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To The Point

by Dhananjay Gautam

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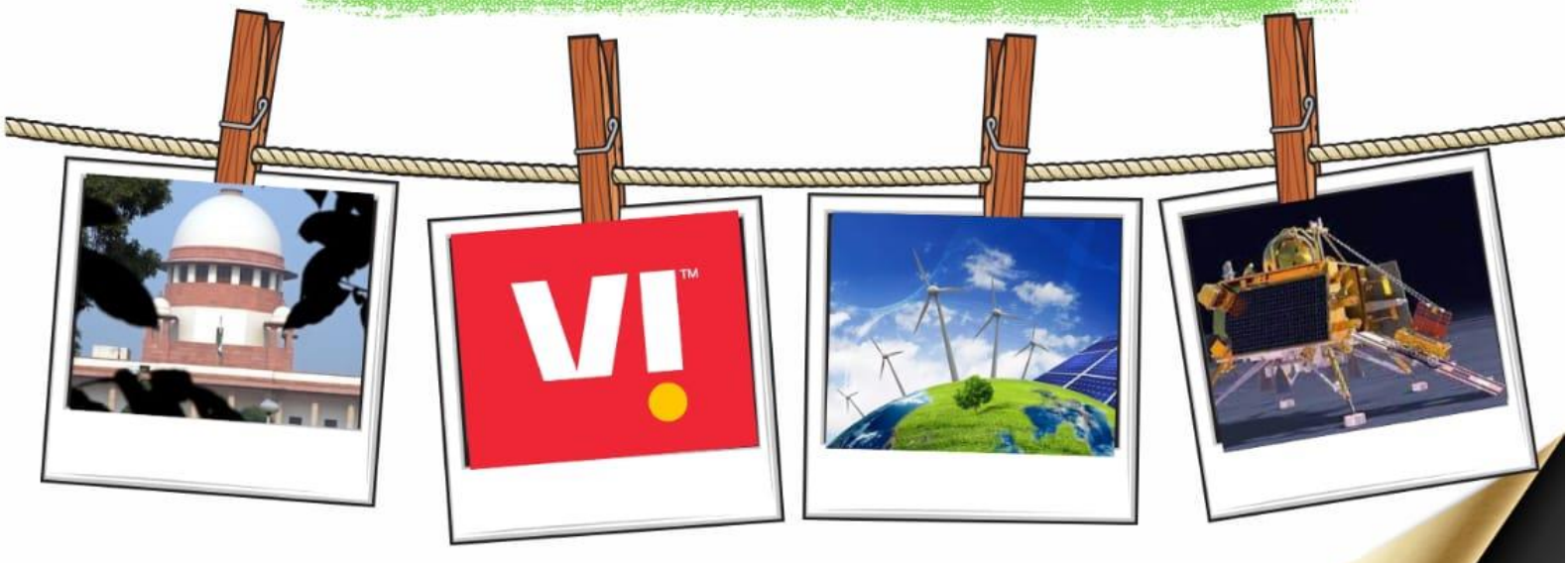

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GS Paper 1 – Indian Society & Culture

Concerns of Rising '1 Person, 1 Family' Culture: Supreme Court's Perspective

Context: Recently, the **Supreme Court of India** raised concerns over the **erosion of traditional family values**, noting the growing trend of a **'1 Person, 1 Family' culture**. This shift contrasts sharply with India's long-held cultural philosophy of **Vasudhaiva Kutumbakam—"The world is one family."**

What is Family?

A **family** is a **social group** characterized by **common residence, economic cooperation, and reproduction**. It serves as the **primary unit of socialization**, profoundly influencing an individual's **behavior, identity, and values**.

In **Indian society**, the family has historically played a central role—not just as a **kinship unit**, but also as a **moral, emotional, and economic anchor**. It has fostered interpersonal dynamics, providing **emotional security, generational wisdom, and social discipline**.

Emergence of the '1 Person, 1 Family' Culture:

Changing Trends:

India, known for its **strong joint family system**, is experiencing a significant transformation in family structures. The rise of the **'1 Person, 1 Family' culture** indicates a shift toward **nuclear families or solo living**.

This trend is particularly noticeable in **urban areas**, where **young professionals, entrepreneurs, and even elderly individuals** are choosing **solitude or micro-family structures** over **large, interdependent households**.

Key Reasons for the Shift:

1. Rapid Urbanization & Economic Independence:

- **Metropolitan cities** evolving into **global economic hubs**, leading to migration and preference for **independent living**.
- **Data Insight: Mumbai, Bengaluru, and Delhi** are witnessing the highest surge in **single-person living**.

2. Changing Aspirations & Individualism:

- Youth now prioritize **personal growth, career ambitions, and self-development** over family obligations.
- **Traditional hierarchical structures** are increasingly being challenged.

3. Delayed Marriages & Changing Relationship Norms:

- Growing acceptance of **live-in relationships, single parenting, and choosing to remain unmarried**.

- **Total Fertility Rate (TFR)** has dropped to **2.0**, below the **replacement level**, reflecting changing family dynamics.

4. Economic Pressures:

- Rising **cost of living** and demanding work-life balance make **joint family living impractical**.

5. Influence of Western Lifestyles:

- Exposure to **social media, education, and employment abroad** has reshaped lifestyle preferences.

6. Decline in Moral & Ethical Values:

- Increased **individualism and materialism** have led to reduced emphasis on virtues like **empathy, respect, honesty, and sacrifice**—critical for harmonious family life.

Challenges of the '1 Person, 1 Family' Trend:

1. **Mental Health Concerns: Loneliness and isolation** are rising, especially among **older adults and remote-working professionals**.
2. **Financial Pressure: Managing rent, utilities, and daily expenses alone** is financially challenging for many.
3. **Declining Family Bonds:** Weaker **intergenerational relationships** and a fading sense of **collective responsibility** may erode the social fabric.

Conclusion:

The **Supreme Court's concerns** about the rising **'1 Person, 1 Family' culture** serve as a **wake-up call** for society to reflect on the values underpinning familial relationships.

While **legal frameworks** can address specific disputes, **cultivating a culture of empathy, respect, and unity** within families is essential for preserving the **social fabric of the nation**.

GS Paper 3 – Indian Economy & Science & Technology

Union Cabinet Approves Electronics Component Manufacturing Scheme

Context: The Union Cabinet, led by the Prime Minister, has given the green light to the **Electronics Component Manufacturing Scheme** with a substantial funding of **22,919 crore**. This initiative is aimed at making India **Atmanirbhar (self-reliant)** in the global electronics supply chain.

Objectives of the Scheme:

- **Develop a Robust Component Ecosystem:** Attracting both **global and domestic investments** to strengthen the electronics manufacturing framework.
- **Boost Domestic Value Addition (DVA):** Enhancing capacity and capability to ensure higher value addition within the country.
- **Integrate Indian Companies into Global Value Chains (GVCs):** Positioning India as a key player in the global electronics ecosystem.

Expected Outcomes:

- Investment Attraction: **Targeting a whopping** 59,350 crore **worth of investments.**
- **Production Growth:** Estimated production output of **4,56,500 crore**.
- **Job Creation:** Anticipating **91,600 direct jobs** alongside numerous indirect employment opportunities.
- **Duration:** Scheme spans over **six years** with an additional **one-year gestation period**.

Understanding the Electronics Sector:

The **electronics sector** encompasses the **design, manufacturing, and marketing** of electronic components and systems. As one of the **fastest-growing industries globally**, it plays a pivotal role in shaping the modern economy.

- **Strategic Importance:** Electronics permeates all sectors, influencing economic and strategic growth.

India's Electronic Sector: Growth & Potential

- **Domestic Production:** Increased from **1.90 lakh crore (FY 2014-15)** to **9.52 lakh crore (FY 2023-24)**, showcasing a **CAGR of over 17%**.
- **Exports:** Boosted from **0.38 lakh crore (FY 2014-15)** to **2.41 lakh crore (FY 2023-24)**, reflecting a **CAGR of more than 20%**.
- **Global Standing: Second-largest mobile phone producer** in the world.
- **Semiconductor Momentum: 1.52 lakh crore** invested across **five landmark projects**.
- **Future Projections:** India's electronics production is expected to reach **USD 300 billion by 2026**.

