The mentors Digest

Adobe Firefly

Our Founder & his Vision

Knowledge is the prime wealth among all wealths. In other words, knowledge is the best and important wealth among all wealths. Start your journey to find or explore the knowledge. Our founder and renowned scholar late Padmashri Dr Vellayani Arjunan's vision is to spread quality education to entire community and make it affordable.

Shri. Vellayani Arjunan was born on 10 February 1933 at Vellayani in the erstwhile Kingdom of Travancore. After receiving a Master of Arts degree in Malayalam, he went on to teach Malayalam Language and Literature at

Sree Narayana College in Kollam. He later became the first Malayalam lecturer in Aligarh Muslim University, from which he gained his PhD degree in 1964.After leaving Aligarh Muslim University, he was appointed director of the State Institute of Encyclopaedic Publications in Kerala

He was honoured with the Padma Shri award by the nation in 2008. Dr Arjun, who was the first Professor of Malayalam at the Aligarh University and head of the Department of Modern Indian Languages. He supervised 20 research scholars and published more than 100 research papers and articles. He had authored 40 books in different genres including poetry, short story, essays and literary criticism, and his books were prescribed as textbooks in Kerala schools from 1959 onwards.

Degree	Topic	Awarding Institution
D.Litt.	Influence of Sree Narayana Guru on Malayalam Poetry.	Aligarh Muslim University
D.Litt.	A Comparative Study of the Mutual Relations and Uniformity of Hindi and Malayalam Languages.	Agra University
D.Litt.	The influence of Hindi Vocabularies on the South Indian Languages: A Linguistic study.	Jabalpur University
Ph.D.	A Comparative Linguistic Study of Common Vocables of Hindi and Malayalam Languages.	Aligarh Muslim University

Other degrees

| Degree	Subject
B.A. Hons	Malayalam Language and Literature
M.A.	Malayalam Language and Literature
M.A.	Hindi Language and Literature
M.A.	Hindi Special
P.G. Diploma	Tamil, Telugu, Kannada

From the Editors Desk…..
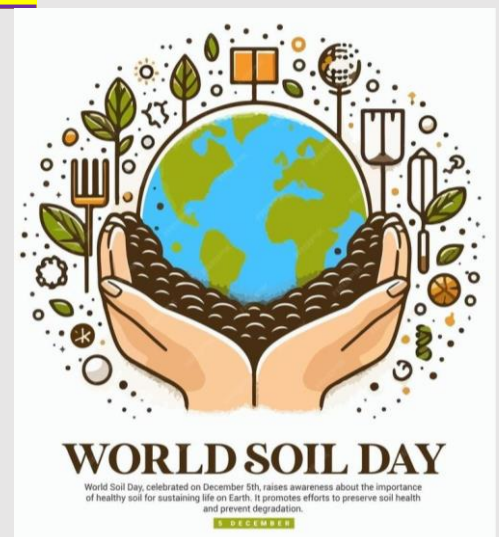
Dear Students & future leaders,

.

Education for Sustainable Development (ESD) is a transformative approach to learning that seeks to empower individuals and communities to build a more sustainable future. The five pillars of education for sustainable development according to UNESCO: learning to know, learning to do, learning to live together, learning to be, and learning to transform oneself and society. It describes the objectives of each pillar, such as acquiring tools to understand the world, acting creatively in one's environment, participating and cooperating with others, developing one's personality and identity, and promoting sustainable lifestyles and social justice
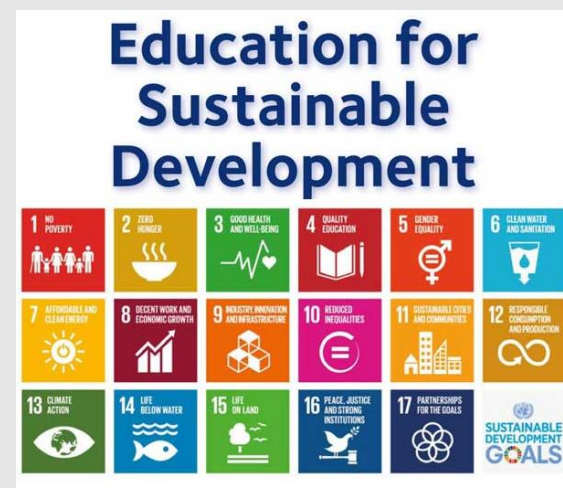
Education for sustainable development aims to empower people, foster responsible citizenship, and allow individuals to improve their quality of life through education.

