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From the Editorial

"Science does not know its debt to imagination"
-Ralph Waldo Emerson

Chemistry is a Science as well as an Art which deals with thousands of substances, or forms of matter, of which all bodies are composed. It is an important part of man's effort to understand the world in which we live and to obtain a mastery of natural forces. It helps in better understanding of the nature of the world and of the phenomena that take place around us.

The twelfth volume of CHRYSL Chemistry Resonating in Young Students Lives has blossomed this year and is now in your hands. CHRYSL serves as a perfect blend of articles, facts, jokes, crosswords and thoughts contributed by our faculty and students.

It is impossible to feel the touch of this magazine without expressing our gratitude to our Principal Dr.(Sr). Ugini Fathima Mary. L, Head of the Department, Dr. Jhancy Mary. S and members of the faculty of our Department without whose help and guidance this magazine would have remained only as a piece of draft. We do acknowledge the writers, our dear students for their contributions. They have made a great effort to select topics of modern trends and were creative in designing the content of their writing. Every article will give new insights in understanding the chemistry of life.

So readers! Dive into the pool of information and come out, not only loaded with extra knowledge but with a greater affinity for the wonder that is 'CHEMISTRY.'

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WHY EATING PICKLES IN EXCESS IS BAD FOR HEALTH?

Pickles are an integral part of Indian cuisine and no meal is complete without them but too much of this can be extremely harmful for your health.

How do pickles harm your health?

i. **High salt content**: We all know that one should not consume large quantities of salt as it increases the risk of hypertension and heart disease. It is also the main reason for swelling and water retention, which causes the volume of blood to increase thereby causing high blood pressure. As per WHO, the recommended dietary intake of salt is 5 g/day or one teaspoon, which is far less than the salt content in one teaspoon of pickle. Homemade pickles are better in quality as the table salt is used in their preservation whereas, commercially prepared pickles are preserved using various chemicals such as sodium benzoate which are very harmful. Sodium benzoate is a potential carcinogen because it deprives cells of oxygen and breaks down the immune system causing cancer.

ii. **Too much oil:** When pickles are made, vegetables are soaked in oil as oil acts as a barrier from moisture thus preserving them. Oil also prevents the contamination of pickles by bacteria and fungus which in generally cause the decaying or rotting of food. But remember that the same oil also increases your cholesterol levels, which means you suffer the risk of contracting heart disease or worsening it. High cholesterol levels also damage the liver in the long run.

iii. **Increase the risk of gastric cancer** : A study conducted in southern India, among people with same dietary patterns and socio economic background, has shown that the consumption of pickled vegetables increases the risk of developing gastric cancer.

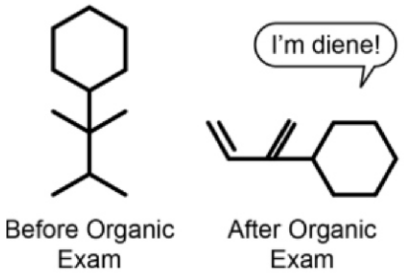
iv. **Increase the risk of oesophageal cancer:** Studies have shown that consumption of pickles doubles the chances of developing oesophageal cancer. Although the study did not give conclusive results but the risk factors cannot be neglected.

If pickles have so many harmful effects on your body, why does the Indian tradition recommend pickle in small quantities? The reason is that it is also a store of good bacteria which helps in the functioning of the gastrointestinal tract.

Life is not easy for any of us.
But what of that? We must have
Perseverance and above all Confidence
in ourselves. We must believe that we are gifted for something
and that this thing must be attained. -Marie Curie

CHEMISTRY JOKES & FUN

1. Question: What is the name of the molecule CH_2O?
   Answer: Seawater.
2. Teacher: What is the formula for water?
   Student: H, I, J, K, L, M, N, O
   Teacher: That's not what I taught you.
   Student: But you said the formula for water is…H to O.
3. A word made only out of chemical symbols.
   Helicopter: He helium, Li lithium, Co cobalt, Pt platinum, Er erbium.
4. One atom of potassium + one atom of iodine + two atoms of sulphur = ?
   Ans: KISS.
5. In a glass if we add water and Cyclohexane, which will float?
   Cyclohexane because it exists in the boat form.
6. Organic Chemistry



7. A neutron walks into a shop, I'd like to have a coke, he says. The shop keeper serves the coke "how much will that be?" asked the neutron. The shop keeper replied, "No charge" for you.
8. Why are chemists so great at solving problems?
   Answer: Because they have all the solutions.
9. Q: What is the molecular formula for coffee?
   A: $CoFe_2$
10. Bear : Why are you shouting for help in water?
    Polar bear: I am dissolving in water.
    Bear : No, you are bear. So you are insoluble in water.
    Polar bear: I think you do not understand, because I am polar.

NANOTECHNOLOGY

Evolution of Nanotechnology

Richard Feynmann, an American physicist in the year 1959, had described a process by which the ability to manipulate individual atoms and molecules might be developed, using one set of precise tools to build and operate another proportionally smaller set. Richard Smalley is best known for co-discovering the soccer ball-shaped 'buckyball' molecule and many of its applications whics are efficiently used in many fields. He is also called as "Father of Nanotechnology"

What is Nanotechnology?

Nanoscience and nanotechnology are the study and application of extremely small things and can be used across all the other science fields such as chemistry, biology, physics, material science and engineering. Nanometer is one-billionth of a metre, smaller than the wavelength of visible light and a hundred-thousandth the width of a human hair. Nanotechnology deals with anything measuring between 1 and 100 nm.

Applications of Nanotechnology

Fabrics

Usage of nano sized particles in fabrics has improved its properties without significant increase in weight thickness or stiffness. Incorporating nano-whiskers into fabric is used to make pants of light weight and stain repellent. For example: Silver nanoparticles in fabric kills bacteria and makes cloth odour resistant.

Solar Cells

Solar panel films incorporate nano particles called colloidal quantum dots, to create light weight & flexible solar cells. It is cheaper to manufacture and easier to install.

Medicine

Nano particles is used to deliver drugs, heat, light & other substances to specific types of cells, especially cancer cells. One of the main advantage is it only treats the cancerous cells and do not damage the surrounding cells or organs in the body. For example: Gold and Bismuth nano particles are used to treat cancer.

Sporting Goods

Nano materials such as carbon nano tubes, silicon nano particles, nano clay fullerenes etc., are incorporated into various sports equipments such as base ball bats, tennis and badminton racquets, fishing rods, archery arrows, sports shoes etc. inorder to increase the control and power.

Nature

Gecko feet are covered with nano sized hairs that use inter molecular forces allowing the lizards to stick

firmly to surfaces. By replicating this, a nano sized adhesive is developed that is biodegradable and can seal wounds or patch caused by a stomach ulcer.

Agriculture

Nano capsules is used to deliver vaccines, fertilizers and other agriculture chemicals more efficiently. Nano sensor is used for monitoring soil conditions and crop growth and also for the detection of animal and plant pathogens.

Electronics

Nano electronics helps in improving display screens on electronic devices. It consumes less power and decreases the thickness and weight of screens. For example: Cadmium selenide nano crystals deposited on plastic sheets form flexible electronic circuits. In future, graphene will become a dominant material in flexible electronics, since it has good electrical conductivity, flexibility and physical strength.

Fuel Cells

Platinum catalyst is used with fuel such as methanol to produce hydrogen ions. Whereas, the catalyst made from a sheet of graphene coated with cobalt nano particle, replaces the expensive pure platinum based catalyst.

Water Purification

Carbon nanotubes are tiny hexagonal tubes made of rolling sheets of graphene. Carbon nanotube filters remove bacteria and viruses more effectively than conventional membrane filters. It is also used to separate harmful organics and removes heavy metal ions from water.

Disadvantages

- Nanoparticles due to their small size can cause inhalation problem and many other fatal diseases.
- The disadvantages can be avoided by creating rules about the use of nanotechnology, with respect to the environment and people health. If it is correctly exploited it can definitely improve the life quality of future generation.

Conclusion

Nanotechnology is a brand new technology that has just begun, it is a revolutionary science that will change all what we knew before. The current research covers an array of industries and various sectors although much of the focus has been on environment, health and safety.

"The next BIG thing is really SMALL"

STABLE CAESIUM-DOPED PEROVSKITES BOOST SILICON SOLAR CELLS

A team of scientists from the UK and Germany has found that adding caesium to a perovskite solar cell can improve its photo stability. The caesium-doped lattice also has the potential to increase the efficiency of a conventional silicon solar cell when placed on top.

Perovskite solar cells have an organometallic halide structure, with a typical device containing a mixture of formamidinium, lead, bromine and iodine. Although their efficiencies have been climbing in recent years, their stability has been questioned.

This instability may arise as iodine-rich regions form in the cell under light. Such changes restrict the voltages obtainable in the device. David McMeekin, from the University of Oxford, UK, and his colleagues have solved this problem by replacing a small fraction of the formamidinium cations with caesium to maintain a single crystalline phase.

The cells wavelength response does not change after one hour of illumination and it has an efficiency of 14.7%, when measured over a 0.715 cm^2 surface area. When layered on top of a silicon solar cell the modified perovskite boosted its efficiency by 7.3%.

GRAPHENE SIEVES DEUTERIUM FROM HYDROGEN

Materials composed of a single layer of atoms, such as graphene, can separate hydrogen and deuterium more effectively than almost any other process. It is the conclusion of scientists in the UK, who believe the new sieves could slash production costs for deuterium for nuclear power generation and research. Deuterium, a heavier isotope of hydrogen containing a neutron in addition to a proton is widely used in the nuclear industry. Combined with oxygen to make 'heavy' water, it is used in fission reactors to slow down emitted neutrons. It is also used in prototype fusion reactors, where deuterium ions are fused with ions of tritium (hydrogen with two neutrons) and helium-3 among others.

In heavy water form, deuterium is present in very small quantities in the Earth's oceans, but is not especially easy to extract. The production of heavy water normally begins with the energy intensive Girdler sulfide process, which typically enriches seawater to about 20% heavy water through a loop reaction with hydrogen sulfide. Nuclear-grade heavy water is at least 99% pure so further processing steps that include electrolysis, which is again energy intensive, or distillation, which is very slow, are needed.

