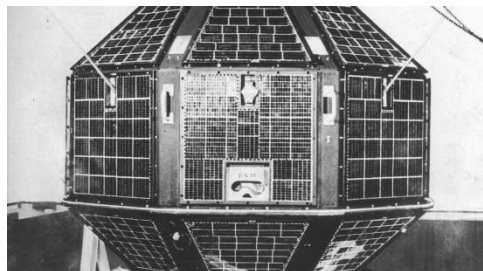


ARYABHATA

50 years since the launch of Aryabhata – India's first satellite



- Aryabhata was India's first indigenously-built satellite, named after the ancient Indian mathematician and astronomer Aryabhata, who lived in the 5th century CE.

- It was launched on **April 19, 1975**, from **Kapustin Yar**, a Soviet launch site, with the help of the **Soviet Union**.
- By launching Aryabhata, **India joined an elite club of 11 countries** capable of sending satellites into orbit, including the **USA, USSR, UK, France, China, West Germany, Australia, Canada, Japan, and Italy**.
- Aryabhata was designed to conduct experiments in **solar physics** and **X-ray astronomy**.
- Although the experiments faced a **power failure** after just **five days**, Aryabhata successfully made **initial X-ray observations** and continued **transmitting data for a few more days**.
- Aryabhata eventually **re-entered Earth's atmosphere** on **February 10, 1992**, giving it an **orbital lifespan of nearly 17 years**.
- **Prime Minister Indira Gandhi** selected 'Aryabhata' from a shortlist that included 'Mitra' and 'Jawahar', reflecting cultural and diplomatic values.

A **special commemorative postal stamp** was issued by India's Posts and Telegraphs Department within hours of the launch.

The **Soviet Union** issued its own **Aryabhata commemorative stamp** in 1976, recognizing the spirit of **scientific cooperation**.

INDIA'S FIRST PROTOTYPE FAST BREEDER REACTOR (PFBR)



- It is a **500 MWe sodium-cooled reactor** located in **Kalpakkam, Tamil Nadu**.
- The PFBR was developed by **BHAVINI (Bharatiya Nabhikiya Vidyut Nigam Limited)**, a government enterprise set up in 2003 under the **Department of Atomic Energy (DAE)** to focus on fast breeder reactors.
- Construction began in 2004 and the reactor was originally expected to be completed in September 2010, but faced a series of delays.
- Unlike traditional nuclear reactors, the **PFBR uses fast neutrons for energy generation and employs liquid sodium as a coolant** instead of water.
- The innovative design enables the reactor to **breed more fuel than it consumes**, offering a **sustainable solution** to India's growing energy demands.
- The PFBR is **powered by plutonium and uranium-based mixed oxide fuel (MOX)**, which ensures **high efficiency** in power generation.
- Additionally, the reactor incorporates **robust safety features**, including a **strong containment structure and passive cooling systems** that prevent overheating.

India's Three-Stage Nuclear Programme:

- India has adopted a three-stage nuclear power programme, with the **long-term goal of deploying a thorium-based closed nuclear fuel cycle**.
- The **first stage** involves the use of **pressurised heavy water reactors (PHWRs)**, fuelled by **natural uranium**, and **light water reactors**.
- The **second stage** involves **reprocessing used fuel from the first stage to recover the plutonium to fuel FBRs**.
- In **stage 3**, **Advanced Heavy Water Reactors (AHWRs)** will burn **thorium-plutonium fuels and breed fissile uranium-233**.



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PIR PANJAL RAILWAY TUNNEL



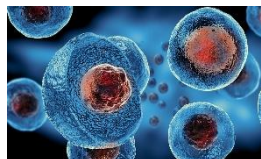
The Udhampur-Srinagar-Baramulla Rail Link's (USBRL) completion, marked by the Katra–Sangaldan section, ensures year-round, faster rail access to the Kashmir Valley.

- The Pir Panjal Railway Tunnel, also known as the Banihal Railway Tunnel, is currently India's longest transportation railway tunnel, measuring 2 kilometers in length.
- It is part of the Udhampur–Srinagar–Baramulla Rail Link (USBRL) and connects Quazigund in the Kashmir Valley with Banihal in Jammu, passing under the Pir Panjal mountain range.
- It is the only broad-gauge mountain railway tunnel in the country and part of the USBRL's 202-km core segment.

