**

The lower front teeth or jaw sit ahead of the upper front teeth or jaw. Also known as a Class III malocclusion.

Vv

- **Veneer**

A thin, tooth-colored shell that is glued to the fronts of teeth to improve their appearance. A veneer can cover up a discolored or broken tooth. Veneers cannot correct malocclusions (misaligned teeth and/or jaws). However, veneers can be easier to place and last longer after an individual has had orthodontic treatment and teeth are properly positioned.

Ww

- **Wax**

Orthodontic wax is placed on the brackets or archwires to prevent them from irritating the lips or cheeks.

- **Wires**

Also known as archwires, they are held to brackets using small elastic o-rings (rubber bands), stainless steel wire ligatures, or by a door on a self-ligating bracket. Wires are used to move the teeth.

Xx

- **X-ray**

Also called a radiograph, an x-ray is a diagnostic tool that is used to see inside the body. Orthodontists take panoramic x-rays to see a complete horizontal image of a patient's upper and lower teeth. A cephalometric x-ray is a side view of a patient's head.

ENGLISH FOR PSYCHOLOGY

Aa

- **Alter ego**

A second self.

- **Anal**

Designating personality traits in the adult, such as orderliness, meanness, stubbornness, etc, due to fixation at the anal stage of development analysisshort for psychoanalysis.

- **Angst**

an acute but nonspecific sense of anxiety or remorse.

- **Anxiety**

a state of intense apprehension or worry often accompanied by physical symptoms such as shaking, intense feelings in the gut, etc, common in mental illness or after a very distressing experience.

Cc

- **Complex**

A group of emotional ideas or impulses that have been banished from the conscious mind but that continue to influence a person's behavior.

- **Compulsion**

An inner drive that causes a person to perform actions, often of a trivial and repetitive nature, against his or her will.

- **Conditioning**

The learning process by which the behaviour of an organism becomes dependent on an event occurring in its environment.

- **Consciousness**

The totality of one's thoughts, feelings, and impressions; conscious mind.

Dd

- **Death wish**

(in Freudian psychology) The desire for self-annihilation.

- **Delusion**

A belief held in the face of evidence to the contrary, that is resistant to all reason.

- **Dementia**

A state of serious mental deterioration, of organic or functional origin, characterized by declining memory and intellectual ability, and emotional and behavioural changes.

- **Depression**

A mental condition characterized by extreme gloom, feelings of inadequacy, and inability to concentrate.

Ee

- **Ego**

The self of an individual person; the conscious subject.

- **Electra**

Complexthe sexual attachment of a female child to her father.

- **Extrovert**

A person concerned more with external reality than inner feelings.

Ff

- **Fixation**

A preoccupation or obsession.

- **Freudian slip**

Any action, such as a slip of the tongue, that may reveal an unconscious thought.

Gg

- **Group therapy**

The simultaneous treatment of a number of individuals who are members of a natural group or who are brought together to share their problems in group discussion.

Hh

- **Hypnosis**

An artificially induced state of relaxation and concentration in which deeper parts of the mind become more accessible: used clinically to reduce reaction to pain, to encourage free association, etc.

- **Hypochondria**

Chronic abnormal anxiety concerning the state of one's health, even in the absence of any evidence of disease on medical examination.

- **Hysteria**

The simultaneous treatment of a number of individuals who are members of a natural group or who are brought together to share their problems in group discussion.

Ii

- **Id**

The mass of primitive instincts and energies in the unconscious mind that, modified by the ego and the superego, underlies all psychic activity.

- **Inferiority complex**

A disorder arising from the conflict between the desire to be noticed and the fear of being humiliated, characterized by aggressiveness or withdrawal into oneself.

- **Introvert**

A person prone to introversion.

Mm

- **Mania**

A psychiatric disorder characterized by great excitement and occasionally violent behavior.

- **Mind**

The human faculty to which are ascribed thought, feeling, etc; often regarded as an immaterial part of a person.

Nn

- **Neurosis**

A relatively mild mental disorder, characterized by symptoms such as hysteria, anxiety, depression, or obsessive behavior.

Oo

- **Obsession**

A persistent idea or impulse that continually forces its way into consciousness, often associated with anxiety and mental illness.

- **Oedipus**

complexa group of emotions, usually unconscious, involving the desire of a child, esp a male child, to possess sexually the parent of the opposite sex while excluding the parent of the same sex.

Pp

- **Paranoia**

A form of schizophrenia characterized by a slowly progressive deterioration of the personality, involving delusions and often hallucinations.

- **Persecution complex**

An acute irrational fear that other people are plotting one's downfall and that they are responsible for one's failures.

- **Persona**

(in Jungian psychology) the mechanism that conceals a person's true thoughts and feelings, esp in his adaptation to the outside world.

- **Personality**

The sum total of all the behavioural and mental characteristics by means of which an individual is recognized as being unique.

- **Personality disorder**

Any of a group of mental disorders characterized by a permanent disposition to behave in ways causing suffering to oneself or others.

- **Phobia**

An abnormal intense and irrational fear of a given situation, organism, or object.

- **Primal therapy or primal scream therapy**

A form of psychotherapy in which patients are encouraged to scream abusively about their parents and agonizingly about their own suffering in infancy.

- **Psyche**

The human mind or soul .

- **Psychoanalysis**

A method of studying the mind and treating psychiatric and emotional disorders based on revealing and investigating the role of the unconscious mind.

- **Psychosis**

Any form of severe mental disorder in which the individual's contact with reality becomes highly distorted.

- **Psychosomatic**

Of or relating to disorders, such as stomach ulcers, thought to be caused or aggravated by psychological factors such as stress.

Rr

- **Regression**

The adoption by an adult or adolescent of behaviour more appropriate to a child, esp as a defence mechanism to avoid anxiety.

- **Repression**

The subconscious rejection of thoughts and impulses that conflict with conventional standards of conduct.

- **Rorschach test or inkblot test**

A personality test consisting of a number of unstructured ink blots presented for interpretation.

Ss

- **Schizophrenia**

Any of a group of psychotic disorders characterized by progressive deterioration of the personality, withdrawal from reality, hallucinations, delusions, social apathy, emotional instability, etc.

- **Self**

An individual's consciousness of his own identity or being.

- **Stress**

Mental, emotional, or physical strain or tension.

- **Subconscious**

That part of the mind which is on the fringe of consciousness and contains material of which it is possible to become aware by redirecting attention.

- **Sublimation**

(in Freudian psychology) the diversion of psychic energy derived from sexual impulses into nonsexual activity, esp of a creative nature.

- **Superego**

That part of the unconscious mind that acts as a conscience for the ego, developing mainly from the relationship between a child and his parents.

- **Syndrome**

Any combination of signs and symptoms that are indicative of a particular disease or disorder.

Tt

- **Trauma**

A powerful shock that may have long-lasting effects.

Uu

- **Unconscious**

The part of the mind containing instincts, impulses, images, and ideas that are not available for direct examination.

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