

The mentors *Digest*



NOVEMBER 2023

ISSUE NO. 06





Our Founder and 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 Editor's Desk.....

Dear Students & future leaders,

The Benefits of Youth Sports in Child Development-
Winning feels good, but youth sports is about so much more than that, with higher stakes than any football game or soccer match.



Through friendly competition, teamwork, and physical activity, kids have the opportunity to learn new skills, develop self-confidence, build character, and so much more. That's why the aim of encouraging overall child development through sports supersedes any desire to top the standings. It's these formative experiences, win or lose, that help shape future generations.

Playing sport helps children learn to control their emotions and channel negative feelings in a positive way.

It also helps children to develop patience and understand that it can take a lot of practice to improve both their physical skills and what they do in school.



WHAT IS SPECIAL ABOUT THE MONTH OF NOVEMBER ?

NOVEMBER 14 : Children's Day in India is a joyous and celebratory occasion that takes place on November 14th every year, commemorating the birth anniversary of India's first Prime Minister, Jawaharlal Nehru. Fondly known as Chacha Nehru or Uncle Nehru, he had a deep affection for children and believed in nurturing their growth and education. On this special day, schools and communities across the country organize various events and activities to honor children and their rights. It's a day filled with fun, games, cultural performances, and educational programs, reminding us of the importance of fostering the well-being, happiness, and future prospects of the youngest members of our society. Children's Day is not just a celebration but a reminder of our responsibility to protect, educate, and empower the youth, who are the future of our nation. It's heartening to witness the vibrant energy and innocence that children bring into our lives. The day is often marked by teachers and parents sharing their wisdom and love with children, emphasizing the significance of education, values, and moral principles in their lives. Many educational institutions also distribute sweets, gifts, and organize creative competitions to encourage children's participation and foster their talents.

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MAGAZINES

JUNE 2023



JULY 2023

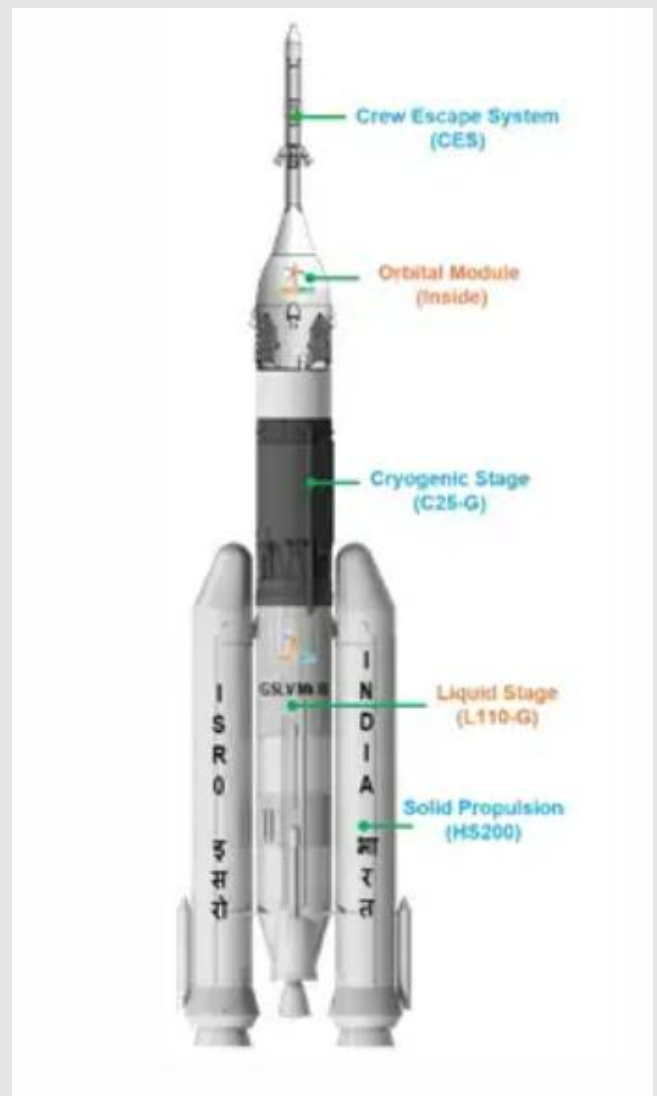




GAGANYAAN : A LITTLE SPLASH BEFORE THE BIG LEAP

The mission is expected to give ISRO multiple invaluable lessons to plan the eventual human spaceflight mission, the Gaganyaan, which in itself will be the first step towards more ambitious goals of setting up a space station and sending astronauts to Moon. Saturday's mission is only the first of several abort tests that ISRO has planned before it attempts the first uncrewed mission, multiple of which will serve as the precursor to the crewed mission planned in 2025.