Challenges Hindering Growth:

- **Dependence on Imports:** Heavy reliance on imported components, particularly **semiconductors**, elevating costs and increasing supply chain risks.
- **Infrastructure Gaps:** Lack of adequate infrastructure for **large-scale manufacturing** and logistics.
- **Skilled Labor Shortage:** Limited availability of skilled workers for **advanced manufacturing and R&D**.

- **High Capital Investment:** Establishing world-class facilities demands substantial investment, posing entry barriers for new players.
- **Technology Gaps:** Absence of cutting-edge technology in some segments of the value chain.
- **Global Competition:** Intense competition from **established manufacturers and low-cost countries**.

Government Schemes Powering the Electronics Boom:

1. **Make in India (2014):** Aimed at boosting India's **manufacturing sector** and economic growth, making the country a global hub for design and manufacturing.
2. **Phased Manufacturing Programme (PMP) (2017):** Promoted **domestic value addition** in mobile phones and their parts through increased investment and local manufacturing.
3. **Production Linked Incentive (PLI) Scheme (2020):** Designed to boost **domestic manufacturing** of mobile phones, electronic components, and semiconductor packaging.

- **Incentives: 3% to 6%** on incremental sales over the base year for eligible companies.
- **Duration: Five years**.

Semicon India Program (2021):

Structured to promote the **domestic semiconductor industry** with a financial outlay of ₹**76,000 crore**.

- **Future Milestone:** India's **first indigenous semiconductor chip** expected to be ready for production by **2025**.

Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS):

Provides a **25% financial incentive on capital expenditure** for identified electronic goods contributing to the downstream value chain.

Increased Budget Allocation:

The budget for electronics manufacturing rose from **5,747 crore (2024-25)** to **8,885 crore (2025-26)**, signifying the government's commitment to growth.

Conclusion: Paving the Path to Global Leadership

India's rapid evolution into a **global electronics manufacturing hub** reflects the success of the **Make in India initiative**. With **numerous supportive schemes**, the country has significantly bolstered **local manufacturing, exports, and investment**. The ambitious goal of achieving **USD 300 billion in electronics production by 2026** will position India as a major player in the **electronics and semiconductor industries**.

GS Paper 2 – Governance, Social Justice & Welfare Schemes

New Study Highlights Major Discrepancies in Child Labour Data in India

Context: A recent study on **child labour** conducted by **Enfold** and **CivicDataLab**, using **judicial data** from the **e-Courts platform**, reveals a significant discrepancy compared to data from the **National Crime Records Bureau (NCRB)**. The study shows a considerably higher number of **child labour cases** across six Indian states.

Key Findings of the Study:

1. Data Discrepancy:

- The study found that **judicial data** indicates **8 times more child labour cases** than reported by the **NCRB**.
- While the **NCRB** reported **1,329 cases (2015-2022)** under the **Child and Adolescent Labour (Prohibition and Regulation) Act, 1986**, the **e-Courts data** reveals **9,193 trials** during the same period.
- A total of **10,800 child labour cases** were analyzed across six states: **Maharashtra, Assam, Bihar, Jharkhand, Tamil Nadu, and Uttar Pradesh**.

2. Flaws in NCRB Data Collection:

- The **NCRB** follows the **"Principal Offence Rule"**, which counts only the **most serious crime** in cases involving multiple offences.
- As a result, **minor crimes** like **child labour** may be **underreported** if they are part of a larger **criminal case**.

3. Significance of Accurate Data:

- **Reliable data** is essential for understanding **crime trends** and developing effective **policies** to address child labour.
- Researchers and academics can use accurate data to **formulate targeted solutions** and improve **social interventions**.

Child Labour: A Persistent Issue in India

Despite numerous **government initiatives**, **child labour** remains a pressing issue in India, driven primarily by **poverty** and **lack of education**.

Statistics on Child Labour:

- **Census 2001:** Approximately **1.26 crore working children** (age 5-14) out of **25.2 crore total child population**.
- **Census 2011:** Around **10.1 million child labourers** (aged 5-14), constituting **3.9%** of the total child population in this age group.

Gurupadswamy Committee (1979):

- Established to study child labour and suggest measures to combat it.
- Identified **poverty** as the main challenge to eradicating child labour.
- Recommended **banning child labour in hazardous sectors** and regulating work in other areas.
- Advocated for a **multi-pronged policy approach**.

Impact of Child Labour on Society:

1. Economic Consequences:

- **Hindered Growth:** Child labour reduces **long-term productivity** as children miss out on **education** and **skill development**.
- **Poverty Trap:** Working children often **perpetuate the cycle of poverty**, as lack of education limits **employment opportunities** in adulthood.
- **Skills Deficit:** A **lack of formal education** results in a **low-skilled workforce**, affecting the nation's **economic future**.

2. Social Consequences:

- **Social Inequality:** Child labour disproportionately affects **marginalized and economically disadvantaged children**.
- **Hindered Progress:** Pervasive child labour obstructs efforts to improve **education, healthcare, and quality of life**.

Challenges in Preventing Child Labour in India:

- **Poverty:** Families depend on children's income for **survival**.
- **Educational Barriers:** Lack of **schools** and **poor infrastructure** hinder children's access to education.
- **Cultural Acceptance:** In some regions, child labour is seen as part of **family tradition**.
- **Economic Exploitation:** Industries requiring **cheap labour** often exploit children.
- **Migration:** Displaced families often push children into work due to **economic instability**.
- **Awareness Gaps:** Many **families and employers** are unaware of the **negative impacts of child labour**.

Constitutional Provisions and Legal Measures:

Fundamental Rights:

- **Article 21A:** Guarantees **free and compulsory education** for children aged **6-14 years**.
- **Article 24:** Prohibits **child labour** below **14 years** in **hazardous employment**.

Directive Principles of State Policy:

- **Article 39(e):** Protects children from **exploitation and abuse**.
- **Article 39(f):** Ensures children develop in an environment of **dignity and freedom**.

Key Legislative Measures:

- **Child Labour (Prohibition & Regulation) Act, 1986:** Bans child labour in **hazardous occupations** and regulates other sectors.
- **Amendment (2016):** Prohibits **child employment below 14 years** in all occupations and extends the prohibition to **adolescents (14-18 years)** in hazardous jobs.
- **National Child Labour Project (NCLP):** Provides **education, vocational training, and rehabilitation** for rescued child labourers.
- **Right to Education (RTE) Act, 2009:** Ensures **free and compulsory education** for children aged **6-14 years**.

- **Mid-Day Meal Scheme:** Encourages **school attendance** by offering free meals, reducing the incentive for children to work.

Integrated Child Protection Scheme (ICPS): Supports and **rehabilitates children at risk**, including those involved in child labour.

Conclusion:

Addressing the issue of **child labour** in India requires **accurate data collection**, **multi-faceted interventions**, and **community involvement**. While **legal frameworks** exist, effective **implementation** and **awareness** are essential to break the cycle of **poverty** and ensure every child's **right to education and development**.

GS Paper 3 – Science & Technology, Environment, Agriculture, & Biodiversity

National Gene Bank: Preserving India's Genetic Wealth

Context: The **central government** has announced the establishment of a **second National Gene Bank (NGB)** as part of the **Union Budget 2025-26**, under the theme **"Investing in Innovations."**

What is a Gene Bank?

A **Gene Bank** is a **bio-repository** that preserves **genetic material** of **plants, animals, and microbes** to ensure **long-term viability**. It plays a crucial role in **conserving biodiversity** and supporting **crop improvement** for **future food security**.

Types of Gene Banks:

Type of Bank	What it Stores	Example
Seed Bank	**Seeds** under controlled conditions	**ICAR-NBPGR**, New Delhi
Field Gene Bank	**Live plants** maintained in the field	For **perennial crops** like **mango**
Cryobank	Genetic material stored at **ultra-low temperatures** (e.g., **-196°C** in **liquid nitrogen**)	**DNA, pollen, embryos**
DNA Bank	**Purified DNA samples**	Used for **genetic research**
In Vitro Bank	**Plant tissues** stored in **nutrient mediums**	**Tissue culture**

Why is a New Gene Bank Needed?