Graphene sieves could offer a simple and cheaper way of producing deuterium for nuclear power stations.Atom-thick membranes, according to chemists and physicists at the University of Manchester, could

extract deuterium more quickly and efficiently. In 2014, the researchers demonstrated that hydrogen nuclei could permeate graphene and a structurally similar material, boron nitride, with the help of a small applied voltage. Now they have gone one step further, by showing that the two-dimensional sheets have a preference for passing common hydrogen nuclei over those of deuterium, and tritium too.

The researcher's measurements show that graphene and boron nitride exhibit an isotope enrichment factor of about 10 for heavy water mixed with normal water. That is in contrast to the Girdler sulfide process, which has an enrichment factor of about two to three, up to 10 for electrolysis or a little over one for distillation. The preference of the graphene and boron-nitride sieves for hydrogen over deuterium is thought to be due to hydrogen's greater vibrational energy, which allows it to 'jump' over the materials' energy barrier.

Karl Johnson at the University of Pittsburgh in Pennsylvania, calls the isotope enrichment demonstration a 'very significant achievement', but believes the sieves would be more useful if they worked the other way around that prefers deuterium over hydrogen. That way, he says, you would only need a little electrical energy to transport the relatively small amount of deuterium across the sieve, rather than a lot of energy to transport the much greater amount of hydrogen.

Even a member of the Manchester group, says that the energy cost of graphene or boron nitride-based isotope separation ought to be at least 10 times lower than most other methods. Moreover, she believes that large sieves made by chemical vapour deposition could soon be used in industry, as soon as they can be incorporated into the existing industrial infrastructure, which should be a relatively simple engineering task.

CURIOSITY ROVER FINDS SILICA ON MARS - A SIGN OF ANCIENT FLOWING WATER

Curiosity found large amounts of silica and also the mineral tridymite, never before seen on Mars. Both provide more clues to the Red Planet's wat

CURIOSITY ROVER

After more than three years of exploring Mars, NASA's robotic detective, Curiosity, has stumbled on a couple of intriguing discoveries that could help scientists piece together the puzzle of how water formed, moved, and then either froze or disappeared from the Red Planet. In the last several months, Curiosity has for the first time found an abundance of the rock-forming chemical silica, a mineral composed of silicon and oxygen and, on Earth, usually deposited by water. “On earth, all the environments where we find this kind of silica require some kind of water activity,” he explained. “Often it's also a very nice environment to find microbial life.”

And, “adding to the puzzle,” as NASA explains, some of the silica at one Martian rock Curiosity drilled, called "Buckskin," is in a mineral named tridymite, which is rare on Earth and has never been seen on Mars. On our own planet, the mineral can be found in the silica-rich rocks spewed by volcanoes, so the discovery of tridymite at Buckskin may be evidence for the evolution of volcanoes on Mars. Or may be tridymite is formed by a different process on the Red Planet, say scientists who are analyzing the latest findings from Curiosity.

"We could solve this by determining whether trydymite in the sediment comes from a volcanic source or has another origin," said Elizabeth Rampe, a planetary geologist at NASA's Johnson Space Center in Houston."A lot of us are in our labs trying to see if there's a way to make tridymite without such a high temperature," she said.

For seven months, Curiosity has been traversing an area of the Red Planet scientists call Marias Pass, near the base of a mountain called Mount Sharp. There, the rover saw a light patch of land where two geologic formations meet, an older layer of mudstone, covered by a younger layer of sandstone. The rover used a laser to identify the composition of the rocks, discovering 90 percent more silica than it had seen anywhere on or around Mount Sharp, as The New York Times reported."These high-silica compositions are a puzzle,” said Albert Yen, a scientist at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, Calif., in an announcement.

“You can boost the concentration of silica either by leaching away other ingredients while leaving the silica behind, or by bringing in silica from somewhere else. Either of those processes involves water. If we can determine which happened, we'll learn more about other conditions in those ancient wet environments," he explained. Curiosity has been studying the geological layers of Mount Sharp since 2014, after two years of exploring the plains surrounding the mountain. The rover, a self-driving cart loaded up with lasers, cameras, and detectors, has since discovered that the lakes that probably existed in the area billions of years ago could have supported life. “What we're seeing on Mount Sharp is dramatically different from what we saw in the first two years of the mission,”

At a meeting of the American Geophysical Union in San Francisco, where researchers presented some of their latest findings on Mars, Dr. Vasavada said that scientists have observed signs of the building blocks for life on Mars, according to the Times.“Stay tuned,” he said. “There are organics in several of these samples we've been seeing lately.”

SCIENCE BEHIND HONEY

Honey derives from plant nectar, which is a mix of various different sugars, proteins and other compounds, in a water solution. While nectar composition varies from plant to plant, often the dominant sugar is sucrose.

Step: 1

Bees are the key intermediate step between nectar and honey. Worker bees will collect the nectar from flowers, and store it in their honey stomach distinct from their normal stomach. Enzymes secreted from glands

are then mixed with the nectar; these enzymes begin the breakdown of the sucrose in the nectar to simpler sugars. Sucrose consists of two different simpler sugars, glucose and fructose, joined together. In the bee's honey stomach, the sucrose molecules are gradually split by the enzymes into glucose and fructose.

Step: 2

Once the worker bee returns to the hive, it will pass it on nectar solution to one of the house bees, who remain in the hive. The house bee will continue the process, it will re-drink the nectar, continuing to mix it with enzymes and breaking it down further. While some sucrose will remain, the majority is broken down into glucose and fructose. Once suitable breakdown has been achieved, the house bee deposits the nectar into the honeycomb in the hive.

Step: 3

Then another important step in the process begins. Nectar can be up to 70% water, and this water must be evaporated in order to produce the consistency of honey. The bees achieve this by fanning the honeycomb with their wings in order to encourage rapid evaporation of the water from the nectar mixture. Eventually, the water content of the solution will drop to around 17%, vastly reduced from the content of the original nectar. The conversion of the watery nectar to syrupy honey takes between 1-3 days.

Reason for Honey Being Not Spoiled

The water content of honey is a key factor to why it doesn't spoil. At 17%, its water content is much lower than that of bacteria or fungi. Honey also has a low water activity; this is a measure of the amount of water in a substance that is available to support microbial growth. Water activity is on a scale of 0 to 1, with most moulds and bacteria being unable to grow under a water activity of 0.75. Honey has a water activity of 0.6. This, combined with the fact that its low water content dehydrates bacteria, makes it resistant to spoiling.

Another factor that helps honey avoid spoiling is its acidity. Its average pH is around 4; this acidity is contributed to by a number of acids, including formic acid and citric acid, but the dominant acid is gluconic acid, produced by the action of bee enzymes on some of the glucose molecules in the honey. This further boosts honey's antibacterial properties.

WHAT ARE ANTIOXIDANTS?

All of us love drinking fruit juice. Did you know? They provide us with a nutrient we really need called antioxidants.

Oxygen free radicals

The food we eat and the oxygen we breathe are carried to all parts of the body by the blood. These then enter every cell. Here they go through complex chemical reactions called the Krebs cycle. In the end, this releases water and energy.

Sugar + Oxygen → Energy + Water + CO_2

However, oxygen is a very dangerous element. In the body, it reacts with many other biochemicals to form reactive oxygen species (ROS). These include hydrogen peroxide (H_2O_2), hypochlorous acid (HOCl), hydroxyl radicals ($^{\cdot}OH$) and superoxide ions (O^{2-}). These ROS can break up proteins and DNA, causing genetic mutations and enzyme failure. In the end this leads to rashes, ulcers and inflammation, which can make you quite sick.

The bodies own antioxidants

To deal with these ROS, our body has many antioxidants of its own. These chemicals attack the dangerous oxygen species and convert them to safer chemicals like water and carbon dioxide. Some of these antioxidants include superoxide dismutase, catalase and glutathione. However, when we eat foods rich in carbohydrates and fats, they produce a lot of ROS in the body. Then its own antioxidants are not enough for the task. We need to get more antioxidants through our food. That's why we need vegetables and fruits.

Foods rich in antioxidants

There are many chemicals found in plants that act as good ROS fighters. These include β carotene (Vitamin A), ascorbic acid (Vitamin C), tocopherol (Vitamin E) and the element selenium. Vegetables like carrots, pumpkins, tomatoes and spinach are rich in β carotene, while citrus fruits (oranges and mangoes) are rich in vitamin C. Grains and vegetable oils are quite rich in vitamin E, while fish are good for selenium.

NACREOUS CLOUDS

Nacreous clouds are wave clouds and are often found downwind of mountain ranges which induce gravity waves in the lower stratosphere. Their sheet-like forms slowly undulate and stretch as the waves evolve. The clouds can also be associated with very high surface winds which may indicate the presence of, or induce, winds and waves in the stratosphere. Nacreous clouds resemble Cirrus or almond-shaped "Altocumulus". The most brilliant colours are observed when the sun is several degrees below the horizon.

These clouds form in the stratosphere, between 10 and 30 miles up. Clouds we see every day actually form in the troposphere, with cirrus clouds being the highest at about 6 miles up. The next layer in our atmosphere is the stratosphere, which is separated from the troposphere. The stratosphere is very different to the troposphere; it is made up of thin dry air in stable conditions. Also in contrast to the troposphere, the temperature rises from the bottom to the top in the stratosphere, which is caused by the absorption of heat from the ozone layer. Also, the stratosphere is very dry and it is rare for moisture to find its way into this layer of the atmosphere. The ice crystals that form nacreous clouds are pushed up into the stratosphere by wave winds that are so strong they oscillate up through the troposphere and into the stratosphere layer above.