WHAT IS SPECIAL ABOUT THE MONTH OF DECEMBER ?

DECEMBER 05 : World Soil Day, celebrated on December 5 each year, is an initiative dedicated to raising awareness about the critical importance of soil health for human well-being, biodiversity, and the environment. Initiated by the International Union of Soil Sciences and later endorsed by the Food and Agriculture Organization (FAO) of the United Nations, this global observance emphasizes the need to combat soil degradation, promote sustainable practices, and ensure soil fertility for future generations. Soil is the foundation of life—it provides essential nutrients for plants, supports diverse ecosystems, stores water, and acts as a carbon sink, playing a key role in mitigating climate change. However, human activities such as deforestation, overgrazing, industrial pollution, and unsustainable farming practices have led to widespread soil erosion, contamination, and loss of organic matter. These challenges threaten food security, water quality, and ecosystem stability. By celebrating World Soil Day, individuals, governments, and organizations are encouraged to take action, such as adopting conservation agriculture, planting cover crops, reducing chemical use, and spreading knowledge about soil preservation. This day reminds us that healthy soils are vital for a sustainable future and that protecting them is a shared responsibility.

NUCLEAR BATTERIES: POWER FOR THE FUTURE

Imagine a battery that can last 50 years without needing to be recharged! That's the promise of new nuclear-powered batteries. Don't worry—they're safe and not like the dangerous ones used in space.

Spacecraft like the **Perseverance rover on Mars** use a special nuclear battery called an RTG (radioisotope thermoelectric generator). It converts heat from radioactive material into electricity. However, RTGs use a very toxic material called plutonium-238, which isn't safe for everyday use.

Here's where the new **Betavolt batteries** come in. Instead of heat, they generate electricity from a process called **beta emission**. This happens when certain materials give off tiny particles called electrons as they break down.

These batteries are made by sandwiching a safe radioactive isotope, **nickel-63**, between layers of a special material like diamond. Though they only produce a small amount of power—less than an ordinary AA battery—they last much, much longer. For example, a Betavolt battery could keep working for **50 years**, while an AA battery might last just an hour at the same power output!

Betavolt batteries are also very safe. The radiation they emit is weak and blocked by the battery's case or even clothing. Plus, as nickel-63 decays, it turns into harmless copper.
This technology might one day power small devices like sensors, medical implants, or gadgets where changing batteries is tricky. So, while your toys might not use nuclear batteries just yet, they could be the future of long-lasting power!

Did you know ?
All odd numbers contain the letter **e**.

DOES YOUR DOG REALLY LOVE YOU? SCIENCE SAYS YES

Ever wondered if your dog truly loves you or just sees you as their personal food provider? While scientists avoid using human emotions like "love" to describe animal feelings, there's growing evidence that dogs' behavior shows deep affection for their human companions.

How Scientists Study Love in Dogs

For a long time, researchers avoided using human terms, like "love" or "personality," to describe animal behavior, instead opting for words like "temperament" or "attachment." However, this view is changing, as there are strong evolutionary reasons to believe that animals, like dogs, share some emotional traits with humans.

To understand if dogs feel love, scientists look at two key factors:

1. Behavioral Signs: Dogs display strong attachment, such as distress when separated from their humans and excitement when reunited. This mirrors the bond seen between mothers and children. Dogs also tend to respond to our emotional states, often staying close when we're upset. Whether this is true empathy or curiosity about our unusual behavior is still debated, but it looks a lot like love.
2. Physical Responses: Dogs' bodies often react in ways similar to humans when they're attached to someone, such as experiencing calming effects during reunions.

Separation Anxiety and Attachment

If your dog seems anxious or destructive when you leave, they may be experiencing separation anxiety—an exaggerated form of attachment. While this can be challenging to manage, it's a sign of how deeply dogs bond with their humans.

Emotional Sensitivity

Dogs are remarkably in tune with their owners' emotions, often approaching when you're sad or crying. This sensitivity could be a way of offering comfort, though scientists continue to explore whether it's driven by concern or curiosity.

So, Is It Love?