- The new **National Gene Bank** aims to **conserve 10 lakh crop germplasm**, significantly expanding India's **conservation capacity**.
- **Genetic resources** preserved here will be essential for **crop improvement** and **genetic resource management**.
- Ensuring **genetic diversity** promotes **sustainable agriculture** and safeguards **future food security**.
- Equipped with **state-of-the-art infrastructure**, the new NGB will enhance India's ability to tackle **climate change**, **disease resistance**, and **yield improvement** challenges.

Existing National Gene Bank:

- The **first National Gene Bank** is located at the **ICAR-National Bureau of Plant Genetic Resources (NBPGR)** in **New Delhi**.
- It is the **second-largest gene bank in the world**, holding:
    - **4,71,561 accessions** from **2,157 species**.

Significance of Gene Banks:

- **Biodiversity Conservation:** Safeguards the genetic diversity of **important crops**.

- **Food Security:** Provides a reservoir of genes that can be used for developing **climate-resilient, high-yielding, and disease-resistant crops**.
- **Research & Development:** Facilitates **scientific research** aimed at improving **agricultural productivity**.
- **Cultural Preservation:** Helps preserve **indigenous varieties and traditional crops** that may otherwise be lost.

The establishment of a **second National Gene Bank** reflects **India's commitment to preserving genetic diversity** and promoting **sustainable agricultural practices**. It is a **strategic investment** aimed at ensuring **food security and climate resilience** for future generations.

South Korea: A Nation of Resilience and Natural Beauty

Context: South Korea, with its capital at **Seoul**, is currently grappling with its **worst-ever wildfires**, which have devastated vast forested areas and prompted large-scale evacuations. The nation's swift response reflects its robust disaster management systems, yet the intensity of the fires highlights growing concerns about **climate change and forest management**.

Political Features:

- **Location:** Situated in **East Asia**, South Korea occupies the southern part of the **Korean Peninsula**.
- **Boundaries:**
  - **North:** Bordered by the **Democratic People's Republic of Korea (North Korea)**.
  - **East:** Faces the **East Sea (Sea of Japan)**.
  - **South:** Opens to the **East China Sea**.
  - **West:** Bordered by the **Yellow Sea**.
- **Division: North and South Korea** are divided along the **38th Parallel**, which is marked by the **Demilitarized Zone (DMZ)**—a heavily fortified border spanning approximately **250 km** (160 miles).

Did you know? The **DMZ** is one of the most heavily guarded borders in the world, yet its isolation has allowed it to become a **unique wildlife sanctuary**, home to endangered species like the **Amur leopard and Siberian tiger**.

Geographical Features:

- **Mountains:** South Korea's landscape is dominated by the **Taebaek Mountain range**, which runs along the **eastern coast** and serves as a natural barrier.
- **Highest Peak:** The nation's tallest mountain is the **extinct volcano, Mount Halla**, located on **Jeju Island**, standing at **1,950 meters (6,398 feet)**.
- **Islands:**
  - **Jeju Island** is the largest and most famous, situated in the **Korea Strait**.
  - Known for its **UNESCO World Heritage Sites**, stunning volcanic landscapes, and unique cultural heritage.
- **Rivers:** Major rivers include the **Han River**, which flows through **Seoul**, and the **Nakdong River**, the longest river in South Korea.

Fun Fact: Jeju Island is also home to the **Manjanggul Lava Tube**, one of the **longest lava tunnels in the world**, extending over **13 km (8 miles)**.

Additional Knowledge:

- South Korea is a technological powerhouse, with **Seoul** often ranked among the world's most technologically advanced cities.
- The **Korean Wave (Hallyu)**, referring to the global popularity of **Korean entertainment and culture**, has significantly boosted South Korea's **soft power** worldwide.

GS Paper 1 – Infrastructure Development

6 Fixing India's Highway Black Spots: Urgent Action Required

Context: India's **national highways (NHs)** continue to be plagued by hazardous "**black spots**"—locations notorious for recurring road accidents resulting in grievous injuries and fatalities. A recent report by the **Parliamentary Standing Committee on Transport, Tourism and Culture** has criticized the **Ministry of Road Transport and Highways (MoRTH)** for its inadequate progress in addressing this alarming issue.

Background:

India consistently reports one of the **highest numbers of road accidents globally**. A significant portion of these incidents occur on NHs due to poorly designed or managed segments known as **black spots**. These are specific areas where a high frequency of accidents and fatalities have been documented over the years.

Despite various measures by **MoRTH** to mitigate road deaths, glaring execution gaps remain. According to the ministry's own data:

- Out of **13,795 black spots** identified, **only 5,036** have undergone long-term rectification.
- This leaves a vast number of **dangerous zones** unaddressed, posing daily threats to drivers and pedestrians.

What Are Black Spots?

A **black spot** refers to a hazardous location on a national highway identified by its recurring record of serious road accidents causing severe injuries or deaths across **three consecutive years**. These spots often arise due to:

- Poor **road design**
- Lack of **signage**
- **Inadequate lighting**
- Sharp **curves**
- Congested **junctions**

Parliamentary Panel's Findings: A Governance Failure:

In its **Demands for Grants for FY 2025-26**, the panel described the slow progress as a **"significant governance failure."** It noted that these black spots are **preventable dangers** that could be addressed through **swift, coordinated intervention**.

Led by **Rajya Sabha MP Sanjay Kumar Jha**, the committee expressed deep concern over the **gap between MoRTH's commitments and on-ground realities**.

Three-Tier Action Plan for Fixing Black Spots:

The panel proposed a **three-tier prioritisation framework** to tackle the issue based on:

- **Severity:** Frequency and seriousness of accidents.
- **Complexity:** The level of effort required to resolve the problem.
- **Population Exposure:** Number of users passing through the spot regularly.

The Plan Includes Strict, Time-Bound Interventions:

- **Category A (Highest Risk):**

- Temporary safety measures to be deployed **immediately**.
- Permanent rectification to begin **within 30 days** of identification.

- **Category B (Moderate Risk):**
  - Must be fixed **within 90 days**.
- **Category C (Lower Priority):**
  - Deadline of **180 days**.

Penalties: Agencies failing to meet these deadlines should face appropriate penalties.

Need for Post-Implementation Audits:

The panel emphasized the importance of **continuous monitoring**. It recommended conducting **safety audits** at **3-month and 12-month intervals** after rectification to ensure the solutions are effective.

Additionally, it proposed creating a **public dashboard** displaying:

- Status of each black spot.
- Progress of rectification.
- Responsible implementing agency.

MoRTH's Targets vs. Reality:

The ministry has set an ambitious target to **reduce road fatalities by 95% by 2028**. Its roadmap includes:

- **Fixing 1,000 black spots** in FY 2025–26.
- **Eliminating all identified black spots by FY 2027-28** through improved **signage, road design, and junction management**.

However, Progress Remains Slow:

- While **short-term measures** (signage, speed breakers, barriers) are implemented quickly, **long-term structural fixes** (underpasses, road widening, redesign) continue to lag.

Conclusion:

Fixing **black spots** on national highways is not merely a technical challenge—it is a **matter of saving lives**. The current pace of work fails to match the ministry's ambitious targets.

The parliamentary panel's recommendations provide a clear path forward, emphasizing **urgency, accountability, and transparency**. Without swift execution and consistent follow-up, the goal of **safer roads in India** will remain elusive.

Ultimately, **behind every black spot, there's a life that can be saved**.

GS Paper 3 – Environment, Ecology & Biodiversity

Deep-Sea Mining: Uncovering Lasting Ecological Impacts

Context: A recent study published in **Nature**, titled **'Long-term Impact and Biological Recovery in a Deep-Sea Mining Track,'** reveals alarming findings about the effects of deep-sea mining. Conducted by scientists from **Britain's National Oceanography Centre**, the research shows that an area of the **Pacific Ocean seabed mined over 40 years ago** has not fully recovered.