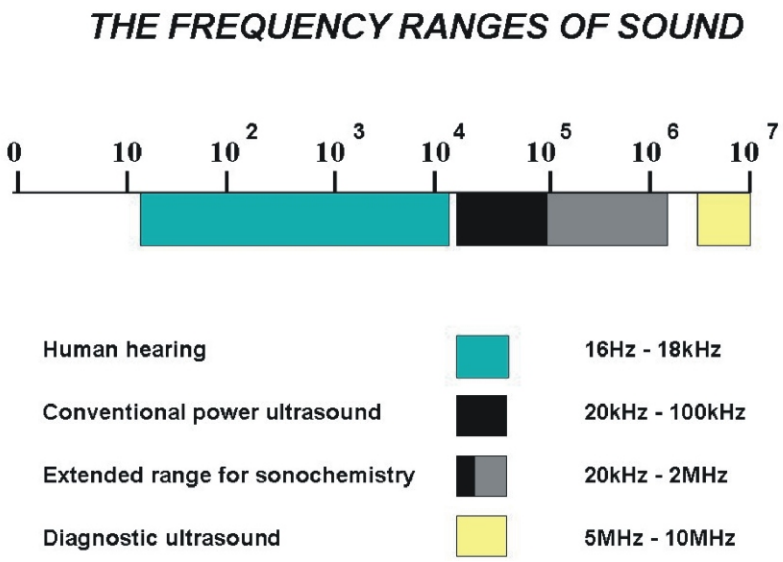
They form at temperatures of around minus 85ºC, colder than average lower stratosphere temperatures, and are comprised of ice particles ~10μm across. The iridescent colours of nacreous cloud are due to the ice crystals being of a uniform shape and size and the cloud cover being thin. The sun has to be at just the right angle below the horizon to cause diffraction and interference with the crystals to produce these beautiful colours. The clouds must be composed of similar sized crystals to produce the characteristic bright iridescent colours by diffraction and interference. An incredible fact is these beautiful clouds actually harm the ozone layer.

SONOCHEMISTRY

Introduction

Sonochemistry is the chemical effects of ultrasound on aqueous and non-aqueous solutions. The effects are due to acoustic cavitations which includes the nucleation, growth and violent collapse of gas/vapor filled micro bubbles in a liquid. The widely accepted Hot Spot Theory proposes that collapse of these micro bubbles is an almost adiabatic process.

This results in the creation of very high temperatures (thousands of Kelvin) and pressures (hundreds of atmospheres) in extremely small and transient regions in the liquid (Hot Spots). The collapse of bubbles is accompanied by the simultaneous emission of light (Sonoluminescence). This article describes the detection of radical species produced as a result of acoustic cavitations in aqueous solutions.

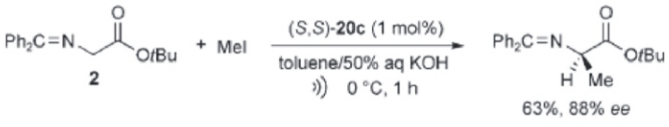


Frequency ranges of sound

Classification of Sonochemistry

- Low frequency-high power ultrasound (20-100kHz)
- High frequency-medium power ultrasound (100KHz-1MHz)
- High frequency-low power ultrasound (1-10MHz)

Applications of Sonochemistry in Synthesis



Scheme: Ultrasonication enhances the reaction rate during the asymmetric synthesis of α-amino acids (Maruoka et al. 2007)

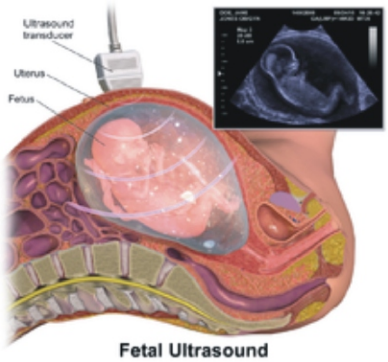
- Sonication can be used for the production of nanoparticles, such as nanoemulsions, nanocrystals, liposomes and wax emulsions, as well as for wastewater purification, degassing, extraction of plant oil, extraction of anthocyanins and antioxidants, production of biofuels, crude oil desulphurization, cell disruption, polymer and epoxy processing, adhesive thinning, and many other processes.
- It is applied in pharmaceutical, cosmetics, water, food, ink, paint, coating, wood treatment, metalworking, nanocomposite, pesticide, fuel, wood product and many other industries.
- The sonochemical method is advantageous as it is nonhazardous, rapid in reaction rate and produces very small metal particles.
- Ultrasound has been shown to act synergistically with antibiotics in bacterial cell killing.
- Ultrasonic waves are used for cutting and machining.
- **Ultrasonic cleaning**

It is the most cheap technique employed for cleaning various parts of the machine, electronic assembles, armatures, watches etc., which cannot be easily cleaned by other methods.

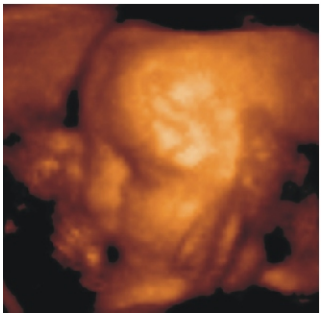
- **Diagnostic sonography**

Medical sonography (ultrasonography) is an ultrasound-based diagnostic medical imaging technique used to visualize muscles, tendons, and many internal organs, their size, structure and any pathological lesions.

They are also used to visualize the foetus during routine and emergency prenatal care. Ultrasound scans are performed by medical health care professionals called sonographers. Obstetric sonography is commonly used during pregnancy.



Fetal Ultrasound



Head of a foetus, aged 29 weeks, in a "3D ultrasound

Obstetric ultrasound is primarily used to:

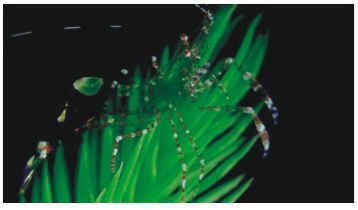
- *Date the pregnancy*
- *Check the location of the placenta*
- *Check for the number of fetuses*
- *Check for physical abnormalities*
- *Check the sex of the baby*
- *Check for fetal movement, breathing, and heartbeat.*

Ultrasonic Examination

WHEN THEY TRY TO ESCAPE, THESE INVISIBLE SHRIMP BECOME VISIBLE

The tiny anemone shrimp (Ancylomenes pedersoni) has nearly perfected the art of invisibility: Despite having the organs, blood, and other body fluids that make most opaque, they have achieved an uncanny, superhero like translucence. But they may lose these superhero powers when it matters most, report physiologists.

Researchers had assumed that transparent animals are always clear as glass. But while collecting anemone shrimp, a graduate student on the team noticed that after a few close calls, one shrimp's body turned cloudy. The more tail flips it did, the more opaque it became. However, the cloudiness went away after a couple of hours. Suspecting that altered blood flow from exercise might be to blame, the researchers measured how much blood was getting into the shrimp's muscles.



They also used electron microscopy to look for structural changes between transparent and opaque muscle. They found that whenever the shrimp made sudden movements, blood flow increased and caused light to scatter, thus making the shrimp visible. Researchers described the difference as akin to that of packed ice and snow. Both substances are made of frozen water and lack any light-absorbing pigment. In ice cubes, each layer bends the light at exactly the same angle, allowing it to pass through easily. But in a snowman, air spaces between the snowflakes cause light to scatter in many different directions at many different angles.

All the colors in the incoming light bounce off the snowman, making him look white. The shrimp, when resting, circulates just a small amount of blood to its tail through one major vessel. But when startled, it opens up more blood vessels, allowing blood to surround the muscle fibers. Differences between the way the blood and the fibre scatter light create the "snowman look."

The researchers also discovered that other stresses, such as altering salt levels in the shrimp tanks, cause them to become cloudy as well. Aside from exposing a weakness in the shrimp's camouflage strategy, the work drives home how challenging it is to achieve transparency in whole animals, as opposed to single tissues like eye lenses.

BIOMIMETICS

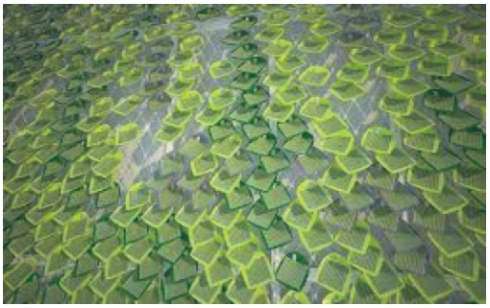
Biomimetic refers to human-made processes, substances, devices, or systems that imitate nature. The art and science of designing and building biomimetic apparatus is called biomimetics. Biomimetics also known as Bionics, biognosis, biomimicry or bionical creativity engineering is the application of biological methods. For example Leonardo da vinci (1452-1519) was first who attempted to create a flying machine by immitating a flying bird.

Application of biomimetics

- Machine vision systems
- Machine hearing systems
- Signal amplifiers
- Navigational systems
- Data converters
- Neural networks
- Nanorobot antibodies (to seek and destroy disease-causing bacteria)
- Artificial organs, arms, legs, hands and feet
- Implantable devices

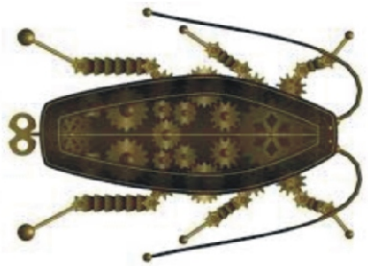
Self-repairing Solar Cells

It is inspired by photosynthesis. The design involves carbon nanotubes studded with phospholipid disks. The resulting photo-electrochemical solar cells are believed to be self-repairing and twice as efficient as the best solid-state solar panels. Engineers try to prevent degradation in solar cells by using solid-state inorganic materials. Nature on the other hand does not try to prevent degradation, but uses various self-healing processes to anticipate and repair the damage caused to liquid state organic materials. This design tries to mimic refurbishing activity by using synthetic disk molecules called phospholipids, each of which carries its own internal reaction centre to convert light into an electric current. When dissolved in a solution containing carbon nanotubes, the disks self-assemble around them. Since carbon conducts electricity better than metals, the nanotubes enhance the transport of electrons freed inside the disks by their exposure to sunlight



Bio-mimetics: commercial successes

- Autoflex MARAG, based on the structural surface features of moth eyes, is an optical thin-film coating that eliminates light reflection and glare. Applications include coatings for PDAs and solar cells.
- The 20 milli micron optically perfect GRIN lenses found on the exoskeleton of certain brittle sea stars and the glass fibres found on a particular glass tea sponge, are influencing the development of micro-lenses and fibre optics respectively.
- BioAvert an object-avoidance software program. Is based on the neural network behaviour of cockroaches.
- Super Microft, an award winning fabric developed by mimicking the water-repelling properties of the lotus leaf including the surface micro-texture.