ISRO on Saturday successfully demonstrated how the crew escape system (CES) could take the crew module (CM) to safety during an in-flight emergency. The mission, launched using a special test vehicle (TV), saw the vehicle and CES, which enabled the CM to get to a safe distance before it began its drop to splashdown before recovery, sinking in the sea.



Lets look at various systems used for the mission and what it means :

Test Vehicle: It is a single-stage liquid rocket. It will carry the crew module and crew escape systems with their fast-acting solid motors, along with crew module fairing (CMF) and interface adapters as payloads



Crew Module: ISRO will use an unpressurised crew module. It will have an overall size and mass of the actual Gaganyaan crew module. It houses all the systems for the deceleration and recovery, including parachutes, recovery aids, actuation systems and pyros. The avionics systems are in a dual redundant mode configuration for navigation, sequencing, telemetry, instrumentation and power,” ISRO said. It has been designed to capture the flight data for evaluation of the performance of various systems.

Crew Escape System: It consists of 5 types of quick acting solid motors, that is, Crew Escape System Jettisoning Motor (CJM), High-altitude Escape Motor (HEM), Low-altitude Escape Motor (LEM), Low-altitude Pitch Motor (LPM) and High-altitude Pitch Motor (HPM), which generate required acceleration for varying mission requirements. The Mission: “In-flight Abort Demonstration of Crew Escape System (CES)” at Mach number 1.2 (1,482 kmph) with the newly developed TV followed by CM separation & safe recovery.

Recovery: Recovery team recovered CM after touchdown, approximately 10km from Sriharikota coast. What it means: The mission is expected to give Isro multiple invaluable lessons to plan the eventual human spaceflight mission, the Gaganyaan, which in itself will be the first step towards more ambitious goals of setting up a space station and sending astronauts to space.





Mathematics

MACHINES LEARNING MATHS

Deep learning is being used to solve a wide range of problems in mathematics, including finding unusual singularities in fluid flow equations, proving mathematical theorems, developing better techniques for multiplying matrices, and analyzing knot theory. Deep learning has the potential to revolutionize the way that mathematicians solve problems by automating many of the tedious and time-consuming tasks involved in mathematical research. The use of deep learning in mathematics is still in its early stages, but it has the potential to revolutionize the way that mathematicians solve problems. Deep learning models can be used to automate many of the tedious and time-consuming tasks involved in mathematical research, freeing up mathematicians to focus on more creative and challenging problems.

Here are some specific examples of how deep learning is being used in mathematics:

- **Search for unusual singularities in fluid flow equations:** Researchers at the University of Cambridge developed a deep learning model to search for unusual singularities in fluid flow equations. The model was able to identify singularities that were previously unknown to mathematicians.
- **Prove that a particular version of the Euler equations breaks down:** Researchers at the University of Oxford used computer-assisted proofs with deep learning to prove that a particular version of the Euler equations breaks down. This is a significant result, as it suggests that the Euler equations may not be valid for all types of fluid flow.
- **Find new conjectures in knot theory:** Researchers at the University of California, Berkeley used deep learning to find new conjectures in knot theory. Knot theory is a branch of mathematics that studies knots, which are closed loops in three-dimensional space.
- **Develop better techniques for multiplying matrices:** Researchers at the University of California, Los Angeles used deep learning to develop better techniques for multiplying matrices. Matrix multiplication is a fundamental operation in many areas of mathematics and computer science.
- **Analyze neural networks:** Researchers at the University of Toronto used deep learning to analyze neural networks. Neural networks are a type of machine learning model that is inspired by the human brain.

These are just a few examples of the many ways that deep learning is being used in mathematics. Deep learning is a powerful tool that has the potential to revolutionize the way that mathematicians solve problems.