The results arrive at a critical time, as **36 countries** recently gathered at a **UN International Seabed Authority (ISA) meeting in Jamaica** to debate whether mining companies should be permitted to extract valuable metals from the ocean floor.

What is Deep-Sea Mining?

Deep-sea mining refers to the extraction of **valuable minerals and metals** from the ocean floor, often located at depths beyond **200 meters**. The process is divided into three main categories:

1. **Collecting Polymetallic Nodules:** Harvesting metal-rich rocks scattered across the ocean floor.
2. **Mining Seafloor Sulphide Deposits:** Extracting materials from hydrothermal vents, often rich in precious metals.
3. **Removing Cobalt Crusts:** Stripping minerals from underwater mountains and volcanic structures.

Why It Matters:

Deep-sea mining is attracting interest because of its potential to provide essential materials such as **nickel, cobalt, rare earth elements, and copper**—all critical for technologies like **renewable energy systems, electric vehicles, and everyday electronics**.

Technological Innovations:

The technology for deep-sea mining is still evolving, with companies exploring methods such as:

- **Vacuum-based Extraction:** Using massive pumps to collect materials from the seabed.
- **AI-Driven Robots:** Deploying sophisticated machines to **selectively gather polymetallic nodules**.
- **Underwater Mining Machines:** Designed to **extract resources from underwater mountains and volcanic regions**.

Strategic Importance:

With **onshore reserves depleting** and the **global demand for critical minerals rising**, governments and corporations are increasingly eyeing the **deep sea** as the next frontier for resource extraction.

Key Findings of the Study

The study focused on a **small-scale mining experiment conducted in 1979** within a section of the **Pacific Ocean seafloor**. Researchers examined an **8-meter strip** of seabed during an expedition in **2023** to assess the long-term impacts.

Major Findings:

1. **Long-Term Damage:** Mining led to **significant sediment disruption** and a **decline in larger marine species**, indicating that the ecosystem has not fully recovered even after **four decades**.
2. **Partial Recovery:** While some species are **beginning to recolonize**, the process is **slow and incomplete**, raising concerns about the long-term viability of deep-sea ecosystems.

3. **Broader Environmental Concerns:** Previous studies have highlighted additional negative effects of deep-sea mining, such as:
    - **Harmful Noise and Vibrations**
    - **Sediment Plumes** disrupting habitats
    - **Light Pollution** impacting deep-sea species

    A **2023 study** published in **Current Biology** concluded that deep-sea mining **significantly reduces animal populations** and has broader ecological impacts than previously estimated.

Implications for Policy and Regulation:

The findings of this study are expected to play a crucial role in shaping **future regulations** by the **International Seabed Authority (ISA)**.

Key Takeaways:

- The research suggests that while **partial recovery is possible**, **full restoration** of deep-sea ecosystems could take **decades or longer**.
- Data from this study contributes to the **Seabed Mining and Resilience to Experimental Impact (SMARTEX) project**, which aims to support **informed decision-making** about the ecological and societal impacts of deep-sea mining.

The Future of Deep-Sea Mining: Clarion Clipperton Zone (CCZ):

The **Clarion Clipperton Zone (CCZ)** is a **mineral-rich region** in the **North Pacific Ocean**, located between **Hawaii and Mexico**. It is known for its abundance of **polymetallic nodules** containing valuable minerals such as:

- **Manganese**
- **Nickel**
- **Copper**
- **Cobalt**

These materials are essential for manufacturing **electric vehicles, solar panels, and other clean energy technologies**.

The Debate Continues:

As interest in deep-sea mining grows, the ISA is currently evaluating whether and under what conditions mining should be allowed. The recent study adds substantial weight to the argument for a **moratorium on deep-sea mining**, particularly in ecologically sensitive areas like the **CCZ**.

Conclusion: A Call for Precaution:

The findings underscore the **lasting impact** of deep-sea mining on fragile marine ecosystems. While technological advancements and resource demands continue to drive interest in deep-sea mining, the **long-term ecological risks** cannot be ignored.

Future regulations must be guided by robust scientific research, prioritizing **sustainability, biodiversity protection, and responsible resource management**.

GS Paper 1 – Indian Society, Art & Culture

Sarhul Festival: Jharkhand's Grand Celebration of Nature and Adivasi Culture

Context: The **Adivasi communities** of **Jharkhand** and the **Chhotanagpur region** are set to celebrate the **Sarhul Festival** on **April 1, 2025**. This grand occasion marks the **New Year** and the much-anticipated **arrival of spring**.

What is Sarhul?

Sarhul is a **New Year festival** celebrated by the **tribal communities** of **Jharkhand** as part of the **Sarna religion**. Held in the **Hindu month of Chaitra**, it occurs **three days after the new moon**. The festival is a vibrant **celebration of spring** and a **reverent homage to nature**.

Nature Worship at the Heart of Sarhul:

- The term **Sarhul** literally means **"worship of the Sal tree"**. The **Sal tree** is considered the **abode of Sama Maa**, the **village-protecting deity**. This festival, deeply rooted in **nature worship**, reflects the Adivasi's **profound connection to the environment**.

Symbolizing the Union of Sun and Earth:

- Sarhul symbolizes the **harmonious union of the Sun and the Earth**. The **pahan (male priest)** represents the **Sun**, while his wife, the **pahen**, symbolizes the **Earth**. This connection highlights the **importance of sunlight and soil** for **sustaining life**.

A Festival Celebrating Life's Cycle:

- Sarhul marks the **renewal of life**. Only after the **rituals are completed** do Adivasis commence **agricultural activities** such as **ploughing, sowing**, and **forest gathering**. This tradition emphasizes the festival's **deep-rooted ties to nature and sustenance**.

Diverse Traditions Among Tribes:

- While **Sarhul** is celebrated by various tribes, including the **Oraon, Munda, Santal, Khadia, and Ho**, each group has its own **unique customs** and **names** for the festival.

From Hunting to Agriculture:

- Originally focused on **hunting**, the festival has **evolved over time** into an **agriculture-based celebration**, mirroring the **changing lifestyle** of Adivasis in the **Chhotanagpur region**.

Sarhul's Journey Across Lands:

- During the **19th and early 20th centuries**, Adivasi communities took **Sarhul** with them when they were sent as **indentured laborers**. As a result, Sarhul is now celebrated in places like **Assam's tea gardens**, the **Andaman and Nicobar Islands**, **Nepal**, **Bangladesh**, and **Bhutan**.

The Three-Day Celebration:

Day One: Preparations

- The festival kicks off with **decorations** at **homes and Sarna Sthals (sacred groves)**, featuring **triangular red and white Sama flags**. The **pahan** observes a **fast** and collects **ceremonial water**, while the community prepares the **sacred sites** and gathers **Sal flowers**.

Day Two: Main Rituals

- At the **Sarna Sthal**, villagers **offer Sal flowers** to the deity and **sacrifice a rooster** to ensure **prosperity**. The **pahan** sprinkles **holy water** while villagers perform **traditional dances** like **Jadur, Gena,** and **Por Jadur**. Young men participate in **ceremonial fishing** and **crab-catching**.

Day Three: Community Feast and Blessings

- The festival concludes with a **grand community feast**, featuring **handia (rice beer)** and traditional dishes. The **pahan blesses the villagers**, marking the **end of the celebrations**.

Transformation Over the Years:

Evolving Symbol of Identity:

- In the **1960s**, **Baba Karthik Oraon**, a notable **Adivasi leader**, initiated a **procession from Hatma to Siram Toli Sarna Sthal**. Today, these **processions** have become a **central feature**, showcasing **Adivasi identity** and fostering a sense of **community pride**.

Debate Over Religious Identity:

- While some **tribal groups** advocate for recognizing the **Sarna religion** as **distinct from Hinduism**, others argue that **Adivasis** are inherently part of **Hindu culture**. This debate continues to shape **identity politics** in the region.