Recent researches include:

- The design of thermal collectors and clothing inspired from polar bear fur.
- The arrangement of leaves on a plant has been adapted for better solar power collection.
- The self-sharpening teeth of many animals have been copied to make better cutting tools.

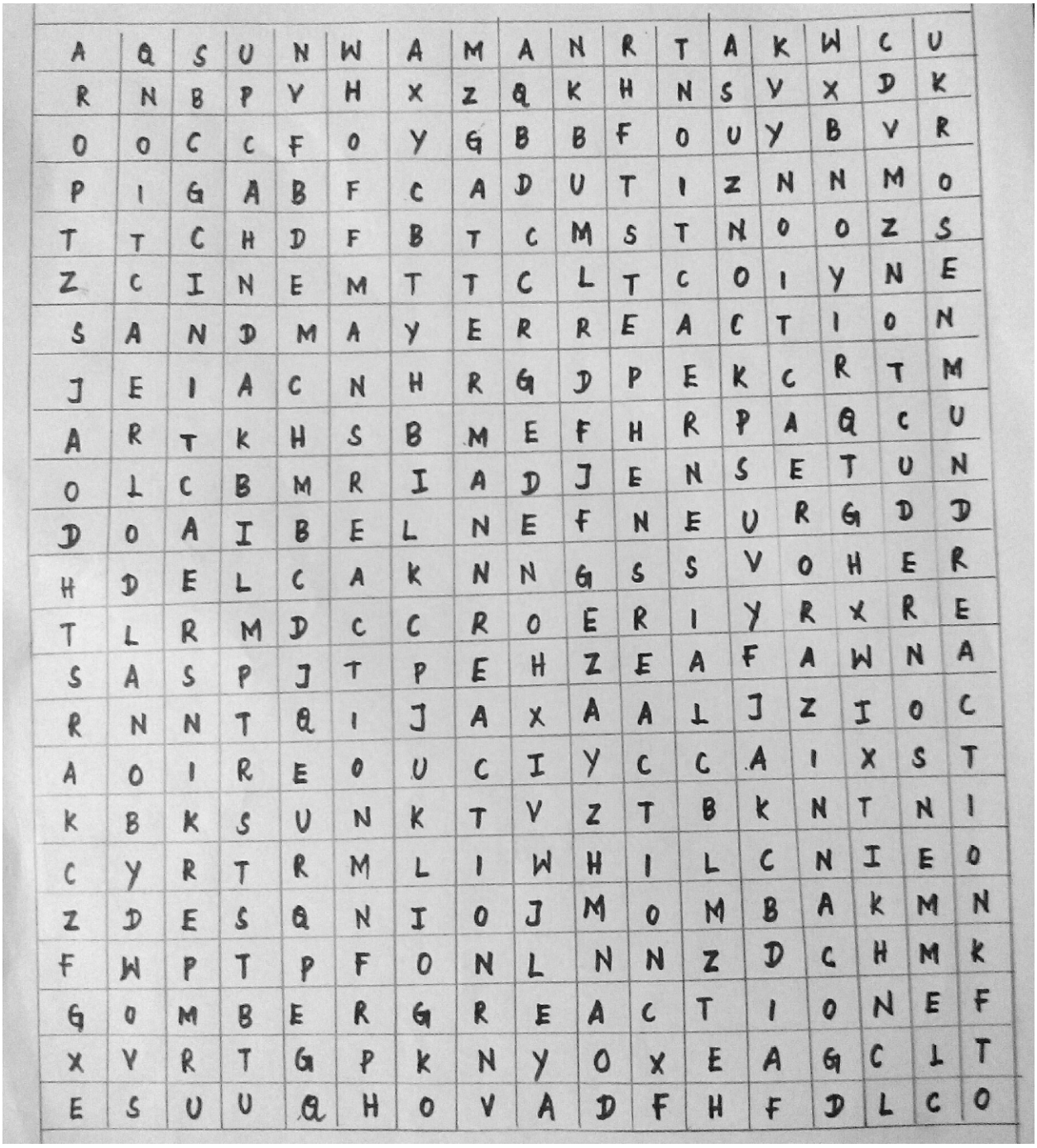
CONFUSING ELEMENT SYMBOLS EXPLAINED

Most of the chemical symbols for elements in the periodic table make perfect sense; there is a small selection, however, that seem to bear no relation to their elements name.

Element	Symbol	Origin
Sodium	**Natrium (Na)**	Latin name, 'natrium', derives from the Greek 'nítron' (a name for sodium carbonate). Its original source is likely to be the Arabic work 'natrun'.
Potassium	**Kalium (K)**	'Kalium' is it's Latin name, and derives from the Arabic 'al qalīy', meaning "calcined ashes" (the ashes left over when plant material is burned).
Iron	**Ferrum (Fe)**	Iron's Latin name, 'ferrum', gives it its symbol Fe; it simply means 'iron' or 'sword', and is possibly of Semitic origin.
Copper	**Cuprum (Cu)**	Copper's Latin name was 'cyprium', the Greek name for Cyprus. The island of Cyprus was famous centuries ago for its copper reserves. The name was eventually simplified to 'cuprum', and then to copper.
Silver	**Argentum (Ag)**	The Latin name for silver, 'argentum', is thought to derive originally from an Indo-European language, likely referring to the metal's shineness. The country Argentina is named after silver and is the only country to be named after a chemical element.

Tin	**Stannum (Sn)**	Tin's Latin name, 'stannum', may be derived from the Indo-European 'stag' (dripping) because tin melts at a low temperature.
Antimony	**Stibium (Sb)**	The Latin 'stibium' derives from the Greek word 'stíbi', meaning eye paint, referring to the use of antimony compounds as an ancient eye cosmetic.
Tungsten	**Wolfram (W)**	Wolfram was named after the mineral it was found in, wolframite. This is from the German 'wolf rahm', or 'wolf's foam', referring to the amount of tin 'eaten' by the metal during its extraction.
Gold	**Aurum (Au)**	The Latin name for gold was 'aurum', meaning 'yellow', derived from the word 'aurora' ('dawn'). The name 'gold', used in Germanic languages, means 'yellow, shining metal'.
Mercury	**Hydrargyrum (Hg)**	Mercury's original Latin name was borrowed from the Greek 'hydrargyros' (liquid silver) to give 'hydrargyrum'. The original English name for the element was 'quicksilver'. Alchemists considered it to be close to gold, and because of this they named it Mercury, after the planet closest to the Sun.
Lead	**Plumbum (Pb)**	Lead's Latin name, 'plumbum', likely originally derives from a language pre-dating Ancient Greek. This Latin name is also the source of the English words 'plumbing' and 'plumber', due to the historic use of lead in water pipes.

FIND THE NAMED REACTIONS IN ORGANIC CHEMISTRY



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R	N	B	P	Y	H	X	Z	Q	K	H	N	S	V	X	D	K
O	O	C	C	F	O	Y	G	B	B	F	O	U	Y	B	V	R
P	I	G	A	B	F	C	A	D	U	T	I	Z	N	N	M	O
T	T	C	H	D	F	B	T	C	M	S	T	N	O	O	Z	S
Z	C	I	N	E	M	T	T	C	L	T	C	O	I	Y	N	E
S	A	N	D	M	A	Y	E	R	R	E	A	C	T	I	O	N
J	E	I	A	C	N	H	R	G	D	P	E	K	C	R	T	M
A	R	T	K	H	S	B	M	E	F	H	R	P	A	Q	C	U
O	L	C	B	M	R	I	A	D	J	E	N	S	E	T	U	N
D	O	A	I	B	E	L	N	E	F	N	E	U	R	G	D	D
H	D	E	L	C	A	K	N	N	G	S	S	V	O	H	E	R
T	L	R	M	D	C	C	R	O	E	R	I	Y	R	X	R	E
S	A	S	P	J	T	P	E	H	Z	E	A	F	A	W	N	A
R	N	N	T	Q	I	J	A	X	A	A	L	J	Z	I	O	C
A	O	I	R	E	O	U	C	I	Y	C	C	A	I	X	S	T
K	B	K	S	U	N	K	T	V	Z	T	B	K	N	T	N	I
C	Y	R	T	R	M	L	I	W	H	I	L	C	N	I	E	O
Z	D	E	S	Q	N	I	O	J	M	O	M	B	A	K	M	N
F	W	P	T	P	F	O	N	L	N	N	Z	D	C	H	M	K
G	O	M	B	E	R	G	R	E	A	C	T	I	O	N	E	F
X	V	R	T	G	P	K	N	Y	O	X	E	A	G	C	L	T
E	S	U	U	Q	H	O	V	A	D	F	H	F	D	L	C	O

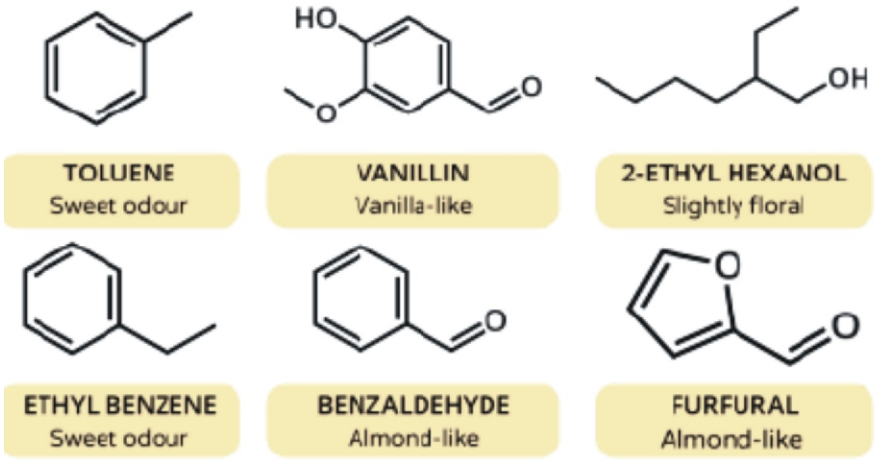
For Answers, see page number 21

OLD BOOK SMELL

Generally, it is the chemical breakdown of compounds within paper that leads to the production of 'old book smell'. Paper contains, amongst other chemicals, cellulose, and smaller amounts of lignin much less in more modern books than in older. Both of these originate from the trees the paper is made from; In trees, lignin helps bind cellulose fibres together, keeping the wood stiff; it's also responsible for old paper's yellowing with age, as oxidation reactions cause it to break down into acids, which then help break down cellulose.
'Old book smell' is derived from this chemical degradation. Modern, high quality papers will undergo chemical processing to remove lignin, but breakdown of cellulose in the paper can still occur (at a much slower rate) due to the presence of acids in the surroundings. These reactions, referred to generally as 'acid hydrolysis', produce a wide range of volatile organic compounds, many of which are likely to contribute to the smell of old books.