CHAPTER OF THE MONTH:

Calculus

LIMITS & DERIVATIVES CHEAT SHEET

PROPERTIES OF LIMITS

$$\lim_{x \rightarrow a} [cf(x)] = c \lim_{x \rightarrow a} f(x)$$

$$\lim_{x \rightarrow a} [f(x) \pm g(x)] = \lim_{x \rightarrow a} f(x) \pm \lim_{x \rightarrow a} g(x)$$

$$\lim_{x \rightarrow a} [f(x)g(x)] = \lim_{x \rightarrow a} f(x) \lim_{x \rightarrow a} g(x)$$

$$\lim_{x \rightarrow a} \left[\frac{f(x)}{g(x)} \right] = \frac{\lim_{x \rightarrow a} f(x)}{\lim_{x \rightarrow a} g(x)} \text{ if } \lim_{x \rightarrow a} g(x) \neq 0$$

$$\lim_{x \rightarrow a} [f(x)]^n = \left[\lim_{x \rightarrow a} f(x) \right]^n$$

LIMIT EVALUATIONS AT $\pm\infty$

$$\lim_{x \rightarrow +\infty} e^x = \infty \text{ and } \lim_{x \rightarrow -\infty} e^x = 0$$

$$\lim_{x \rightarrow \infty} \ln x = \infty \text{ and } \lim_{x \rightarrow 0^+} \ln x = -\infty$$

$$\text{if } r > 0: \lim_{x \rightarrow \infty} \frac{c}{x^r} = 0$$

$$\text{if } r > 0 \text{ \& } \{\forall x > 0 | x^r \in \mathbb{R}\}: \lim_{x \rightarrow -\infty} \frac{c}{x^r} = 0$$

$$\lim_{x \rightarrow \pm\infty} x^r = \infty \text{ for even } r$$

$$\lim_{x \rightarrow +\infty} x^r = \infty \text{ and } \lim_{x \rightarrow -\infty} x^r = -\infty \text{ for odd } r$$

L'HOPITAL'S RULE

$$\text{If } \lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \frac{0}{0} \text{ or } \frac{\pm\infty}{\pm\infty} \text{ then } \lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \lim_{x \rightarrow a} \frac{f'(x)}{g'(x)}$$

DERIVATIVE DEFINITION

$$\frac{d}{dx} [f(x)] = f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

PRODUCT RULE

$$[f(x)g(x)]' = f'(x)g(x) + f(x)g'(x)$$

QUOTIENT RULE

$$\frac{d}{dx} \left[\frac{f(x)}{g(x)} \right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

