DOWNLOAD PDF CHEMISTRY IN LIFE

Chapter 1 : Role of Chemical Science - Importance of Chemistry in our Life.

Chemistry is a big part of your everyday life. You find chemistry in daily life in the foods you eat, the air you breathe, cleaning chemicals, your emotions and literally every object you can see or touch.

Check new design of our homepage! Our very existence depends upon it. There are numerous examples lying around- big and small, that can make us realize how vital chemistry is in everyday life. ScienceStruck Staff Last Updated: Chemistry is a branch of science, which deals with the study of the composition, structure, properties, reactions, and behavior of substances. Hence, chemistry is termed as the central science. It is the essence of our everyday lives and occurs in the food we eat, the air we breathe, the water we drink, everything is a result of chemical processes. In fact, emotions like love and hatred are also driven by chemistry. For a better understanding of the chemistry that is virtually everywhere around us, we have provided day-to-day examples in two sections. Firstly, examples of chemistry within our body and secondly, examples of chemistry that exist outside our body or occur around us. They participate in the primary functions of the body, control our emotions, oversee the metabolic processes and keep diseases at bay. The oxygen that we breathe, the essential nutrients that we require, the genetic make-up of our body - the DNA and RNA - are all made up of different elements and compounds. Let us take a look at few such instances that involve chemistry, and are an integral part of our existence. The elements that are required in larger amounts are called macro-nutrients and the others that are needed in minute quantities, usually in parts per million or less, are called micro-nutrients. Chemically, the human body is made up of water and organic compounds- carbohydrates, proteins, lipids, and nucleic acids. Metabolism The organic processes taking place in the human body are termed as metabolism, which involves huge number of chemical reactions. The enzymes that are secreted by different organs act as biocatalysts that speed up the rate of these reactions, whereas the hormones regulate their occurrence, time, and speed. Our well-being, smooth functioning and normal health depends on these metabolic processes. The coordination and simultaneous occurrences of these life processes in an orderly manner is the reason we are fit, healthy, and alive. Respiration Breathing is the exchange of gases between an organism and its environment. Respiration is a chemical process, which is a reaction between glucose or sugars with oxygen, that release energy. It is the process in which inhalation of oxygen from the air causes inflation of the lungs, and then deflation occurs by exhaling carbon dioxide into the environment. The reaction that takes place during breathing is: Hydrogen - a highly-combustible gas and Oxygen - a gas without which combustion is impossible, form a covalent bond with each other to create the most effective fire extinguisher, which is water. The chemical formula of water is $H2O$. We drink a chemical everyday. Water is important for all the metabolic processes that occur inside our body. As Leonardo da Vinci stated "Water is the driving force of all nature. It stimulates the release of the growth hormone. It plays a role in the release of Insulin and protection of the cardiovascular organs. So, the next time your stomach growls grab a bite because if you fast or skip meals, more Ghrelin is produced thus increasing your craving for food. Digestion Gastric acid is composed of hydrochloric acid HCl and large quantities of potassium chloride KCl and sodium chloride NaCl that is secreted by the parietal cells lining the stomach. This gastric acid helps convert pepsinogen to pepsin which is responsible for the denaturing of the proteins in the stomach. It also kills the micro-organisms in the food before they can make you sick. Tears and Crying Sometimes, crying is a natural reflex. Studies have shown that emotional tears contain more manganese, an element that affects temperament and more prolactin. Prolactin is a hormone that regulates milk production. This elimination of manganese and prolactin is thought to ease out tension building up in the body and you feel energized and rejuvenated. It will help you feel better. Chemistry of LOVE We fall in love or are attracted to someone and have a feeling of belonging due to an increase in the secretion of -Phenylethylamine PEA, or the "love chemical" and the hormones testosterone and estrogen which promote mating. When we fall in love, our brain releases dopamine, norepinephrine and pheromones consistently, which evoke the pleasure center in the brain leading to side effects such as increased heart rate, insomnia, an intense feeling of excitement, elation, and focused attention. Coffee and Sleep Coffee keeps you awake due to the presence of caffeine in it. It increases the adrenaline secretion in the body and speeds up activity in the brain that keeps us awake. Body Odor Perspiration is a way in which the body cools itself. Body odor mainly originates from the Apocrine glands, which are found in the armpits, ears, breasts, the genitals, and hair follicles that become active at the onset of puberty. The sweat that these glands release is slight yellow in color due to the presence of fatty acids and proteins in it. The bacteria that thrive on our skin break down the secretions