While science may not use the word "love" outright, everything from your dog's excitement when you come home to their comforting presence when you're upset points to one conclusion: your furry friend is likely showing you their version of love, and it's every bit as genuine as it seems.

A REVOLUTIONARY BREATH TEST FOR LUNG CANCER DETECTION

Lung cancer remains one of the deadliest cancers worldwide, claiming tens of thousands of lives each year. Early detection is crucial, as it dramatically improves treatment outcomes. Now, scientists from China and Spain have made a significant breakthrough—a simple and non-invasive breath test that could help diagnose lung cancer at an early stage.

This cutting-edge technology relies on ultra-thin metal sensors, called nanoflakes, made from a combination of platinum, indium, and nickel. These nanoflakes are thousands of times thinner than a strand of human hair and are incredibly sensitive to tiny chemical changes in the breath. Specifically, they measure the levels of a compound called isoprene, a chemical found in human breath.

How the Breath Test Works

Isoprene is naturally present in the breath, although scientists are still unsure of its exact origin or purpose in the body. What they do know is that its levels appear to differ significantly between individuals with lung cancer and those without it. Lung cancer patients tend to have lower levels of isoprene—below 40 parts per billion (ppb)—compared to healthy individuals, who typically exhale over 60 ppb. Detecting 2 ppb of isoprene with this sensor is like identifying 2 seconds in a 32-year timeline, showcasing its remarkable precision.

During trials, the device successfully analyzed 13 breath samples, distinguishing between healthy individuals and those with lung cancer. While still in its early stages, the findings highlight its potential to revolutionize screening methods.

The Potential Impact

Lung cancer causes around 35,000 deaths annually in the UK, with nearly 8 out of 10 cases preventable. This breakthrough breath test could allow for early detection, enabling timely treatment and significantly improving survival rates. With further development, this sensor may transform lung cancer diagnosis, offering a simple and effective tool to save lives.

The opposite sides of a die always add up to 7

CONCEPT MAP

COMPLEX NUMBERS AND QUADRATIC EQUATIONS

Class XI

Quadratic Equation

An equation of the form $ax^2 + bx + c$ is called a quadratic equation where $a, b, c \in R$ if $b^2 - 4ac < 0$, then the solution is given as

$$x = \frac{-b \pm \sqrt{4ac - b^2}\, i}{2a}$$

De-Moivre's Theorem

$z = r(\mathrm{cis}\,\theta)$, $z^n = r\,(\mathrm{cis}\,n\theta)$
Also, n^{th} roots of unity is given by $z^n = 1$ and

$$z = \mathrm{cis}\left(\frac{2k\pi}{n}\right),$$

$k = 0, 1, 2, ..., n - 1$
if $n = 3$, $z = 1$, ω, ω^2 are cube roots of unity.

Euler's Form

$z = re^{i\theta}$, $\bar{z} = re^{-i\theta}$
where $-\pi < \theta \le \pi$,
θ is the principal argument.

Forms

Algebra of Complex Numbers

Let $z_1 = a_1 + ib_1$, $z_2 = a_2 + ib_2$

Addition : $z_1 + z_2 = (a_1 + a_2) + i\,(b_1 + b_2)$

Subtraction : $z_1 - z_2 = (a_1 - a_2) + i\,(b_1 - b_2)$

Multiplication : $z_1 z_2 = (a_1 a_2 - b_1 b_2) + i\,(a_1 b_2 + a_2 b_1)$

Division : $\dfrac{z_1}{z_2} = \dfrac{a_1 a_2 + b_1 b_2}{a_2^2 + b_2^2} + i\,\dfrac{a_2 b_1 - a_1 b_2}{a_2^2 + b_2^2}$, where $z_2 \ne 0$

Equality : $z_1 = z_2 \Rightarrow a_1 = a_2$ and $b_1 = b_2$

Multiplicative Inverse :
$$z^{-1} = \frac{1}{z} = \frac{a_1}{a_1^2 + b_1^2} + i\,\frac{(-b_1)}{a_1^2 + b_1^2}$$

Complex Number

A number of the form $z = a + ib$ (where a = Real part, b = Imaginary part and $a, b \in R$) is defined to be a complex number.