CHAINRULE

$$\frac{d}{dx} [f(g(x))] = f'(g(x))g'(x)$$

BASIC PROPERTIES OF DERIVATIVES

$$[cf(x)]' = c[f'(x)]$$

$$[f(x) \pm g(x)]' = f'(x) \pm g'(x)$$

COMMON DERIVATIVES

$$\frac{d}{dx} (x) = 1$$

$$\frac{d}{dx} [af(x)] = a \frac{d}{dx} [f(x)]$$

$$\frac{d}{dx} (ax) = a$$

$$\frac{d}{dx} (ax^n) = nax^{n-1}$$

$$\frac{d}{dx} (c) = 0$$

$$\frac{d}{dx} [f(x)]^n = n[f(x)]^{n-1} f'(x)$$

$$\frac{d}{dx} \left[\frac{1}{x^n} \right] = -nx^{-(n+1)} = -\frac{n}{x^{n+1}}$$

DERIVATIVES OF TRIGONOMETRIC FUNCTIONS

$$\frac{d}{dx} [\sin(x)] = \cos x$$

$$\frac{d}{dx} [\sec(x)] = \sec x \tan x$$

$$\frac{d}{dx} [\cos(x)] = -\sin x$$

$$\frac{d}{dx} [\csc(x)] = -\csc x \cot x$$

$$\frac{d}{dx} [\tan(x)] = \sec^2 x$$

$$\frac{d}{dx} [\cot(x)] = -\csc^2 x$$

DERIVATIVES OF EXPONENTIAL & LOGARITHMIC FUNCTIONS

$$\frac{d}{dx} [e^x] = e^x$$

$$\frac{d}{dx} [a^x] = a^x \ln a$$

$$\frac{d}{dx} [\ln|x|] = \frac{1}{x}$$

$$\frac{d}{dx} [\ln x] = \frac{1}{x}, x > 0$$

$$\frac{d}{dx} [\log_a x] = \frac{1}{x \ln a}$$

$$\frac{d}{dx} [\ln f(x)] = \frac{f'(x)}{f(x)}$$

$$\frac{d}{dx} [e^{f(x)}] = f'(x)e^{f(x)}$$

$$\frac{d}{dx} [a^{f(x)}] = a^{f(x)} \ln a f'(x)$$

$$\frac{d}{dx} [f(x)^{g(x)}] = f(x)^{g(x)} \left(\frac{g(x)f'(x)}{f(x)} + \ln(f(x))g'(x) \right)$$

DERIVATIVES OF INVERSE TRIG FUNCTIONS

$$\frac{d}{dx} [\sin^{-1} x] = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} [\sec^{-1} x] = \frac{1}{|x|\sqrt{x^2-1}}$$

$$\frac{d}{dx} [\cos^{-1} x] = -\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} [\csc^{-1} x] = -\frac{1}{|x|\sqrt{x^2-1}}$$

$$\frac{d}{dx} [\tan^{-1} x] = \frac{1}{1+x^2}$$

$$\frac{d}{dx} [\cot^{-1} x] = -\frac{1}{1+x^2}$$

DERIVATIVES OF HYPERBOLIC FUNCTIONS

$$\frac{d}{dx} [\sinh x] = \cosh x$$

$$\frac{d}{dx} [\operatorname{sech} x] = -\operatorname{coth} x \operatorname{csch} x$$

$$\frac{d}{dx} [\cosh x] = \sinh x$$

$$\frac{d}{dx} [\operatorname{csch} x] = -\tanh x \operatorname{sech} x$$

$$\frac{d}{dx} [\tanh x] = 1 - \tanh^2 x$$

$$\frac{d}{dx} [\operatorname{coth} x] = -1 - \operatorname{coth}^2 x$$



Science & Technology

First Look at Pristine Asteroid Dust Reveals Abundance of Water And Carbon

Initial studies of the 4.5-billion-year-old asteroid Bennu sample collected in space and brought to Earth by NASA show evidence of high-carbon content and water, which together could indicate the building blocks of life on Earth may be found in the rock. NASA made the news Wednesday from its Johnson Space Center in Houston where leadership and scientists showed off the asteroid material for the first time since it landed in September.

This finding was part of a preliminary assessment of NASA's OSIRIS-REx (Origins, Spectral Interpretation, Resource Identification and Security - Regolith Explorer) science team.

"The OSIRIS-REx sample is the biggest carbon-rich asteroid sample ever delivered to Earth and will help scientists investigate the origins of life on our own planet for generations to come," said NASA Administrator Bill Nelson. "Almost everything we do at NASA seeks to answer questions about who we are and where we come from. NASA missions like OSIRIS-REx will improve our understanding of asteroids that could threaten Earth while giving us a glimpse into what lies beyond."



Researchers have so far focused their efforts not on the main sample itself but on "bonus particles," that lay on top of the sample collecting mechanism.