of the Apocrine glands and create smelly odors. These are some of the examples of chemistry inside our body. Chemistry Around Us Chemical reactions influence the stuff around us, and there are numerous instances where chemicals and chemistry helps us live a better life. The cooking of food, the clothes we wear, fertilizers that we use for crops, cement used for building our houses, the power plants that generate electricity, and many other processes depend on chemistry. The human dependence on this natural science is increasing and to understand this, here are a few examples that highlight the importance of chemistry around us. Photosynthesis Photosynthesis involves energy transformation and is a chemical process wherein plants, algae, and some bacteria produce their own food. It is the synthesis of glucose using carbon dioxide and water in presence of sunlight trapped by chlorophyll present in the leaves. The reaction which occurs is depicted as: They both are inter-dependent. We get an uninterrupted supply of oxygen, and plants get the carbon dioxide they need. Thus, photosynthesis plays a significant role in our day-to-day life. Color of Meat There are two types of meat: Red meat contains a highly pigmented protein called myoglobin that stores oxygen in the muscle cells. More the myoglobin in the cells, the redder is the meat. However, as meat is heated, the proteins break down and shrink in size. White meat contains glycogen, which has a translucent "glassy" quality when it is raw. Cutting an apple exposes its cells to the atmospheric oxygen and oxidizes the phenolic compounds present in apples. This is called the enzymatic browning that turns a cut apple brown. In addition to apples, enzymatic browning is also evident in bananas, pears, avocados and even potatoes. This reaction results in the formation of 1-propenyl sulfenic acid. This gas, known as the Lachrymatory factor crying factor , reacts with the water in our eyes to form sulfuric acid causing a burning sensation in your eyes and indicating the tear gland to secrete tears. Stain Removers Soap is formed by the reaction between an alkali and a fatty acid. This produces a molecule with one hydrophilic water-loving and one lipophilic fat-loving ends. The lipophilic ends stick to oil, grease, or dirt. These get engulfed in the soap and are washed away with a fresh stream of water, leaving a clean surface behind. This is just a physical reaction that takes place. Soap and stain removers act as emulsifiers which allow oil and water to mix and so the oily mixtures and difficult stains on body and clothes can be removed after application of soap, stain removers, and water. Ripening of Fruits A simple hydrocarbon gas ethylene switches on the necessary genes that stimulate the secretion of the ripening enzymes which catalyze reactions to change the properties of the fruit. Ethylene channelizes the action of several other chemicals called hydrolase, amylase, kinase, and pectinase. These enzymes convert starch to sugar, alter the cell walls to make them softer, neutralize acids and cause the fruit to emit an aroma. Fermentation Fermentation is the conversion of complex substances to simpler ones under anaerobic conditions. The specific product from fermentation is driven by the type of micro-organisms acting on the substance in which the fermentation occurs. The products of fermentation are alcohols or acids and the release of carbon dioxide. For example, wine produced from fruit juice is an alcohol as a result of fermentation by yeast, whereas beer is the result of yeast fermentation of grain. Antibiotics are obtained through fermentation by molds and some bacteria. Yogurt, cheese, and vinegar are products of bacterial fermentation. Leavened bread is obtained by yeast fermentation. Sunscreens Sunscreens are a combination of organic and inorganic compounds. Inorganic chemicals, like titanium dioxide or zinc oxide, form a physical barrier that reflects or scatters UV waves. Organic components like octyl methoxycinnamate OMC or oxybenzone absorb UV rays and release their energy as heat. This protects our skin from sunburns and detrimental effects like cancer. Nail Paint Removers Nail paint consists of three types of ingredients - organic solvents and drying agents, thickeners and hardening agents, and coloring agents. The remover is actually an organic solvent that is used as an ingredient in nail paint which may be acetone or ethyl acetate. So when you apply the remover you are just bringing it back to its original state. The solvent molecules get in between the chains of polymers and separate them, making it easy to wipe it off with a ball of cotton. Static Shocks All materials are made up of electrical charges in the atoms of the material. There are equal quantities of electrons negative charges and protons positive charges that try to balance each other in the universe. Friction between two materials causes these charges to redistribute. The electrons from one atom are transferred to the other. As we know, like charges repel each other and unlike charges attract each other. Whenever you touch anything that is a good conductor of electricity, the transfer of the extra electrons that have accumulated takes place, and it gives you the static shock. For example, generally in winters, you get a shock when you get out of the car or when you touch the door knob or filing cabinet. Your body itself is a huge chemical factory wherein one or the other chemical reaction takes place every moment.