Pir Panjal Range

- It is part of the Lesser Himalayas, spans across Himachal Pradesh and Jammu & Kashmir. With notable peaks include Indrasan (6,221 m) and Deo Tibba (6,001 m).
- **Hydrological significance:** It separates the Beas and Ravi Rivers from the Chenab River and is the origin zone for tributaries of the Jhelum and Indus Rivers.
- **Strategic passes:**
 - The Mughal Road traverses the Pir Panjal Pass (3,490 m) to link Poonch and Rajouri with Srinagar.
 - The Jawahar Tunnel (2.5 km) under Banihal Pass connects Banihal to Qazigund.
- **Tourism and History:** The region hosts famous destinations like Gulmarg and was historically an ancient trade route connecting Kashmir with mainland India.

STEM CELL THERAPY FOR PARKINSON'S DISEASE



Researchers at Kyoto University conducted a Phase I/II clinical trial to assess the safety and side effects of stem cell therapy.

- Parkinson's disease is a **neurodegenerative disorder** that causes the **progressive loss of dopamine-producing neurons** in the brain.
- **Dopamine** is a critical **neurotransmitter** responsible for regulating **motor functions**.
- The conventional treatment mainly involves **dopaminergic medications**, but these **do not restore lost neurons** and may have **long-term side effects**.

Induced Pluripotent Stem Cells (iPSCs)

- iPSCs are **pluripotent stem cells** generated from **adult somatic cells** (like skin or blood).
- They are **reprogrammed** to an embryonic-like state, allowing them to develop into **any human cell type**.
- Used in:
 - **Diabetes** (converted into **beta cells**),
 - **Leukaemia** (to generate new blood cells),
 - **Neurological diseases**.

Stem Cells

- **Stem cells** are **undifferentiated primitive cells** capable of developing into **specialised cells** like blood, muscle, or liver cells.
- Their ability to **self-renew and differentiate** makes them vital for **regeneration and repair**.
- Found in:
 - **Bone marrow**,
 - **Gastrointestinal tract** (divide regularly),
 - Less active in organs like **pancreas** or **heart** (divide under specific conditions).

K2-18B



In 2025, scientists detected the presence of either dimethyl sulphide (DMS) or dimethyl disulphide (DMDS) in the atmosphere of K2-18b.

- **K2-18b** is an **exoplanet** (a planet located **outside our solar system**) situated **124 light-years** away from Earth in the **constellation Leo**, orbiting a star called **K2-18**.
- It was **discovered in 2015** by the **Kepler Space Telescope**.
- **K2-18b** is **5.2 times wider** and **around 9 times more massive** than Earth, suggesting it may possess a **hydrogen-rich atmosphere**.
- The planet receives a **similar level of stellar radiation** from its star as Earth does from the Sun, hinting at the possibility of **habitable surface conditions**.

Atmospheric Discoveries

- In **2019**, the **Hubble Space Telescope** detected **water vapour** in the atmosphere of K2-18b.
- Later, the **James Webb Space Telescope (JWST)** found the presence of **carbon dioxide (CO₂)** and **methane (CH₄)**.
- The **absence of ammonia** along with CO₂ and CH₄ in a **hydrogen-rich atmosphere** is significant because it may indicate the **possible presence of a liquid water ocean**.

About Dimethyl Sulphide (DMS)

- **DMS** is considered a **potential biomarker** because, on **Earth**, it is mostly produced by **phytoplankton** in the **oceans**.
- DMS is formed when phytoplankton die and enzymes break down **dimethylsulphoniopropionate (DMSP)**.
- It is also released when **soil bacteria** decompose plant matter and in trace amounts during **volcanic eruptions**.
- A **2015 study** found that **76% of soil bacteria** on Earth contain a **gene that produces DMS**, reinforcing its biological origin.

INDIA RAISES CONCERNS OVER U.S. VISA REVOCATIONS AFFECTING INDIAN STUDENTS

Background of the Issue:

- **Large-scale visa revocations:**
 - A recent survey by the American Immigration Lawyers Association (AILA) found that **50% of the visa revocation notices** sent in the past two months were **received by Indian students**.
 - Other affected nationalities include students from **China (14%), South Korea, Nepal, and Bangladesh**.
- **Denial of targeting by U.S. authorities:**
 - U.S. officials denied any discriminatory targeting, stating that the “continuous vetting and visa revocation actions” apply to all nationalities equally.
 - The revocations are part of a new AI-assisted initiative called “**Catch and Revoke**”, aimed at identifying visa holders with views perceived as inimical to U.S. foreign policy, especially through social media monitoring.