A selected number of compounds have had their contributions pinpointed: benzaldehyde adds an almond-like scent; vanillin adds a vanilla-like scent; ethyl benzene and toluene impart sweet odours; and 2-ethyl hexanol has a 'slightly floral' contribution. Other aldehydes and alcohols produced by these reactions have low odour thresholds and also contribute.

Furfural is one of these compounds, shown below. It can also be used to determine the age and composition of books, with books published after the mid-1800s emitting more furfural, and its emission generally increasing with publication year relative to older books composed of cotton or linen paper.



So, in conclusion, as with many aromas, we can't point to one specific compound, or family of compounds, and categorically state that it's the cause of the scent. However, we can identify potential contributors, and, particular in the case of old book smell, a number of compounds have been suggested such as furfural.

MILK

Milk plays a major role in `providing protein for children's growth. Milk is a pale liquid produced by the mammary glands of mammals. Early lactation milk contains colostrums which carries mother's antibodies to its young and can reduce the risk of many diseases. It contains many other nutrients including protein and lactose. Hence feeding of mother's milk up to six months is recommended by WHO. Child produce lactase for digestion whereas adults do not produce lactase to digest the lactose in milk.

Milk products

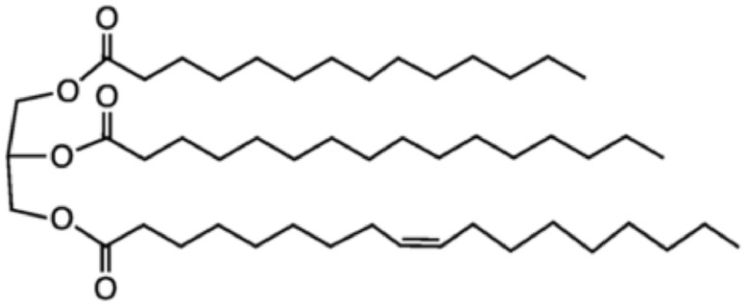
Cream, butter, yogurt, kefir, ice creams and cheese

Industrial products

- Casein, whey protein, lactose, condensed milk and powdered milk.
- Whole milk butter and cream have high levels of saturated fat. Sugar lactose is found only in milk.

Properties of milk

Milk is an emulsion or colloid of butterfat globules within a water-based fluid that contains dissolved carbohydrates and protein aggregates with minerals. The principal requirements are energy (lipids, lactose, and protein), biosynthesis of non-essential amino acids supplied by proteins (essential amino acids and amino groups), essential fatty acids, vitamins and inorganic elements, and water.



Butterfat is a triglyceride (fat) formed from fatty acids such as myristic, palmitic, and oleic acids.

The milk contains fat-soluble vitamins A, D, E, and K along with essential fatty acids such as linoleic and linolenic acid which are found within the milk fat portion of the milk.

Proteins

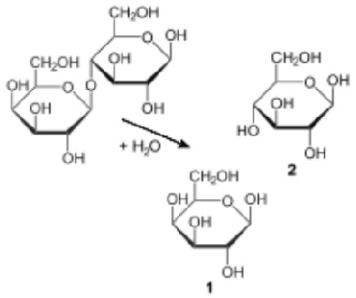
Normal bovine milk contains 3035 grams of protein per liter of which about 80% is arranged in casein micelles.

Caseins

The largest structures in the fluid portion of the milk are "casein micelles": aggregates of several thousand protein molecules with superficial resemblance to a surfactant micelle, bonded with the help of nanometer-scale particles of calcium phosphate.

Constituents

Minerals or milk salt are traditional names for a variety of cations and anions within bovine milk. Calcium, phosphate, magnesium, sodium, potassium, citrate, and chlorine are all included as minerals and they typically occur at concentration of 540 mM. The milk salts strongly interact with casein, most notably calcium phosphate. In addition to calcium, milk is a good source of many other vitamins. Vitamins A, B6, B12, C, D, K, E, thiamine, niacin, biotin, riboflavin, folates, and pantothenic acid are all present in milk.



Lactose

Lactose molecule being broken down into

1. Galactose
2. Glucose

Composition of milk

- Human milk contains, on average, 1.1% protein, 4.2% fat, 7.0% lactose (a sugar), and supplies 72 kcal of energy per 100 grams.
- Cow's milk contains, on average, 3.4% protein, 3.6% fat, and 4.6% lactose, 0.7% minerals and supplies 66 kcal of energy per 100 grams.

Constituents	Unit	Cow	Goat	Sheep	Water buffalo
Water	g	87.8	88.9	83.0	81.1
Protein	g	3.2	3.1	5.4	4.5
Fat	g	3.9	3.5	6.0	8.0
Saturated fatty acids	g	2.4	2.3	3.8	4.2
Monounsaturated fatty acids	g	1.1	0.8	1.5	1.7
Polyunsaturated fatty acids	g	0.1	0.1	0.3	0.2
Carbohydrate (i.e the sugar form of lactose)	g	4.8	4.4	5.1	4.9
Cholesterol	mg	14	10	11	8
Calcium	mg	120	100	170	195
	kcal	66	60	95	110
Energy	kJ	275	253	396	463

Hence it is essential to consume milk every day to make our bones strong and enhance our growth.

SALICYLIC ACID- EVERYDAY CHEMICAL COMPOUND

Salicylic acid is a naturally occurring compound, which can be isolated from the bark of the willow tree. It can be synthetically produced, either by biosynthesis of the amino acid phenylalanine, or from phenol.

Use in Acne Cream & Shampoo

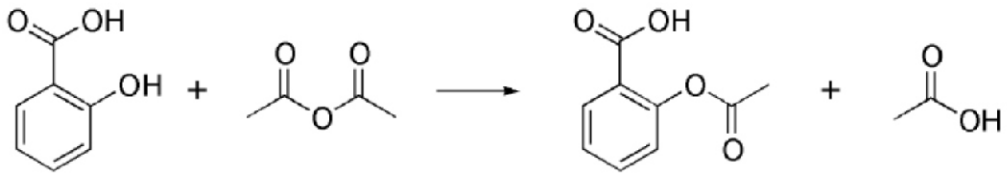
Salicylic acid is a common active ingredient in topical acne creams, usually in concentrations of up to 2 percent. It works by acting as a keratolytic agent, softening the outer layer of the skin and causing the skin cells to shed more readily. It also helps unclog skin pores, but does not affect the oiliness of skin, nor the bacteria which causes acne. Formulations containing 17% and 27% salicylic acid are used for wart removal. Salicylic acid's keratolytic effect is also behind its use in antidandruff shampoos. These will typically contain up to 3% salicylic acid, which helps to loosen and remove dry skin on the scalp.

Use in Toothpastes & Mouthwash

The sodium salt of salicylic acid, sodium salicylate, is often added to mouthwash and toothpastes as an antibacterial agent. Studies have shown that, as well as having its own antibacterial effect, it can promote the effects of other antibiotics in some cases. Due to its antiseptic effect, it also has limited use as a food preservative.

As a Precursor to Aspirin

Salicylic acid is one of the organic compounds from which aspirin can be synthesised. As shown below, it can be reacted with acetic anhydride, using a sulfuric acid or phosphoric acid catalyst, to produce aspirin and acetic acid as a side product.



Aspirin is used as an analgesic to relieve minor aches and pains, and as an anti-inflammatory agent. It is also used long-term at low doses to help prevent heart attacks, strokes, and blood clots in some patients. Around 40,000 tonnes of aspirin are consumed worldwide every year.

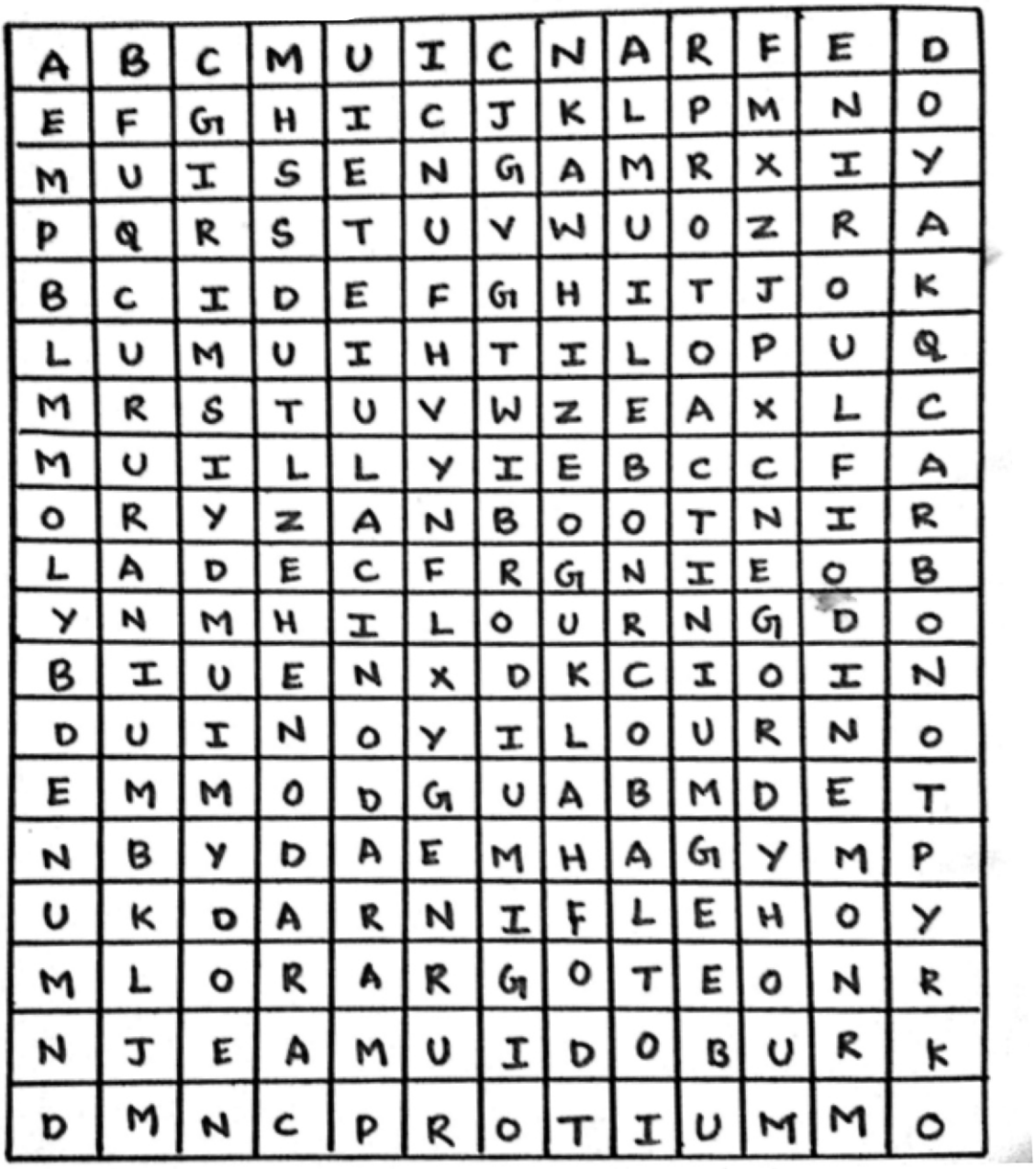
Answers :