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Chapter 2 : Chemistry of life | Biology | Science | Khan Academy

Learn how chemistry makes life possible! From you, to your dog, to your dinner, to the global ecosystem, all living systems are made out of atoms that obey the basic rules of chemistry.

Worksheets Chemistry in Everyday Life Chemistry is a huge part of your day-to-day life. You will find chemistry in everyday life within the foods you consume, your soap, the air you breathe, your emotions and literally each and every object you can observe or touch. Have a look at everyday chemistry. Your body comprises of chemical compounds that are combinations of components. While you most likely know your body is usually water, which is oxygen and hydrogen. The emotions which you feel are due to chemical messengers, mostly neurotransmitters. Soap is actually a chemical that humankind has been creating for a very long period. You can build a crude soap through mixing animal fat and ashes. Our whole universe comprises of matter which is continually changing forms and evolving into additional forms of energy. Chemistry is actually defined as the research or science of this ever altering matter. The additional sciences that we study commonly such as physics, mathematics and biology all are dependent on chemistry and are called specific studies beneath the elaborate topic of chemistry. Examples of Chemistry in Everyday Life Since there is actually chemistry noticed in physical states of nature and biological forms, you can find subjects known as physical chemistry and biochemistry that assist study these types of changes. You can find many chemical changes which take place around us daily. Examples of chemistry in everyday life are: This particular sulfur gets combined with moisture and so irritates your own eyes. The Chemistry of Life Chemistry, occasionally known as biological chemistry, is the analysis of chemical processes within and associated with, the chemistry of life. By handling information circulation through biochemical signaling and also the flow of chemical energy via metabolism, biochemical processes give increase to the complexity of life. During the last 40 years biochemistry is becoming so successful at detailing living processes which now virtually all areas of the life sciences through botany to medicine are employed in biochemical study. Nowadays the main concentrate of pure biochemistry is in knowing how biological molecules give increase to the processes that take place within living cells, that in turn relates greatly for the study and knowing of entire organisms. Biochemistry is strongly associated with molecular biology, study regarding the molecular mechanisms where genetic information encoded within DNA is able to lead to the processes of life. According to the exact classification of the terms employed, molecular biology could be thought of like a branch of biochemistry, or biochemistry like a tool with that to investigate and molecular biology study. Chemistry for Kids Numerous interesting and fun science experiments will also be safe for kids. Chemistry for kids is a number of science projects and experiments which are safe sufficient for kids to use, even without having adult supervision. Find a simple science project which you can do making use of common household materials. These effortless projects are excellent for fun, school science lab experiments or for home school science education.

Chapter 3 : Biochemistry - Wikipedia

Chemistry is not limited to beakers and laboratories. It is all around us, and the better we know chemistry, the better we know our world. Chemistry is present in every aspect of life, and few examples are-.