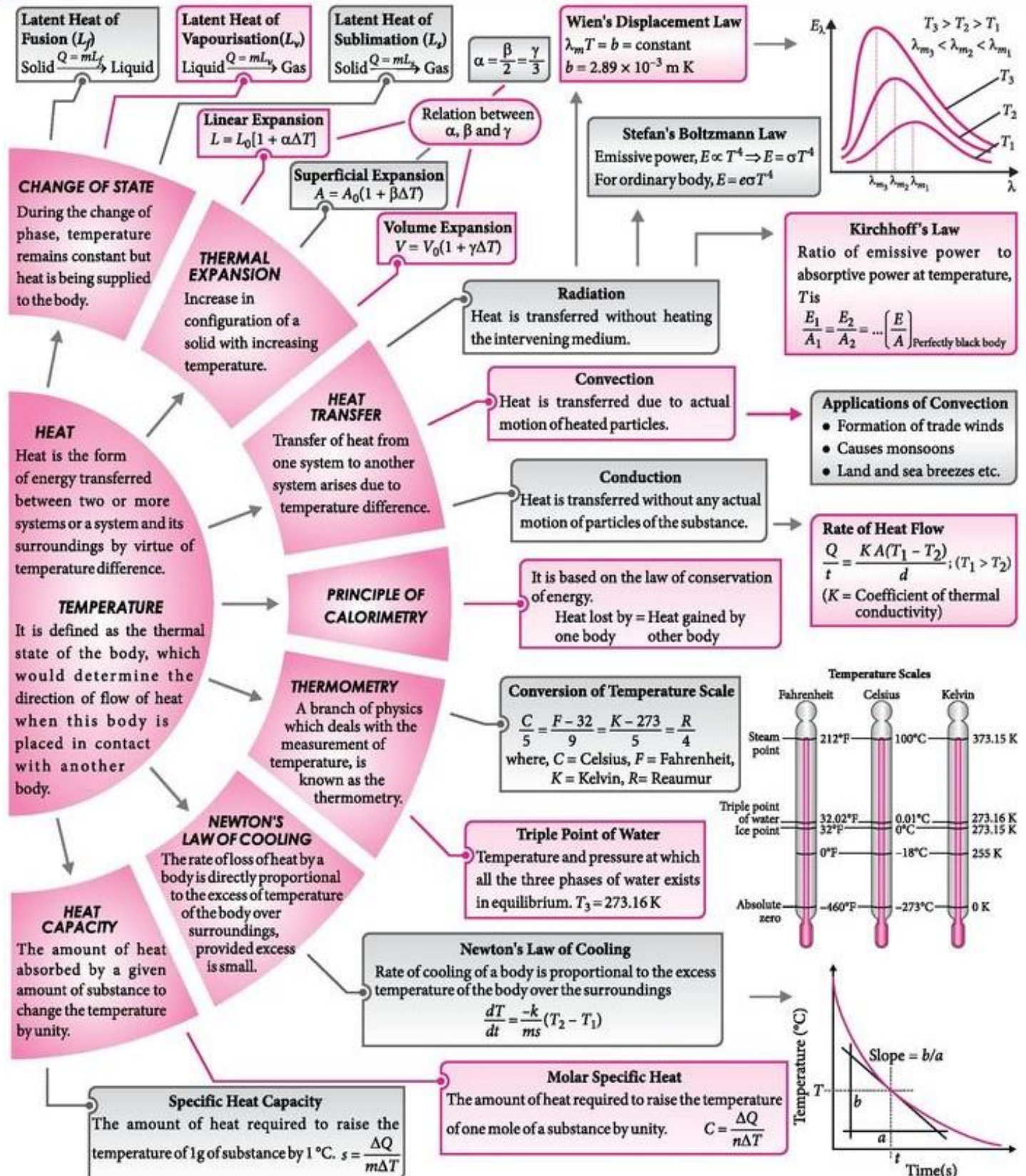
An inspection of the remainder of the sample will follow later.

Back in October 2020, when the OSIRIS-REx probe shot nitrogen gas at Bennu to collect material, a flap meant to seal the sample got wedged open, allowing some of the material to flow out into another compartment.

NASA says it will preserve at least 70 percent of the sample at Houston for future study - a practice first started in the Apollo era with Moon rocks.



CHAPTER OF THE MONTH : THERMAL PROPERTIES OF MATTER





TWIST YOUR MIND

(Answers will be given in the December 2023 digest)

RIDDLES

1. What can be measured, but has no length, width, or height?
2. You are in a room with 3 monkeys. One has a banana, one has a stick, one has nothing. Which primate in the room is the smartest?

PUZZLES

1. Find a 10-digit number where the first digit is how many zeros in the number, the second digit is how many 1s in the number etc. until the tenth digit which is how many 9s in the number.
2. What is unique about 8549176320 ?

Bright Spots: Positive Events from October 2023

In October 2023, there were many major positive events around the world, including:

- New Zealand lifted all of its remaining COVID-19 restrictions.
- India achieved 100% vaccination coverage for adults against COVID-19.
- The world's first commercial fusion reactor was successfully tested.
- The James Webb Space Telescope released its first images, which are the deepest and sharpest infrared images of the distant universe ever taken.
- The world's first malaria vaccine was approved by the World Health Organization.

These events are a sign of progress and hope in the world, and they remind us that there is still good to be found.

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ABOUT US

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