1. Clemmenson	6. Stephen
2. Gomberg	7. Cannizaro
3. Gattermann	8. Rosenmund
4. Perkins	9. Hoffmann
5. Aldol	10. Claisen

APPLICATIONS OF RAMAN SPECTROSCOPY

- Raman spectroscopy is commonly used in chemistry, since vibrational information is specific to the chemical bonds and symmetry of molecules. Therefore, it provides a fingerprint by which the molecule can be identified.
- In solid-state physics, spontaneous Raman spectroscopy is used to characterize materials, measure temperature, and find the crystallographic orientation of a sample.
- Raman spectroscopy can be used to observe other low frequency excitations of the solid, such as plasmons, magnons, and superconducting gap excitations.
- Spatially-offset Raman spectroscopy (SORS), which is less sensitive to surface layers than conventional Raman, can be used to discover counterfeit drugs without opening their packaging, and for non-invasive monitoring of biological tissue.
- Raman spectroscopy can be used to investigate the chemical composition of historical documents and contribute to knowledge of the social and economic conditions at the time the documents were produced.
- Raman spectroscopy is being investigated as a means to detect explosives for airport security.
- Raman spectroscopy can be used as a technique for identification of seafloor hydrothermal and cold seep minerals.
- It is used in medicine, aiming to the development of new therapeutic drugs and in the diagnosis of arteriosclerosis and cancer.
- Used to discriminate between healthy and unhealthy tissues, or to determine the degree of progress of a certain disease.
- Raman spectroscopy is the basis for distributed temperature sensing(DTS) along optical fibers, which uses the Raman-shifted backscatter from laser pulses to determine the temperature along optical fibers.
- Raman active fibers, such as aramid and carbon, have vibrational modes that show a shift in Raman frequency with applied stress. Polypropylene fibers also exhibit similar shifts. The radial breathing mode is a commonly used technique to evaluate the diameter of carbon nanotubes.
- Raman spectroscopy has also been used to confirm the prediction of existence of low-frequency phonons in proteins and DNA greatly stimulating the studies of low-frequency collective motion in proteins and DNA and their biological functions.

FIND THE ELEMENTS



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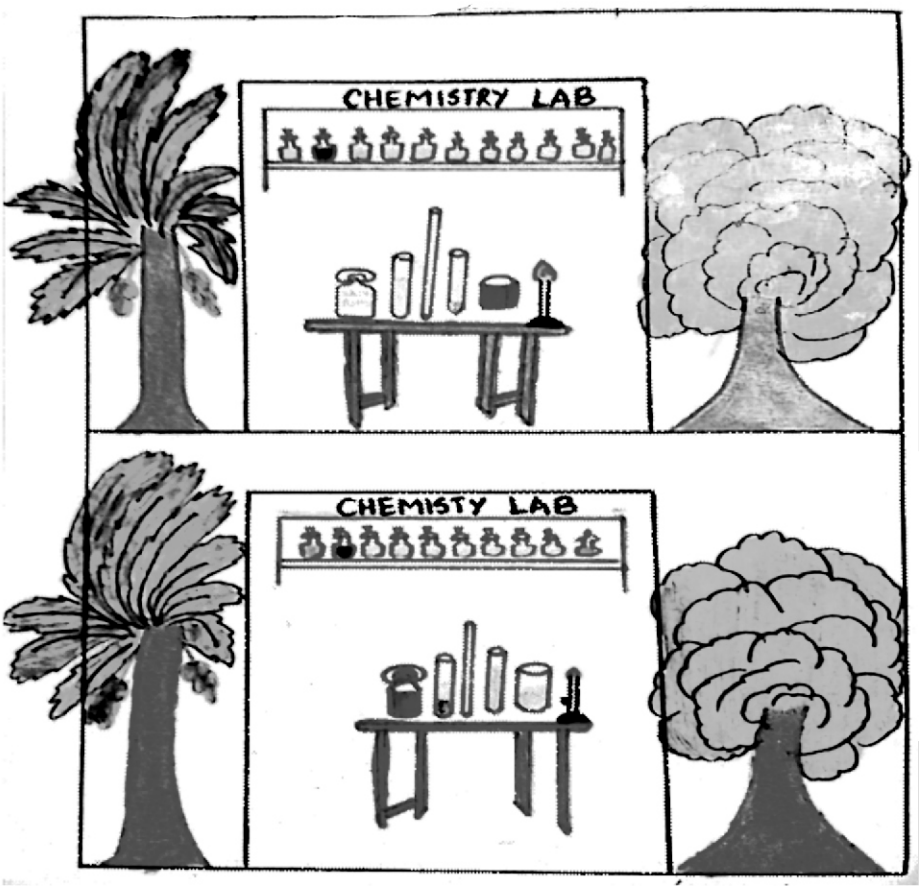
M	U	I	S	E	N	G	A	M	R	X	I	Y
P	Q	R	S	T	U	V	W	U	O	Z	R	A
B	C	I	D	E	F	G	H	I	T	J	O	K
L	U	M	U	I	H	T	I	L	O	P	U	Q
M	R	S	T	U	V	W	Z	E	A	X	L	C
M	U	I	L	L	Y	I	E	B	C	C	F	A
O	R	Y	Z	A	N	B	O	O	T	N	I	R
L	A	D	E	C	F	R	G	N	I	E	O	B
Y	N	M	H	I	L	O	U	R	N	G	D	O
B	I	U	E	N	X	D	K	C	I	O	I	N
D	U	I	N	O	Y	I	L	O	U	R	N	O
E	M	M	O	D	G	U	A	B	M	D	E	T
N	B	Y	D	A	E	M	H	A	G	Y	M	P
U	K	D	A	R	N	I	F	L	E	H	O	Y
M	L	O	R	A	R	G	O	T	E	O	N	R
N	J	E	A	M	U	I	D	O	B	U	R	K
D	M	N	C	P	R	O	T	I	U	M	M	O

Turn to Page Number 30 for Answers

FIND ANY TEN DIFFERENCES



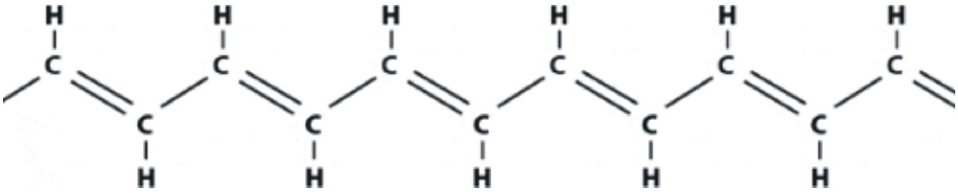
CONDUCTING POLYMERS

Polymers/Plastics are one of the most widely used materials in the modern world as they possess good insulating properties. Polymers range from synthetic plastics such as polystyrene to natural polymers such as DNA and proteins that are fundamental to biological functions. Polymers, both natural and synthetic, are created via polymerization of many small molecules, known as monomers. They possess large molecular mass and unique physical properties such as toughness, viscoelasticity, flexibility, malleability and tensile strength. They are made up of small molecules that are arranged in a simple repeating structure to form larger molecules.

Polymers which were once considered insulating are now reported to be semiconducting in nature. An example of a polymer with unsaturated backbone structure is polyacetylene. The electrical cconductiviy of pure polyacetylene is ~ 10^{-9} (cis) and 10^{-5} (trans) S cm^{-1}. High electrical conductivity was observed when the polymer was "doped" with oxidizing or reducing agents. Research in the field of conducting polymers started nearly three decades ago when Shirakawa and his group found drastic increase in the electrical conductivity of polyacetylene films when exposed to iodine vapor .The highest crystalline variety of the polyacetylene showed

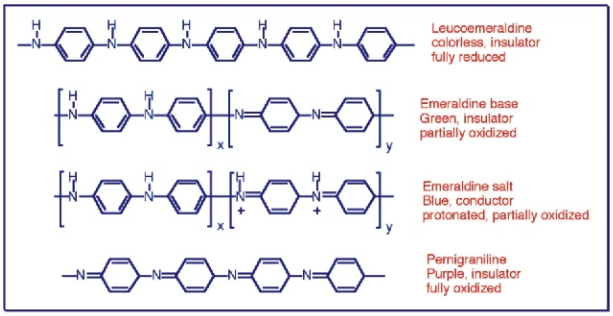
electrical conductivity of the order of 10^{-5} S / cm and was the trans-form of polyacetylene. Leading on from this breakthrough, many small conjugated molecules were found to polymerize, producing conjugated polymers, which were either insulating or semiconducting in the oxidized or doped state. Alan J. Heeger, Alan G. MacDiarmid and Hideki Shirakawa have changed the view that polymers are nonconducting with their discovery that a polymer, polyacetylene can be made conductive almost like a metal.