A Festival Honoring Nature:

Nature at the Center:

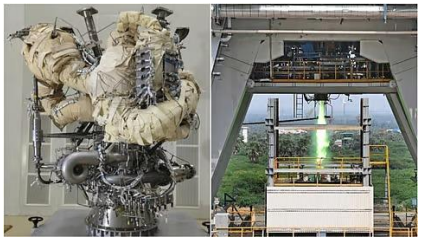
- Unlike other festivals that celebrate **human achievements**, **Sarhul** is dedicated to **nature**, with the **Sal tree** as its central symbol. The festival is devoid of **idols** or **temple processions**, focusing purely on the **worship of nature**.

Preserving Adivasi Heritage:

- As **urbanization** impacts **tribal traditions**, Sarhul emerges as a **cultural movement** reinforcing **Adivasi identity**. It offers a **valuable lesson** to modern celebrations—teaching us that **true festivity lies in respecting nature, not in extravagant displays**.

GS Paper 3 – Science & Technology, Space Technology & Achievements

ISRO's Breakthrough in Semi-Cryogenic Engine Development for LVM3



Context: The Indian Space Research Organisation (ISRO) has made a significant **breakthrough** in developing a **semi-cryogenic engine** with a remarkable thrust of **2,000 kN (kilonewtons)**. The first successful **hot test** of the **Engine Power Head Test Article (PHTA)** was conducted at the **ISRO Propulsion Complex, Mahendragiri, Tamil Nadu**. This achievement is set to enhance India's **space launch capabilities** by integrating this engine into the **Launch Vehicle Mark-3 (LVM3)**.

What is Geostationary Transfer Orbit (GTO)?

Understanding Transfer Orbi:

A **Transfer Orbit** is used to move a satellite from one circular orbit to another in a **fuel-efficient manner**. The most commonly used maneuver for such transfers is the **Hohmann Transfer Orbit**.

Geostationary Transfer Orbit (GTO):

Geostationary Transfer Orbit (GTO) is a **highly elliptical orbit** designed to move satellites closer to their **final geostationary orbit (GEO)**.

- **Perigee** (closest point to Earth): **180-200 km** above Earth's surface.
- **Apogee** (farthest point from Earth): Approximately **35,900 km** (near **geostationary orbit**).

Why is GTO Important?

Satellites are first placed in **GTO** before they use their **own propulsion systems** to reach their **final geostationary orbit (GEO)**. This approach:

- **Reduces energy requirements** from the launch vehicle.
- **Enhances fuel efficiency**.

What is a Semi-Cryogenic Engine?

A **Semi-Cryogenic Engine** is a type of **liquid rocket engine** that uses:

- **Liquid Oxygen (LOX)** as an **oxidiser** (**cryogenic component**).
- **Refined Kerosene (RP-1)** as **fuel** (**stored at ambient temperature**).

Why It Matters?

The combination of **LOX and RP-1** offers a **high thrust-to-weight ratio** and improved **efficiency**, making it ideal for **heavy-lift launch vehicles**.

Significance of ISRO's Semi-Cryogenic Engine Development

Engine Power Head Test Success:

- The **PHTA** was tested successfully for **2.5 seconds** to validate **ignition and boost strap mode operation**.

- All **engine parameters performed as expected**.
- Developed by: **Liquid Propulsion Systems Centre (LPSC)** under **ISRO**.

Future Plans:

ISRO plans to conduct **a series of further tests** on the **PHTA** before achieving a **fully integrated engine**.

Replacing the Current LVM3 Core Stage:

The **SC120 stage** (powered by the **SE2000 engine**) will **replace the existing L110 stage** in the **LVM3**.

Impact on Payload Capacity:

- **Payload capacity** to **Geosynchronous Transfer Orbit (GTO)** will **increase from 4 tonnes to 5 tonnes**.

This achievement marks a **crucial milestone** for ISRO's **space exploration ambitions** and positions **India** to achieve **greater efficiency and payload capabilities** in future missions.

GS Paper 1 – Geography

The Majestic Amur Tiger: Guardians of the Snowy Forests

Context: The **Amur Tiger** (*Panthera tigris altaica*), also known as the **Siberian Tiger**, is a symbol of strength and resilience, roaming the icy landscapes of eastern Russia, China, and possibly North Korea. Renowned for their **immense size and stunning beauty**, these tigers are uniquely adapted to **survive in harsh, cold environments**.

Conservation Status & Population:

- **IUCN Red List Status: Endangered**
- **Estimated Population (2022):** Approximately **265–486** in **Russia**, with a **small population** in **China** and **possibly North Korea**.
- **Major Threats: Habitat loss**, **poaching**, **roadkill incidents**, and **prey depletion**.

Latest News: A study published in *Oryx* highlights a worrying **increase in tiger roadkill incidents**, which could jeopardize their **long-term survival**.

Habitat & Distribution:

- **Primary Habitat: Eastern Russia's birch forests**.
- **Other Regions: Northeastern China** and **possibly parts of North Korea**.
- **Preferred Environment: Dense forests** with ample prey and minimal human disturbance.

Diet & Hunting Habits:

- **Diet: Carnivorous**, primarily preying on **elk**, **wild boar**, and other **ungulates**.
- **Hunting Technique:** Stealthy ambush predator, relying on **strength and agility** to take down large prey.
- **Daily Food Requirement:** Can consume up to **60 pounds** of meat in one sitting.

Physical Characteristics & Unique Adaptations:

- **Size: Up to 10.75 feet** in length.
- **Weight:** Can reach **660 pounds**, making them the **largest tiger subspecies**.
- **Lifespan: 10-15 years** in the wild, up to **20 years** in captivity.

Special Adaptations:

- **Thick Fur:** Protects against **freezing temperatures**.
- **Large Size:** Provides strength to take down **powerful prey**.
- **Lighter Coat Color:** Helps in **camouflaging** within snowy landscapes.
- **Fat Layer:** Provides **insulation** against the cold.

Fascinating Facts About Amur Tigers:

- **Largest Wild Cat:** The **Amur Tiger** is the **largest of all tiger subspecies**.
- **Territorial Giants:** Male Amur tigers can have territories spanning **up to 4,000 square miles**.
- **Exceptional Swimmers:** Despite their cold habitat, Amur tigers are **strong swimmers** and can cross rivers to expand their territory.

- **Cultural Significance:** Revered in **Russian and Chinese folklore** as a **symbol of power and bravery**.

Conservation Efforts & Challenges:

Despite successful conservation efforts in recent years, including **anti-poaching measures** and **habitat restoration**, **Amur Tigers** continue to face severe threats. The **rise in roadkill incidents**, as noted in the latest studies, calls for **urgent interventions** to ensure their **survival and recovery**.

Did you know? Amur tigers have a more robust and muscular build compared to other tigers, allowing them to tackle larger prey in snowy and rugged terrain.

The battle to save these **magnificent creatures** is ongoing, and efforts must continue to preserve their place in the **wild world**.

The Chicken's Neck Corridor: India's Strategic Lifeline

Context: The **Chicken's Neck Corridor**, also known as the **Siliguri Corridor**, is a **narrow and vulnerable strip of land** located in the **northern part of West Bengal**, connecting **mainland India** to its **northeastern states**. Despite its slender size, the corridor holds **immense strategic and geopolitical importance** for India.

Geography & Location:

- **Location: Northern West Bengal**, India.
- **Width:** Approximately **22 kilometers** at its narrowest point.
- **Bordering Nations:**
  - **Nepal** to the **west**.
  - **Bhutan** to the **north**.
  - **Bangladesh** to the **south**.
- **Connectivity:** Links **India's Northeastern Region (NER)**, comprising **eight states**:
  - **Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura**, to the **rest of India**.

Significance of the Siliguri Corridor:

The **Chicken's Neck Corridor** is often referred to as **India's Achilles' heel** due to its **geopolitical sensitivity and strategic value**.

Why It's So Important:

- **Critical for Connectivity:** Acts as the **sole land link** between **mainland India** and its **Northeast**.
- **Military Movement:** Essential for the **deployment of troops, supplies, and defense equipment** to the **northeast**, especially in the event of conflict.
- **Economic Lifeline:** Facilitates the **movement of goods and essential supplies** between the **Northeast and the rest of India**.