Polar Form

$z = a + ib$
$= r(\cos\theta + i\sin\theta) = r\,\mathrm{cis}\,\theta$
where r = modulus of z
$= \sqrt{a^2 + b^2}$,
and θ = angle with x-axis in +ve direction
i.e., $\theta = \tan^{-1}\left(\dfrac{b}{a}\right)$

Modulus

Modulus of $z = a + ib$ is $|z| = \sqrt{a^2 + b^2}$
$|z| = 0 \Leftrightarrow z = 0$

Properties

- $|z| = |\bar{z}| = |-z| = |-\bar{z}|$
- $z\bar{z} = |z|^2$
- $|z_1 z_2| = |z_1||z_2|$; $|z_1 / z_2| = |z_1| / |z_2|$ $(z_2 \ne 0)$
- $|z^n| = |z|^n$
- $|z_1 - z_2| \ge \big||z_1| - |z_2|\big|$
- $|z_1 + z_2 + ... + z_n| \le |z_1| + |z_2| + ... + |z_n|$
- $|z_1 \pm z_2|^2 = |z_1|^2 + |z_2|^2 \pm 2\,\mathrm{Re}(z_1\bar{z}_2)$

Some Terms of Complex Numbers

Conjugate

Conjugate of $z = a + ib$ is $\bar{z} = a - ib$

Properties

- $(\bar{\bar{z}}) = z$
- $\mathrm{Re}(z) = \dfrac{z + \bar{z}}{2}$; $\mathrm{Im}\,z = \dfrac{z - \bar{z}}{2}$
- $z = \bar{z} \Leftrightarrow z$ is purely real
- $z + \bar{z} = 0 \Leftrightarrow z$ is purely imaginary
- $\overline{z_1 \pm z_2} = \bar{z}_1 \pm \bar{z}_2$; $\overline{z_1 z_2} = \bar{z}_1\,\bar{z}_2$; $\overline{(z_1 / z_2)} = \bar{z}_1 / \bar{z}_2\,(\bar{z}_2 = 0)$
- $\overline{(z^n)} = (\bar{z})^n$
- $\alpha = f(z) \Rightarrow \bar{\alpha} = f(\bar{z}), \alpha \in c$

Argument

Argument of z is the angle between +ve real axis to the line joining the point to the origin.

Properties

- $\arg(z_1 z_2) = \arg(z_1) + \arg(z_2)$
- $\arg(z_1 / z_2) = \arg(z_1) - \arg(z_2)$
- $\arg(z^n) = n\arg(z)$

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STEREOCHEMISTRY

Class XII

Stereochemistry is a unique part of chemistry concerned with the study of the spatial arrangement of atoms and molecules in the compound, its effect on chemical reaction and relations to the properties of compounds. It is also known as 3D chemistry. Different enantiomers have different selectivity for biological targets and have different biological actions. Hence, stereochemistry have great importance in pharmaceutical industry.

CONCEPT MAP

Stereoisomers

The isomers that are different from each other only in the way the atoms are oriented in space are called *stereoisomers*.

Absolute Configuration (R and S system of nomenclature)

In order to designate absolute configurations a system of nomenclature called *Cahn-Ingold-Prelog system* has been developed.
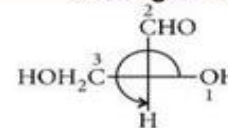
- Assign priority to the groups attached. Higher atomic number will get higher priority.
- The H atom or group of lowest priority is brought vertically in Fischer projection.

R-configuration
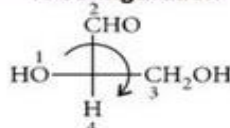
Move the arrow in order of decreasing priority. If it rotates clockwise, configuration is R (*rectus*) configuration.
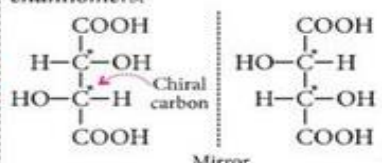
S-configuration

Move the arrow in order of decreasing priority. If it rotates anti-clockwise, then the configuration is S (*sinister*) configuration.

Enantiomers

Stereoisomers having non super-imposable mirror images are optically active and these are called *enantiomers*.

(dextrorotatory)
d-enantiomer
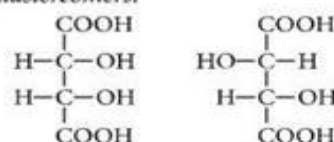Rotates the plane polarised light towards right.