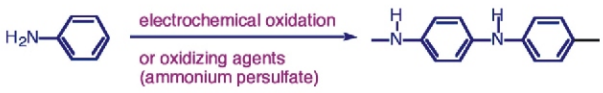
The first condition for a polymer to become conductive is that the polymer should consist of alternating single and double bonds, called conjugated double bonds. In conjugation, the bonds between the carbon atoms are alternately single and double. Every bond contains a localised "sigma" (σ) bond which forms a strong chemical bond. In addition, every double bond also contains a less strongly localised "pi" (π) bond which is weaker.



In addition to conjugation, the charge carriers in the form of extra electrons or holes have to be injected into the material. A hole is the position where an electron is missing. When such a hole is filled by an electron jumping in from neighbouring position, a new hole is created and so on allowing the charge to migrate a long distance. The second condition is that the plastic has to be disturbed - either by removing electrons from (oxidation), or inserting them into (reduction), the material. The process is known as *doping*. There are two types of doping: oxidation with halogen (or *p*-doping) and reduction with alkali metal (n-doping).

The conducting polymers combine the characteristics of both metals and plastics. Among the conducting polymers, polyaniline is the most widely studied polymer in the recent past. It is a conducting polymer that can be grown by using aqueous and non-aqueous route, can be obtained by electrochemical synthesis or oxidative coupling of aniline and doping can be achieved by adding protonic acid. It exists in several forms such as leucoemeraldine, emeraldine, emeraldine salt and pernigraniline.





The different methods of preparation of Polyaniline are as follows:

Heterophase polymerization

- Synthesis of polyaniline colloidal dispersion
- Direct and inverse emulsion polymerization of aniline
- Direct and inverse miniemulsion polymerization of aniline
- Direct and inverse microemulsion polymerization of aniline
- Reversed micelle polymerization of aniline

➢ Solution polymerization of aniline
➢ Interfacial polymerization of aniline
➢ Seeding polymerization of aniline
➢ Metathesis polymerization of aniline
➢ Self-assembling polymerization
➢ Sonochemical synthesis of polyaniline
➢ Electrochemical synthesis of polyaniline
➢ Template synthesis of polyaniline
➢ Enzymatic synthesis of polyaniline
➢ Photo-induced polymerization of aniline
➢ Plasma polymerization of aniline

The applications of conducting polymers are as follows:

➢ Energy storage (batteries)
➢ Electrochromic windows (intelligent windows)
➢ Actuators (Artificial muscles)
➢ Sensors (field effect transistors)
➢ Electrostatic coatings
➢ Electromagnetic shielding
➢ Rechargeable Batteries

Batteries using polyaniline have higher energy and power densities (light weight) than conventional ones using lead-acid or Ni-Cd. E.g. polyaniline used in 3V coin-shaped batteries (*Poly. Adv. Tech*. 1990, *1*, 33). Poly(ethylenedioxythiophene) doped with acid is used as an antistatic material. Polyaniline is used as an antistatic layer in computer disk by Hitachi-Maxwell (Synth. Metals 1993, 57, 3696). Polymers with extended π-conjugated systems usually absorb strongly in the visible region. Many of them also emit light after absorbing a photon (photoexcitation).

The different colored structures, charges and conformations of the multiple oxidation states of polyaniline also make the material promising for applications such as actuators, supercapacitors and electrochromics. They are suitable for manufacture of electrically conducting yarns, antistatic coatings,

electromagnetic shielding, and flexible electrodes.

Attractive fields for current and potential utilization of polyaniline is in antistatics, charge dissipation or electrostatic dispersive (ESD) coatings and blends, electromagnetic interference shielding (EMI), anticorrosive coatings, hole injection layers, transparent conductors, indium tin oxide replacements, actuators, chemical vapor and solution based sensors, electrochromic coatings (for color change windows, mirrors etc.), toxic metal recovery, catalysis, fuel cells and active electronic components.

Currently, the major applications are printed circuit board manufacturing, antistatic and ESD coatings, and corrosion protection.

Not only polyaniline, but also other polymers such as polyfuran, polythiophene, polypyrrole etc have wide applications. The blends and composites of polyaniline are also under extensive research. Substituted polyanilines and their blends and composites have attracted researchers in the recent past with their ease of synthesis, environmental stability, and electrical conductivity in the semiconducting range. There is lot of scope for research in the field of conducting polymers which are the novel materials of this era.

Research is search for new knowledge in the field of your own interest. As students develop the interest in learning the subjects in depth and also focus your attention in gaining knowledge on recent advances and trends in Chemistry. It is exciting as well as interesting when we unveil the applications hidden in new materials.

2016 - INTERNATIONAL YEAR OF PULSES

The United Nations, led by its Food and Agriculture Organization (FAO), launched the 2016 International Year of Pulses (IYP) to raise awareness about the protein power and health benefits of all kinds of dried beans and peas, to boost their production and trade, and to encourage new and smarter uses throughout the food chain. On 10th November 2015, "nutritious seeds for a sustainable future" was adopted as the slogan The hope of the 2016 International Year of Pulses is to position pulses as a primary source of protein and other essential nutrients. In this IYP 2016, the prime importance is given to the pulses due to its multifaceted nutritional values. The logo of IYP 2016 given represents the different pulses displayed in different colours representing numerous and diverse types and uses of pulses, the heart shape represents the health benefits particularly promoting health and the spoon represents the role of pulses in nutritious diet.

The main aims of IYP 2016 are:

- To promote the value and utilization of pulses
- To raise awareness about the benefits of pulses, including sustainable agriculture and nutrition.
- To encourage the global production of pulses.
- To foster enhanced research in pulses.
- To advocate better utilization of pulses in crop rotations.
- To address the challenges in the trade of pulses.

What are the Pulses?

The name pulse is derived from the Latin word pulse which means thick soup or potage and it is used more than 10,000 years. Pulse is the term used for the edible dry seeds of the Legume (plants with Pod) and Legume families of plants include more than 600 genera and more than 13,000 species. Pulses do not include fresh green beans or peas although they are related to pulses because they are also edible seeds of podded plants, soya beans and peanuts differ from pulses because they have a much higher fat content, where as pulses contains virtually no fat. Some of the common pulses are yellow moong dal, chana dal, Red lentils (Mysoor dal), green moong dal, beans etc.

Advantages of eating Pulses

Pulses fight against some of the chronic diseases like Cancer, Diabetes, Alzheimer's, cardiovascular disease, Blood Pressure (Hyper and Hypotension), Cholesterol etc. Pulses also increase serum lipid Profiles, cardiovascular disease risk factors like B.P, increases platelet activity, assists in maintaining blood glucose and insulin levels, acts against HIV virus, has antioxidant activity and they also control body weight. Pulses contain high amount of Proteins (17 -30%) which is twice the amount found in cereals like rice, wheat, oats, barley etc. Proteins are very essential for body building. Other than proteins it also contains carbohydrates, vitamins like folate, thiamin, niacin etc, Minerals such as Fe, Zn, P, C, Na, K, Mg, Se etc and phytochemicals like saponins and tannins, higher amounts of amino acids like lysin, cysteine, niacin etc which are essential for our healthy daily living.

Health organizations focus on diabetes, heart disease and cancer and they promote pulse consumption as part of healthy diets for reducing the risk of these chronic diseases. Consumption of approximately ½ cup of pulses per day results in higher intakes of fibre, Proteins, folate, Zn, Fe, Mg with lower intakes of saturated fat and total fat. Soluble fiber is well known for its positive effect on total and LDL cholesterol which are recognized to reduce the risk factors for heart disease and controls the blood sugar level. Insoluble fibre helps with digestion and regularity. The recommended intake of fibre is 38% g/day of total fibre for men and 25g/day of total fibre for women. The research shows that eating pulses for at least three weeks significantly reduces LDL cholesterol levels, which can lower the risk of heart attack and stroke. Pulse consumption lowers LDL cholesterol levels by about 5%.

Pulses contain high amount of complex carbohydrates including simple and complex similar to whole grains. The complex carbohydrates present in pulses are resistant and slowly digestible starch as well as oligosaccharides. Resistant starch and oligosaccharides behave like fibre in the body because they are not digested or absorbed. In contrast, slowly digestible starch does get digested completely at a slow rate which keeps the body's blood sugar level closer to normal and this is responsible for the low glycemic index.

Pulses have additional benefit for the people who are obese, diabetic especially type 2, high blood cholesterol levels, constipated and those who suffer from chronic diseases like Cancer, Diabetes, Heart

problems and for the vegetarians. Since pulses contain more of insoluble fibre and it is filling in nature , it is recommended to drink more water.

Themes of IYP2016

The Global Pulse Confederation and its IYP 2016 partners have identified a series of thematic areas that will be the focus for activities during the 2016 International Year of Pulses. These areas represent the key issues where new and increased efforts could help make a difference in promoting sustainable agriculture and livelihoods, as well as healthy diets, through increased production, trade and consumption of pulses.

The IYP committee is working on more than 100 activities and projects related to IYP 2016, four of them have already been launched in the areas of branding, school programs, recipes, and market access. Fifteen external partners have been recruited to work on the year, from major science centres, health institutes, academia to farm groups. Additionally, a total of 30 national committees have begun activities in every continent. The activities will be built around four thematic areas like

Advantages of cultivating pulses

- Pulses are important component of crop rotations to maintain soil fertility.
- Pulses require less fertilizers than other crops.
- It has low carbon source
- Have a positive impact on soil quality because they help fix nitrogen in the soil.
- Help to feed the microbes in the soil - Benefits soil health.