Proximity to China:

- **Located near the India-China border**, particularly the **Chumbi Valley in Tibet**.
- **China has built significant military infrastructure** in the region, raising concerns about the corridor's **security and accessibility**.
- In case of conflict, **China could potentially cut off India's access to its northeastern states** by targeting this corridor.

Latest Developments & News:

Recently, **Bangladesh has invited China** to **invest in a river conservation project** near the **Chicken's Neck Corridor**. This development raises **geopolitical concerns** for India due to the **involvement of China** in an area so **close to its sensitive border region**.

Historical Context & Challenges:

- **Partition of 1947:** The creation of **East Pakistan (now Bangladesh)** left the **Siliguri Corridor** as India's **only land bridge** to the northeast.
- **Geographical Vulnerability:** Its **narrow width** makes it highly **susceptible to blockades or disruption**, whether by natural calamities or external threats.
- **Infrastructure Challenges:** Ensuring **uninterrupted connectivity** through the corridor requires **constant monitoring and development** of **roads, railways, and communication networks**.

Additional Facts & Knowledge:

- **Alternative Connectivity:** India has been actively working on the **Kaladan Multi-Modal Transit Transport Project** and the **Agartala–Akhaura rail link** to improve **connectivity with the Northeast via Bangladesh**.
- **New Rail Links:** Indian Railways is developing **broad-gauge rail connectivity** to the Northeast through the corridor to **strengthen supply lines**.
- **Strategic Concerns:** Any **blockade** or **disruption** could severely impact **India's national security and economic stability**.
- **Economic Growth Potential:** Enhanced connectivity through the corridor is crucial for **boosting trade and development** in the **Northeastern Region**.

The **Chicken's Neck Corridor** remains a **strategic chokepoint** for India. With the **involvement of China in projects nearby**, the **importance of securing and developing the corridor** has become more crucial than ever.

GS Paper 3 – Environment, Biodiversity & Conservation

Kasampatty Sacred Grove: A Jewel of Biodiversity and Culture

Context: The **Kasampatty Sacred Grove**, also known as the **Veera Kovil Sacred Grove**, is a sacred and ecologically rich site nestled in **Kasampatty village** of **Dindigul District**, Tamil Nadu. This sacred grove has recently been **notified as a Biodiversity Heritage Site** by the Tamil Nadu government, underscoring its significance in preserving both **natural heritage** and **cultural values**.

A Glimpse into Kasampatty Sacred Grove :

- **Location: Kasampatty Village**, **Dindigul District**, Tamil Nadu
- **Area: 4.97 hectares**
- **Proximity:** Near the **Alagarmalai Reserve Forest**, surrounded by **lush mango plantations** that enrich the grove's fertility.

Flora and Fauna of the Grove:

The **Kasampatty Sacred Grove** is a **biodiversity hotspot**, hosting a wide variety of species:

- **48 plant species**, including rare and medicinal varieties.
- **22 shrub species** and **21 lianas (woody vines)**.
- **29 herb species** that contribute to the grove's ecological balance.
- **Over 12 bird species**, small **mammals**, **reptiles**, and **numerous insects**, showcasing its **genetic richness** and **ecosystem diversity**.

This extraordinary diversity makes the grove a **critical site for conservation** and **environmental education**.

Biodiversity Heritage Sites (BHS): A National Effort to Protect Nature

A **Biodiversity Heritage Site (BHS)** is a unique and highly valued ecosystem with extraordinary biodiversity. These sites are recognized for their **cultural, ecological, and aesthetic significance**.

Key Characteristics of BHS:

- **Richness of Species:** Both **wild** and **domesticated species**, along with **intra-specific categories**.
- **High Endemism:** Presence of species found nowhere else.
- **Rare and Threatened Species:** Including **keystone species** and species with **evolutionary significance**.
- **Cultural Significance:** BHS sites have important **cultural, ethical, or aesthetic values**, sometimes linked to long-standing human association with the land.
- **Fossil Beds:** Some sites feature remnants of **preeminent biological components**, like ancient fossils.

Kasampatty Sacred Grove's Designation as a BHS:

- **Tamil Nadu Government** declared the **Kasampatty Sacred Grove** as the **state's second BHS** under the **Biological Diversity Act, 2002**.
- This designation helps protect the **biological diversity** and ensures **sustainable management** of the site while **respecting the cultural heritage** of the local community.

Understanding the Biological Diversity Act, 2002:

The **Biological Diversity Act, 2002**, empowers state governments to designate areas as **Biodiversity Heritage Sites** in consultation with local bodies. This act aims to:

- **Conserve biodiversity** and prevent the **degradation of ecosystems**.
- **Enhance the quality of life** for **local communities** through sustainable practices.
- Ensure that **local traditions and practices** are respected while maintaining the grove's ecological health.

Historical Context and Future of Kasampatty Sacred Grove:

- The grove's **sacred status** has long been respected by the local community, who have nurtured its **ecological richness** through **spiritual practices**.
- The Tamil Nadu government's move to protect this site enhances efforts to **preserve the grove's biodiversity** and **cultural significance**.

Additional Facts and Knowledge:

- **Sacred Groves in India**: India is home to over **13,000 sacred groves**, each preserving local **flora and fauna**, representing a unique blend of **cultural reverence** and **ecological importance**.
- **Biodiversity Importance**: Protecting sacred groves like **Kasampatty** ensures the **continuation of traditional ecological knowledge**, which is crucial for the **conservation of endangered species** and ecosystems.
- **Cultural Significance**: These groves have been places of **worship and spiritual significance** for centuries, fostering a deep connection between **nature and culture**.

The **Kasampatty Sacred Grove** stands as a testament to the harmonious relationship between nature and culture. Its new status as a **Biodiversity Heritage Site** marks a significant step in preserving **India's natural heritage** and protecting the invaluable species that call it home.

GS Paper 3 – Science & Technology

Historic Polar Orbit Mission: SpaceX Achieves a Groundbreaking Feat

Context: SpaceX recently made history with the successful launch of **Fram2**, a **private astronaut crew mission** aboard a **Falcon 9 rocket** from NASA's **Kennedy Space Center** in Florida. This mission marks a pivotal milestone as the **first human spaceflight to utilize a polar orbit trajectory**—an achievement that expands the boundaries of human space exploration.

What is a Polar Orbit?

A **Polar Orbit (PO)** is a specific type of **Low Earth Orbit (LEO)**, typically ranging between **200 km to 1,000 km** in altitude. Unlike equatorial orbits that circle the Earth from **west to east**, polar orbits travel **from pole to pole**, allowing satellites to **cross over every part of the Earth's surface** over time.

Interesting Fact: A deviation of up to **10 degrees** from the exact **North-South trajectory** is still classified as a polar orbit.

Why Polar Orbits Matter:

Polar orbits are crucial for:

- **Global Earth Observation:** They provide **comprehensive, repeated coverage** of the entire Earth's surface as the planet rotates beneath the satellite's path.
- **Climate Monitoring:** Vital for **tracking changes in the atmosphere, oceans, and land surfaces**, polar orbits are essential for understanding **climate change**.
- **Reconnaissance Missions:** Governments and private entities use polar orbits for **high-resolution imaging and surveillance**.

Did You Know? Most **Earth observation satellites**, like those in the **Landsat program**, utilize polar orbits for detailed monitoring of environmental changes.

Significance of the Fram2 Mission:

1. **First Human Spaceflight in Polar Orbit:** Unlike traditional missions that follow **equatorial orbits**, Fram2 travels from **pole to pole**. This trajectory enables **complete observation of Earth's surface over time**, making it invaluable for **climate studies, global surveillance, and research**. **Fact:** Prior to Fram2, polar orbits were almost exclusively used by **Earth-observing satellites and reconnaissance missions**—not human missions.
2. **Expanding Commercial Spaceflight:** Fram2 is **SpaceX's sixth private astronaut mission**, further solidifying its dominance in the **commercial spaceflight sector**. By demonstrating the feasibility of **polar-orbiting human missions**, SpaceX highlights the **growing role of private companies** in space exploration, reducing reliance on government agencies like **NASA**.
3. **Reusable Spacecraft Innovation:** The mission uses the **Crew Dragon capsule**, a **reusable spacecraft** developed by **SpaceX** with **NASA funding**. To date, SpaceX has successfully conducted **16 crewed missions** with this capsule, proving the **cost-efficiency and reliability of reusable technology**.