Data Research Analyst, Worldofchemicals. Why do we study chemistry? We all are made of chemicals and everything around us is made of chemicals. Everything we hear, see, smell, taste, and touch involves chemistry and chemicals matter. Hearing, seeing, tasting, and touching all involve intricate series of chemical reactions and interactions in our body. Many of the changes we observe in the world around are caused by chemical reactions. Chemistry is not limited to beakers and laboratories. It is all around us, and the better we know chemistry, the better we know our world. Chemistry is present in every aspect of life, and few examples are- 1. Sky is Blue An object is coloured because of the light that it reflects. The white light from the sun contains all the wavelengths, but when it impacts on an object some of its wavelengths are absorbed and some reflected. The colour of the sky can be explained considering phenomena named Rayleigh scattering that consists on the scattering of light by particles much smaller than its wavelength. This effect is especially strong when light passes through gases. Ice Float on Water Ice is less dense than liquid water. The heavier water displaces the lighter ice, so ice floats on top. Sunscreen combines organic and inorganic chemicals to filter the light from the sun so that less of it reaches the deeper layers of your skin. The reflective particles in sunscreen usually consist of zinc oxide or titanium oxide. Meals are cooked faster in a Pressure Cooker A pressure cooker has a more elaborated lid that seals the pot completely. When we heat water it boils and the steam cannot escape, so it remains inside and starts to build up the pressure. Under pressure, cooking temperatures raise much higher than under normal conditions, hence the food is cooked much faster. Chemistry of Love Chemistry is at the bottom of every step in a relationship. When we fall in love, our brain suffers some changes and also certain chemical compounds are released. Love is driven by these hormones: Coffee keeps us awake Coffee keeps us awake because of the presence of a chemical called adenosine, in your brain. It binds to certain receptors and slows the nerve cell activity when sleep is signaled. Vegetable is colored Many vegetables and fruits are strongly coloured because they contain a special kind of chemical compound named carotenoids. These compounds have an area called chromophore, which absorbs and gives off particular wavelengths of light, generating the colour that we then perceive. Then when soap is added to the water, the long hydrophobic chains of its molecules join the oil particles, while the hydrophilic heads go into the water. An emulsion of oil in water is then formed, this means that the oil particles become suspended in the water and are liberated from the cloth. With the rinsing, the emulsion is taken away. We cry while cutting onions Onions make you cry due to the presence of sulfur in the cells which break after the onions are cut. This sulfur gets mixed with moisture and thus irritates your eyes.

Chapter 4 : Department of Chemistry and Life Science - Life Science

Editor's Note: This occasional series of articles looks at the vital things in our lives and the chemistry they are made of. You are what you eat.