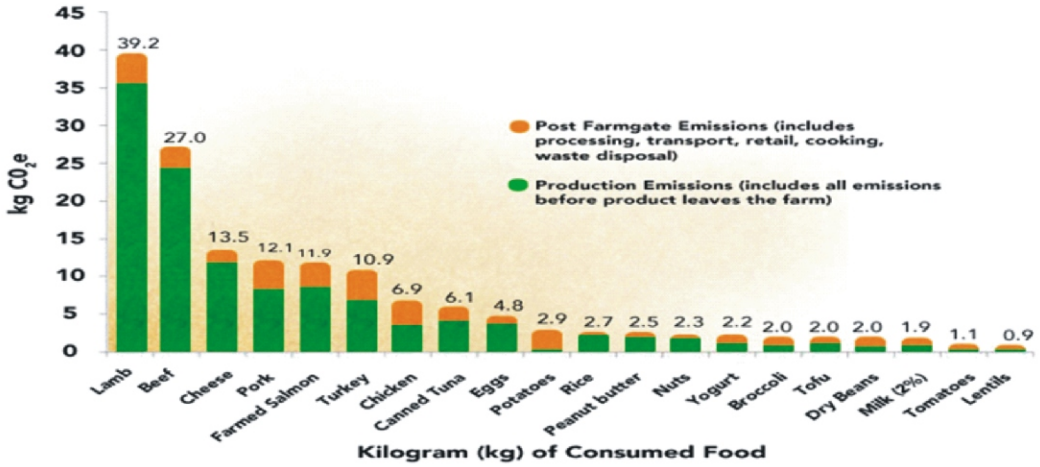
Pulses are economically important crops for farmers, in both developing and in developed countries. 70% of pulse production comes from developing countries and India produces about a quarter of the world's pulses.

We can promote the IYP in some of the following simple ways

- Eat more pulses and include pulses more often in your daily diet
- Bring pulses into gatherings with family, friends and colleagues - January 6th for the Pulse **Feast!**

- Tell everyone about the International Year of Pulses.
- Tell your local shops and store about IYP
- Contact local youth groups and ask them to promote pulses by including them in their activities!
- Include pulses in your daily dishes, you already know or invent new recipes.

The graph indicates that the pulses emit only 0.9kg of carbondioxide compared to other common Proteins and vegetables



Pulses also offer a great potential to lift farmers out of rural poverty, as they can yield two to three time higher prices than cereals, and their processing provides additional economic opportunities, especially for women. Despite strong evidence of the health and nutritional benefits of pulses, the consumption of pulses remains low in many developing and developed countries. The International Year of pulses can help overcome this lack of knowledge. Let this IYP, help us to become more aware of the importance of the pulses and help us to change our food habits by adding more pulses in our daily meal and enjoy good health.

Dr. Sr. Jaya Shanthi R

Department of Chemistry

Answers :

1. Lithium
2. Molybdenum
3. Cobalt
4. Carbon
5. Iodine
6. Uranium
7. Fluorine
8. Actinium
9. Hydrogen
10. Krypton
11. Neodymium
12. Francium

SPIRITUALITY IN HIGHER EDUCATION

We live in a world of 'SPIRIT' that moves all beings both living and non-living. We conceive it in the form of God with our own experiences. In the realm of science it is articulated as 'power' or 'energy' that becomes the basis of all organisms i.e. Atom.

In this article, my desire is to bring to our consciousness that how do we use this Power (spirit/atom) for our livelihood and to achieve the purpose in one's life. I would like to start the reflection from where we are. Because, it is necessary to become aware of our present reality in order to understand the life of spirituality. It is the obvious fact that both biologically and psychologically the life of adolescence strongly pulls oneself towards the materialistic world. The world that produces more young people with the plague of deep wounds of depressions, substance abuse, violence, false self image, life of immorality and so on. In this crucial and important stage the academic experiences of a college student must make a person more 'humane' with spiritual values. It is possible if only an individual constantly tries to be in touch with his/her human consciousness.

Therefore, the central process of research and higher education must be focused on 'Human consciousness' which has the capacity to *observe* our thoughts and feelings as they arise in our consciousness. This is the period an individual contemplates on his/her Reason of Being. He/she understands the differences in his/her Passion (that which he/she loves, Mission(that which the world needs from him/her), Vocation(that which he/she can be paid for), Profession (that which he/she is good at). But higher education should make them convince that out of all these, Compassion is the one that is expected of them from God and others. It is difficult to see how most of our contemporary domestic and world problems can ever be resolved without a substantial increase in our individual and collective self-awareness. It's saddening to notice that our education from the grass root level onwards makes it clear the amount of attention devoted to 'the exterior' way of knowing oneself rather than 'the interior'. Thus, while we are justifiably proud of our 'outer' development in fields such as science, medicine, technology and commerce, we have increasingly come to neglect our 'inner' development: the sphere of values and beliefs, emotional maturity, moral development, spirituality and self-understanding in totality the Integral Formation as a Human Person.

The renowned psychologist, Gestalt uses the 'principle of totality' in studying the mechanism of human brain. Thus, 'the whole can best be understood by studying its parts'; in the world of complexities and chaos we can use its resource in a right manner if only we try to understand our self life of spirituality'.

BIOMATERIALS IN TISSUE ENGINEERING

Mankind has always been looking for new ways to prevent or treat diseases and injuries. In infectious diseases, large steps forward have been taken with the introduction of antibiotics, vaccines, anti-virals and anti-fungals. One of the most frequent, expensive and serious problems facing human health care, is the loss or failure of organs or tissues. The medical need for tissue and organ substitutes can arise from trauma, infectious,

inherited or age-related diseases, or organ failure. When it comes to injured or failing tissues, however, patients often end up on waiting lists for organ or tissue transplantation. Nowadays, the tissues and/or organs for transplantation mainly come from donations, which, however, cannot meet the clinical needs and also encounter serious problems and limitations. The main reasons are the use of autografts and allografts are associated with donor shortage and donor site morbidity, whereas allografts and xenografts have the risk of transmitting harmful diseases and also triggering undesirable immune responses and moreover for the thriving illegal organ trade in India are an acute mismatch in the demand and supply of organs.

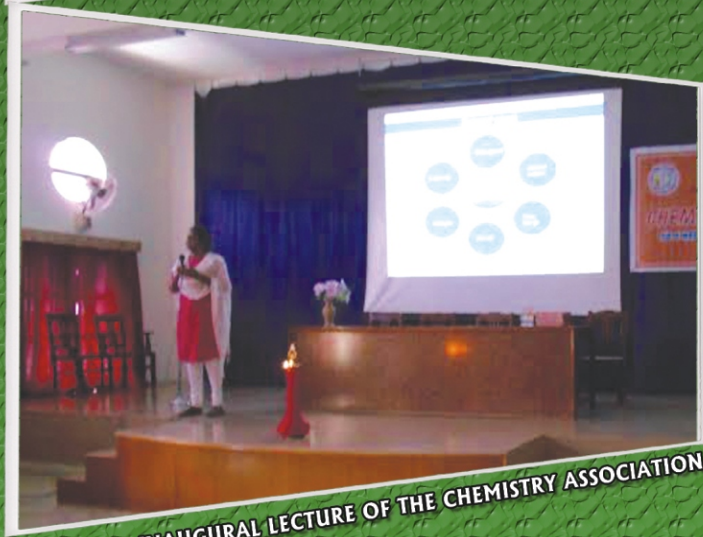
Tissue-engineering is one of the most innovative approaches for tackling many diseases and body parts that need to be replaced, by developing artificial tissues and organs. The fundamental goal of tissue engineering is to develop biological substitutes that restore, maintain, or improve tissue function and to apply these to clinical scenario where tissue is lost through trauma or disease.

A biomaterial is a "material intended to interface with biological systems to evaluate, treat, augment or replace any tissue, organ or function of the body" Biomaterials play a crucial role in tissue engineering by serving as 3D synthetic frameworks commonly referred to as scaffolds, matrices, or constructs for cellular attachment, proliferation, and in growth ultimately leading to new tissue formation.

The cell support structure a scaffold should serve as a three-dimensional template for initial cell attachment and subsequent tissue formation, both in vitro and in vivo. Scaffolds are processed in order to produce 3D structures, with proper shape, size, architecture, and physical properties, tailored to fulfill specific functions. Therefore, tissue engineering products are designed to mimic tissue architecture and responses.

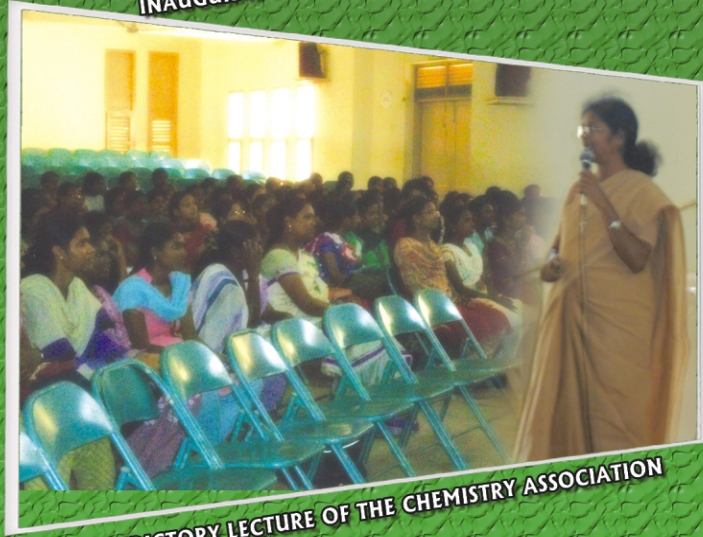
In tissue engineering, matrices are developed to support cells, promoting their differentiation and proliferation towards the formation of a new tissue. Such strategies allow for producing hybrid constructs that can be implanted in patients to induce the regeneration of tissues or replace failing or malfunctioning organs. Different materials have been proposed to be used in the processing of scaffolds, namely biodegradable polymers. Natural-based polymers offer the advantage of being similar to biological macromolecules, which the biological environment is prepared to recognize and deal with metabolically. Biomaterials play a crucial role in tissue engineering by serving as 3D synthetic frameworks commonly referred to as scaffolds, matrices, or constructs for cellular attachment, proliferation, and in growth ultimately leading to new tissue formation.

RUSAC INTERCOLLEGIATE PG QUIZ COMPETITION



INAUGURAL LECTURE OF THE CHEMISTRY ASSOCIATION

PG PAPER PRESENTATION PROGRAMME



VALEDICTORY LECTURE OF THE CHEMISTRY ASSOCIATION

VISIT TO THE GOVT. AFTER CARE HOME, VELLORE