Fact: Reusability reduces the cost of space missions by up to **70%**, a game-changer for making space travel more accessible.

Future Implications:

The success of the **Fram2 mission** signals a **new era of space exploration**, where **commercial entities push the boundaries of technology and trajectory**. With the ability to **explore polar orbits**, we can expect enhanced **global monitoring, improved climate models, and expanded human missions to previously inaccessible orbits**.

GS Paper 1 – Art & Culture (Contributions to Knowledge Systems)

Abel Prize 2025: Celebrating Mathematical Excellence

Context: The **Abel Prize** is a prestigious international award recognizing groundbreaking contributions to the field of **mathematics**. Established by the **Norwegian Parliament in 2002** to mark the 200th anniversary of the birth of the brilliant Norwegian mathematician **Niels Henrik Abel (1802-1829)**, the prize has become a highly coveted honor in the mathematical community.

Often regarded as the **"Nobel Prize of Mathematics,"** the Abel Prize fills the void left by the absence of a mathematics category in the Nobel Prizes. It carries a **monetary award of 7.5 million kroner (approximately $720,000)** and a **glass plaque** crafted by Norwegian artist **Henrik Haugan**.

The award is managed by the **Norwegian Academy of Science and Letters** on behalf of the **Norwegian government**. Recipients are selected by a specialized committee appointed by the Academy with guidance from the **International Mathematical Union (IMU)** and the **European Mathematical Society (EMS)**.

Abel Prize 2025 Winner: Masaki Kashiwara

This year, the **Abel Prize** has been awarded to **Masaki Kashiwara**, a **Japanese mathematician** whose pioneering work has profoundly transformed **algebraic analysis, representation theory, and sheaf theory**.

Kashiwara's most celebrated contributions include:

- **Development of the Theory of D-Modules:** A framework essential for understanding systems of differential equations and their solutions.
- **Discovery of Crystal Bases:** A revolutionary approach that simplifies complex algebraic calculations by replacing them with graphs of **vertices and edges**. This has become a powerful tool in **representation theory** and has led to significant advancements in understanding symmetries in mathematical structures.

His work has bridged previously unconnected areas of mathematics, creating new pathways for **future research** and contributing to solving longstanding, challenging problems.

The Significance of Masaki Kashiwara's Work:

- **Crystal Bases and Quantum Groups:** Kashiwara's discovery of crystal bases provided a fundamental structure within the theory of **quantum groups**, which play a crucial role in both pure mathematics and theoretical physics.
- **D-Modules:** His theory of **D-modules** has applications beyond mathematics, influencing areas such as **string theory, algebraic geometry, and representation theory**.
- **Collaborations and Influence:** Kashiwara's work has inspired numerous mathematicians worldwide, contributing to a deeper understanding of **algebraic structures** and their applications.

Did You Know?

- **Niels Henrik Abel**, after whom the prize is named, died at the age of **26** but made monumental contributions, including proving the impossibility of solving general quintic equations by radicals.
- The Abel Prize is often compared to the **Fields Medal**, but unlike the Fields Medal, which is awarded every four years to mathematicians under the age of **40**, the Abel Prize has **no age restriction** and is awarded **annually**.

Legacy and Future Impact:

Masaki Kashiwara's contributions continue to inspire **new research** and drive innovation in mathematics. His breakthroughs have not only resolved deep mathematical puzzles but also established tools that future generations of mathematicians will build upon.

The **Abel Prize 2025** stands as a testament to Kashiwara's brilliance, dedication, and vision, solidifying his legacy as one of the foremost mathematicians of our era.

GS Paper 3 – Environment, Security and Disaster Management

Tensions Rise in the Arctic as Global Powers Compete for Strategic Control

Context: The Arctic, once a frozen and remote region, has quickly become a **strategic hotspot** on the global stage. **Climate change** is causing the ice caps to melt at an unprecedented rate, opening up new trade routes and revealing **vast untapped natural resources**. These developments have led to increased interest from major powers, intensifying the competition for control of this critical region. **If tensions are not managed properly**, the Arctic could become a focal point for **military conflicts** and political struggles.

Why the Arctic Matters: Strategic and Economic Value:

1. **Natural Resources**: The Arctic is home to **13% of the world's undiscovered oil** and **30% of its untapped natural gas reserves**. It also boasts rich deposits of **rare earth elements, copper, and phosphates**, and is crucial for fishing industries. These resources, long buried under ice, are now becoming accessible due to **global warming**.
2. **New Shipping Routes**: The melting ice is opening up vital **new shipping lanes**, like the **Northeast Passage** along Russia's Arctic coast. This route could reduce travel time between **East Asia** and **Europe** by nearly **8,000 km**, making it a game-changer for global trade. China is particularly invested in this opportunity, proposing the creation of a **"Polar Silk Road"** to bypass traditional chokepoints such as the **Suez Canal**.

Legal Framework and Territorial Disputes:

Unlike the **Antarctic**—which is governed by an international treaty system—the Arctic's territorial disputes are handled under the **United Nations Convention on the Law of the Sea (UNCLOS)**. Nations can claim seabed areas beyond their **200-nautical-mile Exclusive Economic Zones (EEZs)** if they can prove geological continuity with their continental shelf.

- **The Arctic Council** consists of eight nations: **U.S., Canada, Russia, Denmark (via Greenland), Norway, Sweden, Finland, and Iceland**. Although the Council aims to promote **environmental protection** and **scientific collaboration**, **geopolitical rivalries** have placed significant strain on its cohesion.
- Nations like **Canada**, **Denmark**, and **Russia** have submitted overlapping claims to the **UN Commission on the Limits of the Continental Shelf**. If these claims are approved, countries could gain control over vast portions of the Arctic seabed.

Key Points of Tension in the Arctic:

1. **U.S. and Canada Dispute**: The **Northwest Passage**, a potential shortcut for shipping, is a major flashpoint. **Canada** claims it as its **internal waters**, while the **U.S.** insists it's an **international strait**, emphasizing the right to **freedom of navigation**. This ongoing disagreement adds to tensions between the two neighboring countries.
2. **Greenland's Strategic Importance**: Former U.S. President **Donald Trump's attempt to buy Greenland** from **Denmark** sparked controversy, especially given the **Pituffik U.S. military base**

located there. This move raised alarm bells in **Denmark** and **Europe**, leading to strengthened security commitments.

3. **Russia's Assertiveness**: **Russia** has the most advanced Arctic infrastructure, including the world's only **nuclear-powered icebreaker fleet**. It has also revived several **Soviet-era military bases** and planted its flag on the Arctic seabed during a 2007 submarine expedition. Russia's claims over parts of the **Svalbard Islands**, which belong to **Norway**, have further fueled tensions with NATO allies.
4. **NATO's Growing Presence**: The **admission of Sweden** and **Finland** into **NATO** has shifted the balance in Arctic geopolitics. NATO now conducts **military exercises** near Russian borders, increasing the **military stakes** in the region.
5. **China's Arctic Ambitions**: Despite not being an Arctic nation, **China** has declared itself a **"Near-Arctic State"** and is actively pursuing **Arctic shipping routes**. China's collaboration with Russia, including joint **naval drills**, demonstrates the growing **strategic ties** between the two nations, which alarms Western powers.

Broader Implications for Global Security:

The **Arctic's strategic value** extends far beyond its natural resources. As **global powers** vie for control of the region, it is becoming a **high-stakes arena** for energy politics, military posturing, and trade competition.

- The **absence of clear legal frameworks** and the **limited scope for multilateral cooperation** raise the risk of **conflict**.
- **Environmental concerns** are also critical. **Increased shipping and drilling activities** could accelerate the **ecological degradation** of the Arctic, which is already under immense stress due to **climate change**.