(laevorotatory)
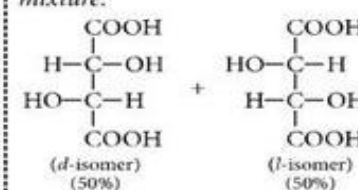*l*-enantiomer
Rotates the plane polarised light towards left.

Diastereomers

Stereoisomers that are not mirror images of each other are called *diastereomers*.

Number of stereoisomers

The number of stereoisomers depends on structure and number of asymmetric carbon atoms present in the molecule.

In unsymmetrical molecule

Number of enantiomers $= 2^n$

Meso forms $= 0$

Total optical isomers $= 2^n$

where, n = number of chiral or asymmetric carbon atoms.

Racemic mixture

If both *d* and *l* enantiomers present in equal amount (50-50%) then the mixture is optically inactive due to external compensation, the mixture is known as *racemic mixture*.

(*d*-isomer) (50%) + (*l*-isomer) (50%)

Resolution of racemic mixture

The process of separation of a racemic mixture into *d*- and *l*-forms is called *resolution*.

Following are the methods by which a racemic mixture can be resolved:

- Mechanical separation
- Biochemical separation
- Chemical separation
- Chromatographic method
- Selective adsorption method

Meso form

If plane of symmetry is present in the molecule then, one of the isomer will be optically inactive due to internal compensation because half of the molecule will rotate the plane polarised light towards right and another half towards left. So, total rotation of plane polarised light will be zero.

(*Meso*-form)

In symmetrical molecule

- When n is odd,
  Number of enantiomers $= 2^{(n-1)} - 2^{(0.5n-0.5)}$
  Meso forms $= 2^{(0.5n-0.5)}$
  Total optical isomers $= 2^{(n-1)}$

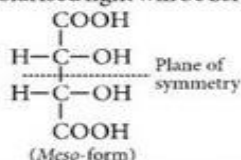- When n is even,
  Number of enantiomers $= 2^{(n-1)}$
  Meso forms $= 2^{(n/2-1)}$
  Total optical isomers $= 2^{(n-1)} + 2^{(n/2-1)}$

Racemisation

Conversion of (+) or (−) isomer into its racemic mixture (±) is known as *racemisation*. It is reverse of resolution and can be carried out either by heat, light or use of chemical reagents, etc.
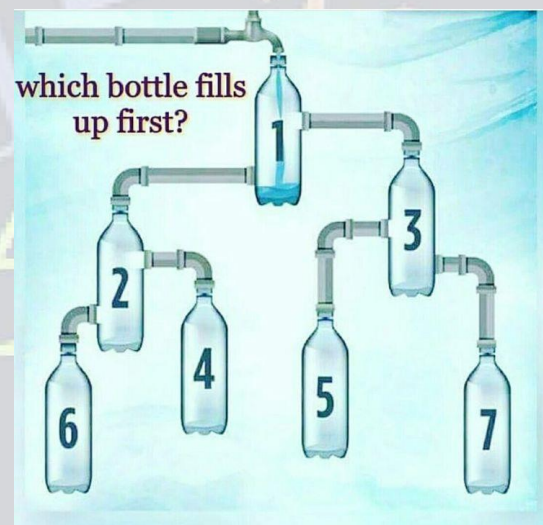
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RIDDLLES

1. I have no voice, yet I can tell you tales. I have no eyes, yet I've seen historical trails. I'm often turned, sometimes torn, A silent companion, forever born. What am I ?

2. Where does today come before yesterday?

PUZZLE

which bottle fills up first?

Bright Spots: Positive Events from NOVEMBER 2024

- India successfully launches Chandrayaan-4, its second lunar mission.
- NASA's Artemis II mission with astronauts blasts off, marking a significant step towards returning humans to the Moon.
- A groundbreaking climate change agreement is reached at the COP28 summit, committing nations to ambitious emission reduction targets.
- A new species of rare butterfly is discovered in the Amazon rainforest.
- Scientists develop a revolutionary solar cell technology with record-breaking efficiency.
- India hosts the G20 Summit, focusing on global cooperation and sustainable development.

word of the month

Bibilophilia : The love of books

NOVEMBER ANSWERS
RIDDLES : 1.Lead 2. Time
PUZZLE : 36

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