It is often seen as linked to the quest to turn lead or another common starting material into gold, [5] though in ancient times the study encompassed many of the questions of modern chemistry being defined as the study of the composition of waters, movement, growth, embodying, disembodying, drawing the spirits from bodies and bonding the spirits within bodies by the early 4th century Greek-Egyptian alchemist Zosimos. The current model of atomic structure is the quantum mechanical model. This matter can be studied in solid, liquid, or gas states , in isolation or in combination. The interactions , reactions and transformations that are studied in chemistry are usually the result of interactions between atoms, leading to rearrangements of the chemical bonds which hold atoms together. Such behaviors are studied in a chemistry laboratory. The chemistry laboratory stereotypically uses various forms of laboratory glassware. Solutions of substances in reagent bottles, including ammonium hydroxide and nitric acid , illuminated in different colors A chemical reaction is a transformation of some substances into one or more different substances. It can be symbolically depicted through a chemical equation , which usually involves atoms as subjects. The number of atoms on the left and the right in the equation for a chemical transformation is equal. When the number of atoms on either side is unequal, the transformation is referred to as a nuclear reaction or radioactive decay. The type of chemical reactions a substance may undergo and the energy changes that may accompany it are constrained by certain basic rules, known as chemical laws. Energy and entropy considerations are invariably important in almost all chemical studies. Chemical substances are classified in terms of their structure , phase, as well as their chemical compositions. They can be analyzed using the tools of chemical analysis , e. Scientists engaged in chemical research are known as chemists. Several concepts are essential for the study of chemistry; some of them are: Matter In chemistry, matter is defined as anything that has rest mass and volume it takes up space and is made up of particles. The particles that make up matter have rest mass as well â€” not all particles have rest mass, such as the photon. Matter can be a pure chemical substance or a mixture of substances. Atom A diagram of an atom based on the Bohr model The atom is the basic unit of chemistry. It consists of a dense core called the atomic nucleus surrounded by a space occupied by an electron cloud. The nucleus is made up of positively charged protons and uncharged neutrons together called nucleons , while the electron cloud consists of negatively charged electrons which orbit the nucleus. In a neutral atom, the negatively charged electrons balance out the positive charge of the protons. The nucleus is dense; the mass of a nucleon is appromixately 1, times that of an electron, yet the radius of an atom is about 10, times that of its nucleus. Chemical element A chemical element is a pure substance which is composed of a single type of atom, characterized by its particular number of protons in the nuclei of its atoms, known as the atomic number and represented by the symbol Z. The mass number is the sum of the number of protons and neutrons in a nucleus. Although all the nuclei of all atoms belonging to one element will have the same atomic number, they may not necessarily have the same mass number; atoms of an element which have different mass numbers are known as isotopes. For example, all atoms with 6 protons in their nuclei are atoms of the chemical element carbon , but atoms of carbon may have mass numbers of 12 or The periodic table is arranged in groups , or columns, and periods , or rows. The periodic table is useful in identifying periodic trends. Chemical compound A compound is a pure chemical substance composed of more than one element. The properties of a compound bear little similarity to those of its elements. Organic compounds are named according to the organic nomenclature system. When a compound has more than one component, then they are divided into two classes, the electropositive and the electronegative components. In this scheme each chemical substance is identifiable by a number known as its CAS registry number. A molecule is the smallest indivisible portion of a pure chemical substance that has its unique set of chemical properties, that is, its potential to undergo a certain set of chemical reactions with other substances. However, this definition only works well for substances that are composed of molecules, which is not true of many substances see below. Molecules are typically a set of atoms bound together by covalent bonds , such that the structure is electrically neutral and all valence electrons are paired with other electrons either in bonds or in lone pairs. Thus, molecules exist as electrically neutral units, unlike ions. When this rule is broken, giving the "molecule" a charge, the result is sometimes named a molecular ion or a polyatomic ion. However, the discrete and separate nature of the molecular concept usually requires that molecular ions be present only in well-separated form, such as a directed beam in a vacuum in a mass spectrometer. Charged polyatomic collections residing in solids for example, common sulfate or nitrate ions are generally not considered "molecules" in chemistry. Some molecules contain one or more unpaired electrons, creating radicals. Most radicals are comparatively reactive, but some, such as nitric oxide NO can be stable. A 2-D skeletal model of a benzene molecule C6H6 The "inert" or noble gas elements helium , neon , argon , krypton , xenon and radon are composed of lone atoms as their smallest discrete unit, but the other isolated chemical elements consist of either molecules or networks of atoms bonded to each other in some way. Identifiable molecules compose familiar substances such as water, air, and many organic compounds like alcohol, sugar, gasoline, and the various pharmaceuticals. However, not all substances or chemical compounds consist of discrete molecules, and indeed most of the solid substances that make up the solid crust, mantle, and core of the Earth are chemical compounds without molecules. These other types of substances, such as ionic compounds and network solids , are organized in such a way as to lack the existence of identifiable molecules per se. Instead, these substances are discussed in terms of formula units or unit cells as the