Implementation of ‘Catch and Revoke’:

- **AI-powered surveillance:**
 - Initiated by U.S. Secretary of State Marco Rubio, the program **uses AI to monitor social media** and assess the political views of students.
 - It is linked to the Student and Exchange Visitor Information System (**SEVIS**), which records visa status.
- **Homeland security crackdown:** The Department of Homeland Security (DHS) is also terminating the status of students whose names appear in **police databases**, even for minor infractions or as victims of crime.

Indian Students Among the First Affected:

- Two Indian students, Ranjani Srinivasan and Badar Khan Suri, were among the first to be asked to “self-deport”. Many other **Indian students** have since **approached courts** for the restoration of SEVIS status.
- The **Ministry of External Affairs (MEA)** initially cautioned Indian students to follow U.S. laws, but is now **actively assisting affected students** through Indian embassies and missions.

Human Rights and Legal Concerns:

- **Unjust revocations:**
 - The AILA report noted many revocations were **based on minor offences** such as traffic violations or campus infractions.
 - In some extreme cases, even victims of domestic abuse had their visas cancelled due to their names appearing in police reports.
 - Only 2 out of 327 cases involved any **alleged political activity**.
- **Expert criticism:** Experts highlighted the economic and scientific contributions of international students, warning that **such actions threaten U.S. national interest**.

Diplomatic Outlook and Upcoming Visit:

- **High-level meetings in India:**
 - U.S. Vice President **J.D. Vance**, along with Assistant Secretary of State Ricky Gill, will be in **Delhi for bilateral talks**.
 - Prime Minister Narendra Modi is expected to host Mr. Vance.
 - Though MEA Spokesperson confirmed that all bilateral issues will be discussed, he did not specify whether the **visa issue or U.S. tariffs** will be directly raised.
- **Engagement beyond Delhi:**
 - Vance is also scheduled to visit **Jaipur and Agra**.
 - U.S. State Department officials will participate in the **India-U.S. Forum**, organized by the Ananta Centre in collaboration with MEA.

ENZYMES AND COENZYMES



- Enzymes are **proteins** that catalyze biochemical reactions, enhancing the efficiency of **cellular metabolism**.
- Many enzymes require **helper molecules** for proper function. These are called **cofactors**, and when they are **organic molecules**, they are termed **coenzymes**.
- **Coenzymes** bind to enzymes and **support their activity**, playing a crucial role in various metabolic pathways.

What is Coenzyme Q (Ubiquinone)?

- **Coenzyme Q (CoQ)**, also known as **ubiquinone**, is an **organic antioxidant molecule** with multiple **isoprene units**.
- It exists in **ten different forms**, from **CoQ1 to CoQ10**, and is **lipid-soluble** but **water-insoluble**.
- Coenzyme Q is **vital for mitochondrial function** and is found in **every cell membrane**, where it aids **cellular energy production**.

Significance of CoQ9 in Plants

- **CoQ9**, containing **nine isoprene units**, is predominantly produced in **cereal crops** such as **wheat, rice, oats, barley, corn, rye, and millet**.
- It is also found in **bamboo, barley, and flowering plants** like **cinnamon, avocado, and pepper**.

Importance of CoQ10 in Human Health

- **CoQ10** is an **essential part of the mitochondrial electron transport chain**, generating the majority of the body's **cellular energy**.
- Organs like the **heart**, which have **high energy demands**, contain **high levels of CoQ10**.
- Although **CoQ9** is available in staple foods, **humans require additional CoQ10** due to **genetic factors, aging, and neurological disorders**.



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INS SUNAYNA



- It is the second Saryu-class offshore patrol vessel of the Indian Navy.
- It was designed and **constructed indigenously** by the **Goa Shipyard Limited**.
- It was commissioned at Kochi on 15th October 2013.
- It is based **under Southern Naval Command**.
- It is designed to undertake **fleet support operations**, coastal and **offshore patrolling**, **ocean surveillance** and **monitoring** of sea lines of communications and offshore assets, and **escort duties**.

What is IOS SAGAR?

- IOS SAGAR is a pioneering effort aimed at **bringing together the navies and maritime agencies of the Southwest Indian Ocean Region (IOR) on an Indian Naval platform**.
- The mission will serve as an opportunity to provide comprehensive **training to sea-riders from the Friendly Foreign Nations (FFNs)** and marks an unprecedented collaboration in maritime security.
- It is a unique mission **based on** the Government of India's **regional initiative** of maritime collaboration titled **SAGAR, which stands for Security and Growth for All in the Region**.
- IOS SAGAR also emphasises India's role as a "preferred security partner" and the "first responder" in the IOR.
- The **tagline** of IOS SAGAR is '**One Ocean One Mission**'.