smallest repeating structure within the substance. Examples of such substances are mineral salts such as table salt , solids like carbon and diamond, metals, and familiar silica and silicate minerals such as quartz and granite. One of the main characteristics of a molecule is its geometry often called its structure. While the structure of diatomic, triatomic or tetra atomic molecules may be trivial, linear, angular pyramidal etc. Substance and mixture Examples of pure chemical substances. From left to right: A chemical substance is a kind of matter with a definite composition and set of properties. Examples of mixtures are air and alloys. Mole The mole is a unit of measurement that denotes an amount of substance also called chemical amount. The mole is defined as the number of atoms found in exactly 0. Phase In addition to the specific chemical properties that distinguish different chemical classifications, chemicals can exist in several phases. For the most part, the chemical classifications are independent of these bulk phase classifications; however, some more exotic phases are incompatible with certain chemical properties. A phase is a set of states of a chemical system that have similar bulk structural properties, over a range of conditions, such as pressure or temperature. Physical properties, such as density and refractive index tend to fall within values characteristic of the phase. The phase of matter is defined by the phase transition , which is when energy put into or taken out of the system goes into rearranging the structure of the system, instead of changing the bulk conditions. Sometimes the distinction between phases can be continuous instead of having a discrete boundary, in this case the matter is considered to be in a supercritical state. When three states meet based on the conditions, it is known as a triple point and since this is invariant, it is a convenient way to define a set of conditions. The most familiar examples of phases are solids , liquids , and gases. Many substances exhibit multiple solid phases. For example, there are three phases of solid iron alpha, gamma, and delta that vary based on temperature and pressure. A principal difference between solid phases is the crystal structure , or arrangement, of the atoms. Another phase commonly encountered in the study of chemistry is the aqueous phase, which is the state of substances dissolved in aqueous solution that is, in water. Less familiar phases include plasmas , Boseâ€”Einstein condensates and fermionic condensates and the paramagnetic and ferromagnetic phases of magnetic materials. While most familiar phases deal with three-dimensional systems, it is also possible to define analogs in two-dimensional systems, which has received attention for its relevance to systems in biology. Chemical bond An animation of the process of ionic bonding between sodium Na and chlorine Cl to form sodium chloride , or common table salt. Ionic bonding involves one atom taking valence electrons from another as opposed to sharing, which occurs in covalent bonding Atoms sticking together in molecules or crystals are said to be bonded with one another. A chemical bond may be visualized as the multipole balance between the positive charges in the nuclei and the negative charges oscillating about them. A chemical bond can be a covalent bond , an ionic bond , a hydrogen bond or just because of Van der Waals force. Each of these kinds of bonds is ascribed to some potential. These potentials create the interactions which hold atoms together in molecules or crystals. In many simple compounds, valence bond theory , the Valence Shell Electron Pair Repulsion model VSEPR , and the concept of oxidation number can be used to explain molecular structure and composition. An ionic bond is formed when a metal loses one or more of its electrons, becoming a positively charged cation, and the electrons are then gained by the non-metal atom, becoming a negatively charged anion. The two oppositely charged ions attract one another, and the ionic bond is the electrostatic force of attraction between them. The ions are held together due to electrostatic attraction, and that compound sodium chloride NaCl , or common table salt, is formed. In the methane molecule CH4 , the carbon atom shares a pair of valence electrons with each of the four hydrogen atoms. Thus, the octet rule is satisfied for C-atom it has eight electrons in its valence shell and the duet rule is satisfied for the H-atoms they have two electrons in their valence shells. In a covalent bond, one or more pairs of valence electrons are shared by two atoms: Atoms will share valence electrons in such a way as to create a noble gas electron configuration eight electrons in their outermost shell for each atom. Atoms that tend to combine in such a way that they each have eight electrons in their valence shell are said to follow the octet rule. However, some elements like hydrogen and lithium need only two electrons in their outermost shell to attain this stable configuration; these atoms are said to follow the duet rule, and in this way they are reaching the electron configuration of the noble gas helium , which has two electrons in its outer shell. Similarly, theories from classical physics can be used to predict many ionic structures. With more complicated compounds, such as metal complexes , valence bond theory is less applicable and alternative approaches, such as the molecular orbital theory, are generally used. See diagram on electronic orbitals. Energy In the context of chemistry, energy is an attribute of a substance as a consequence of its atomic , molecular or aggregate structure. Since a chemical transformation is accompanied by a change in one or more of these kinds of structures, it is invariably accompanied by an increase or decrease of energy of the substances involved. Some energy is transferred between the surroundings and the reactants of the reaction in the form of heat or light ; thus the products of a reaction may have more or less energy than the reactants. A reaction is said to be exergonic if the final state is lower on the energy scale than the initial state; in the case of endergonic reactions the situation is the reverse. A reaction is said to be exothermic if the reaction releases heat to the surroundings; in the case of endothermic reactions , the reaction absorbs heat from the surroundings. Chemical reactions are invariably not possible unless the reactants surmount an energy barrier known as the activation energy.

Chapter 5 : Chemistry In Everyday Life | WorldOfChemicals

Examples of Chemistry in the Real World. There are many examples of chemistry in daily life, showing how prevalent and important it is. Digestion relies on chemical reactions between food and acids and enzymes to break down molecules into nutrients the body can absorb and use.

Sugars are carbohydrates, but not all carbohydrates are sugars. There are more carbohydrates on Earth than any other known type of biomolecule; they are used to store energy and genetic information , as well as play important roles in cell to cell interactions and communications. The simplest type of carbohydrate is a monosaccharide , which among other properties contains carbon, hydrogen, and oxygen, mostly in a ratio of 1: Glucose C6H12O6 is one of the most important carbohydrates; others include fructose C6H12O6 , the sugar commonly associated with the sweet taste of fruits , [34] [a] and deoxyribose C5H10O4. A monosaccharide can switch between acyclic open-chain form and a cyclic form. The open-chain form can be turned into a ring of carbon atoms bridged by an oxygen atom created from the carbonyl group of one end and the hydroxyl group of another. The cyclic molecule has an hemiacetal or hemiketal group, depending on whether the linear form was an aldose or a ketose. For example, the aldohexose glucose may form a hemiacetal linkage between the hydroxyl on carbon 1 and the oxygen on carbon 4, yielding a molecule with a 5-membered ring, called glucofuranose. The same reaction can take place between carbons 1 and 5 to form a molecule with a 6-membered ring, called glucopyranose. Cyclic forms with a 7-atom ring called heptoses are rare. Two monosaccharides can be joined together by a glycosidic or ether bond into a disaccharide through a dehydration reaction during which a molecule of water is released. The reverse reaction in which the glycosidic bond of a disaccharide is broken into two monosaccharides is termed hydrolysis. The best-known disaccharide is sucrose or ordinary sugar , which consists of a glucose molecule and a fructose molecule joined together. Another important disaccharide is lactose found in milk, consisting of a glucose molecule and a galactose molecule. Lactose may be hydrolysed by lactase , and deficiency in this enzyme results in lactose intolerance. When a few around three to six monosaccharides are joined, it is called an oligosaccharide oligo- meaning "few". These molecules tend to be used as markers and signals , as well as having some other uses. They can be joined together in one long linear chain, or they may be branched. Two of the most common polysaccharides are cellulose and glycogen , both consisting of repeating glucose monomers. Sugar can be characterized by having reducing or non-reducing ends. A reducing end of a carbohydrate is a carbon atom that can be in equilibrium with the open-chain aldehyde aldose or keto form ketose. If the joining of monomers takes place at such a carbon atom, the free hydroxy group of the pyranose or furanose form is exchanged with an OH-side-chain of another sugar, yielding a full acetal. This prevents opening of the chain to the aldehyde or keto form and renders the modified residue non-reducing. Lactose contains a reducing end at its glucose moiety, whereas the galactose moiety forms a full acetal with the C4-OH group of glucose. Saccharose does not have a reducing end because of full acetal formation between the aldehyde carbon of glucose C1 and the keto carbon of fructose C2. Lipid , Glycerol , and Fatty acid Structures of some common lipids. At the top are cholesterol and oleic acid. At the bottom is the common phospholipid , phosphatidylcholine. Some lipids are linear aliphatic molecules, while others have ring structures. Some are aromatic , while others are not. Some are flexible, while others are rigid. In triglycerides , the main group of bulk lipids, there is one molecule of glycerol and three fatty acids. Fatty acids are considered the monomer in that case, and may be saturated no double bonds in the carbon chain or unsaturated one or more double bonds in the carbon chain. In general, the bulk of their structure is nonpolar or hydrophobic "water-fearing" , meaning that it does not interact well with polar solvents like water. Another part of their structure is polar or hydrophilic "water-loving" and will tend to associate with polar solvents like water. This makes them amphiphilic molecules having both hydrophobic and hydrophilic portions. In the case of cholesterol , the polar group is a mere -OH hydroxyl or alcohol. In the case of phospholipids, the polar groups are considerably larger and more polar, as described below. Most oils and milk products that we use for cooking and eating like butter , cheese , ghee etc. Vegetable oils are rich in various polyunsaturated fatty acids PUFA.

Lipid-containing foods undergo digestion within the body and are broken into fatty acids and glycerol, which are the final degradation products of fats and lipids. Lipids, especially phospholipids , are also used in various pharmaceutical products , either as co-solubilisers e. Proteins are very large molecules â€" macro-biopolymers â€" made from monomers called amino acids. The side chain "R" is different for each amino acid of which there are 20 standard ones. It is this "R" group that made each amino acid different, and the properties of the side-chains greatly influence the overall three-dimensional conformation of a protein. Some amino acids have functions by themselves or in a modified form; for instance, glutamate functions as an important neurotransmitter. Amino acids can be joined via a peptide bond. The resulting molecule is called a dipeptide , and short stretches of amino acids usually, fewer than thirty are called peptides or polypeptides. Longer stretches merit the title proteins. As an example, the important blood serum protein albumin contains amino acid residues. A schematic of hemoglobin. The red and blue ribbons represent the protein globin ; the green structures are the heme groups. For instance, movements of the proteins actin and myosin ultimately are responsible for the contraction of skeletal muscle. One property many proteins have is that they specifically bind to a certain molecule or class of moleculesâ€"they may be extremely selective in what they bind. Antibodies are an example of proteins that attach to one specific type of molecule. Antibodies are composed of heavy and light chains. Two heavy chains would be linked to two light chains through disulfide linkages between their amino acids. Antibodies are specific through variation based on differences in the N-terminal domain. Probably the most important proteins, however, are the enzymes. Virtually every reaction in a living cell requires an enzyme to lower the activation energy of the reaction. These molecules recognize specific reactant molecules called substrates ; they then catalyze the reaction between them. By lowering the activation energy , the enzyme speeds up that reaction by a rate of or more; a reaction that would normally take over 3, years to complete spontaneously might take less than a second with an enzyme. The enzyme itself is not used up in the process, and is free to catalyze the same reaction with a new set of substrates. Using various modifiers, the activity of the enzyme can be regulated, enabling control of the biochemistry of the cell as a whole. The structure of proteins is traditionally described in a hierarchy of four levels. The primary structure of a protein simply consists of its linear sequence of amino acids; for instance, "alanine-glycine-tryptophan-serine-glutamate-asparagine-glycine-lysine-â€¦". Secondary structure is concerned with local morphology morphology being the study of structure. Tertiary structure is the entire three-dimensional shape of the protein. This shape is determined by the sequence of amino acids. In fact, a single change can change the entire structure. The alpha chain of hemoglobin contains amino acid residues; substitution of the glutamate residue at position 6 with a valine residue changes the behavior of hemoglobin so much that it results in sickle-cell disease. Finally, quaternary structure is concerned with the structure of a protein with multiple peptide subunits, like hemoglobin with its four subunits. Not all proteins have more than one subunit. They can then be joined to make new proteins. Intermediate products of glycolysis, the citric acid cycle, and the pentose phosphate pathway can be used to make all twenty amino acids, and most bacteria and plants possess all the necessary enzymes to synthesize them. Humans and other mammals, however, can synthesize only half of them. They cannot synthesize isoleucine , leucine , lysine , methionine , phenylalanine , threonine , tryptophan , and valine. These are the essential amino acids , since it is essential to ingest them. Mammals do possess the enzymes to synthesize alanine , asparagine , aspartate , cysteine , glutamate , glutamine , glycine , proline , serine , and tyrosine , the nonessential amino acids. While they can synthesize arginine and histidine , they cannot produce it in sufficient amounts for young, growing animals, and so these are often considered essential amino acids. The amino acids may then be linked together to make a protein. It is first hydrolyzed into its component amino acids. A suitable method for excreting it must therefore exist. Unicellular organisms simply release the ammonia into the environment. Likewise, bony fish can release the ammonia into the water where it is quickly diluted. In general, mammals convert the ammonia into urea, via the urea cycle. Methods like sequence alignments and structural alignments are powerful tools that help scientists identify homologies between related molecules. By finding how similar two protein sequences are, we acquire knowledge about their structure and therefore their function. Nucleic acids , so called because of their prevalence in cellular nuclei , is the generic name of the family of biopolymers. They are complex, high-molecular-weight biochemical macromolecules that can convey genetic information in all living cells and viruses. Because they contain at least one phosphate group, the compounds marked nucleoside monophosphate, nucleoside diphosphate and nucleoside triphosphate are all nucleotides not simply phosphate-lacking nucleosides. The most common nitrogenous bases are adenine , cytosine , guanine , thymine , and uracil. The nitrogenous bases of each strand of a nucleic acid will form hydrogen bonds with certain other nitrogenous bases in a complementary strand of nucleic acid similar to a zipper. Adenine binds with thymine and uracil; thymine binds only with adenine; and cytosine and guanine can bind only with one another. Aside from the genetic material of the cell, nucleic acids often play a role as second messengers , as well as forming the base molecule for adenosine triphosphate ATP , the primary energy-carrier molecule found in all living organisms.

Chapter 6 : Chemistry - Wikipedia

Chemistry plays a vital role in our survival, and life without chemicals can't even be imagined. They participate in the primary functions of the body, control our emotions, oversee the metabolic processes and keep diseases at bay.

Chapter 7 : Chemistry News - Biochemistry, Polymers, Materials Science

Chemistry in everyday life is a very interesting topic. You yourself are a big bag of chemicals! While some may be obvious, some other might surprise you.

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Our bodies are made of chemicals. When we eat, breathe, or just sit down, chemical reactions are taking place. In fact all matter is made from some kind of chemicals so chemistry is the study of.

Chapter 9 : You'll Be Amazed By These Examples of Chemistry in Everyday Life

In more formal terms chemistry is the study of matter and the changes it can undergo. Chemists sometimes refer to matter as 'stuff', and indeed so it is.