Conclusion: The Arctic as the New Global Frontier

As the **ice retreats**, the Arctic is rapidly becoming a **center of geopolitical rivalry**. Nations are eager to stake their claims to its **energy resources** and **shipping lanes**. The potential for conflict looms large, and without **robust international cooperation**, the Arctic could evolve into a major **flashpoint** in a world that is becoming increasingly **multipolar**.

Government Increases Stake in Vodafone Idea: Equity Conversion and AGR Dues

Context: The Indian government is set to increase its stake in **Vodafone Idea (Vi)** to nearly **49%** by converting an additional **36,950 crore** of the company's dues into equity. This move significantly boosts the government's stake, up from its previous holding of about **23%**, making it the largest shareholder. However, the **promoters** will retain **operational control** of the company. Vi will issue **3,695 crore shares** at **10** per share—**47% above its market price** of **6.8**. These dues primarily cover **spectrum auction payments** and **deferred liabilities** after the moratorium period.

Background: Vodafone Idea and AGR Issue

AGR Dues and Legal Struggles :

Vodafone Idea (Vi) has faced significant financial burdens due to a ruling by the **Supreme Court** on **Adjusted Gross Revenue (AGR)** dues. **AGR** determines the portion of revenue telecom operators must share with the government, including charges for **spectrum usage** and **licensing**.

- **AGR Controversy**: The **Department of Telecom (DoT)** mandates that AGR includes all revenues, including non-telecom sources like **deposit interest** and **asset sales**. Telecom companies have contested this, arguing AGR should only encompass telecom service revenues.
- **Supreme Court Ruling**: In **October 2019**, the **Supreme Court** ruled in favor of the government, expanding AGR to include **all revenues** except termination fees and roaming charges. This decision placed a massive financial strain on telecom operators.
- **Final Ruling (2020)**: On **September 1, 2020**, the Court upheld the government's definition of AGR and directed companies to clear their dues, including interest and penalties. The payment schedule was set from **April 2021** to **March 2031**. Defaults would lead to **penalties** and **contempt of court**.

Government Relief Measures and the Lifeline for Vodafone Idea:

Telecom Reform Package (2021) :

In **September 2021**, the **Union Cabinet** approved a **telecom reforms package** designed to ease the burden on telecom operators and improve liquidity. Key measures included:

- A **four-year moratorium** on **spectrum** and **AGR dues** (set to end in **October 2025**).
- A one-time option to **convert interest on deferred payments** into **equity** after the moratorium period.

Second Lifeline for Vodafone Idea:

To further aid Vodafone Idea, the government converted **16,000 crore** of **interest liabilities** into equity in **February 2023**, increasing its stake to **33.1%**. With this latest conversion, the government's stake in Vi will rise to **49%**, helping the company manage its massive debt burden.

Vodafone Idea's Debt Burden:

As of **December 2024**, Vi's total debt is approximately **2.3 lakh crore**, comprising:

- **77,000 crore** in **AGR liabilities**.
- **1.4 lakh crore** in **spectrum liabilities**.

Despite the **equity conversion**, the company still faces immense debt, with no new capital infusion from this move.

Impact of Equity Conversion on Vodafone Idea:

1. **Debt Relief and Financial Runway** : The conversion of debt into equity helps **Vi** reduce its **spectrum dues**, preventing an immediate financial crisis. Without this intervention, the company would have faced an annual installment of **40,000 crore** post-**September 2025**. This relief is expected to provide Vi with a financial runway for **two more years**.
2. **Limited Debt Reduction**: While this move reduces the debt by **37,000 crore**, **Vi's total debt** remains high at **2.1 lakh crore**. However, there is **no fresh capital infusion**, meaning existing shareholders face further **dilution** of their holdings.
3. **Government Ownership Limit** : The government's equity stake cannot exceed **50%**. Beyond this threshold, Vi would be classified as a **Public Sector Undertaking (PSU)**. This ownership limit prevents the government from converting more debt into equity without fundamentally changing the company's structure.
4. **Potential for Raising New Debt**: With increased government ownership, **Vi** may gain increased confidence from **investors** and **banks**, making it easier for the company to raise the **25,000 crore** in new debt it seeks to secure.

Conclusion: A Mixed Outlook for Vodafone Idea

The government's **equity conversion** has provided **Vodafone Idea** with some much-needed financial breathing room, though its future remains uncertain. The company's ability to raise new debt and manage its overwhelming liabilities will determine whether this lifeline proves sustainable or if further support will be required. For now, the government's increased stake has provided a temporary **reprieve**, but **long-term financial stability** will depend on **Vi's operational performance** and ability to navigate its substantial debt load.

GS Paper 2 – Governance, Constitution, Polity, Social Justice

Commemorating the 50th Anniversary of the Biological Weapons Convention (BWC)

Context: The **Biological Weapons Convention (BWC)**, marking its **50th anniversary** in 2025, stands as the **first multilateral treaty** to fully ban a class of **Weapons of Mass Destruction (WMDs)**. The treaty was **opened for signature in April 1972** and officially entered into force on **March 26, 1975**.

Understanding the Biological Weapons Convention (BWC)

Full Name and Purpose : Formally titled, **"The Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction,"** the BWC is a critical component in the global effort to prevent the use of biological and toxin weapons.

Definition of Biological and Toxin Weapons:

Biological and toxin weapons are either **microorganisms** such as **viruses**, **bacteria**, or **fungi**, or **toxic substances** naturally produced by living organisms. These weapons are **deliberately engineered and released** to cause **disease and death** in **humans**, **animals**, or **plants**.

Examples of Biological Weapons

- **Anthrax**
- **Botulinum toxin**
- **Plague**

Potential Consequences:

The use of biological weapons can lead to catastrophic outcomes, including:

- **Food shortages**
- **Environmental devastation**
- **Severe economic losses**
- **Widespread illness**
- **Public fear and distrust**

The Genesis of the BWC:

The **BWC** was negotiated during a series of discussions held at the **Conference of the Committee on Disarmament** in **Geneva, Switzerland**. This multilateral effort was driven by the shared global understanding that biological weapons posed a unique and terrifying threat to human, animal, and plant life, as well as to global security and stability.

Key Provisions of the BWC:

The Biological Weapons Convention imposes stringent prohibitions on:

1. **Development** of biological and toxin weapons.
2. **Production** and **stockpiling** of such weapons.
3. **Acquisition** and **transfer** of biological weapons.
4. **Use** of biological and toxin weapons in warfare.

The **BWC** supplements the **1925 Geneva Protocol**, which only prohibited the **use** of biological weapons, extending the ban to **development** and **stockpiling** as well.

Global Membership and Reach:

- **188 States Parties** have ratified the BWC, reflecting its broad **international support**.
- There are **four Signatory States**: **Egypt**, **Haiti**, **Somalia**, and **Syria**.
- **India** is a member of the **BWC**, contributing to the global commitment to peace and security by refraining from the use of biological weapons.

Impact of the BWC: A Global Achievement in Disarmament:

Universal Commitment to Peace:

The BWC has played a pivotal role in **eliminating** the threat of biological weapons from state actors and has been a cornerstone in the **global disarmament framework**. The treaty's near-universal membership demonstrates the **global commitment** to preventing the catastrophic consequences of biological warfare.

Challenges and the Need for Strengthening Enforcement: While the BWC has been instrumental in curbing the proliferation of biological weapons, **verification** and **enforcement** mechanisms remain challenges. Ongoing discussions continue to explore ways to strengthen the **treaty's effectiveness** in addressing emerging threats and ensuring full compliance by all states.

Looking Ahead: The Future of the BWC:

As the world commemorates the **50th anniversary** of the **BWC**, it is an opportune moment to reflect on its achievements and the work still required to combat evolving threats in the **biological warfare domain**. The **advancement of science and technology**, alongside geopolitical challenges, underscores the need for continued global cooperation and vigilance to maintain the security and safety of all nations from the dangers of **biological weapons**.

GS Paper 3 – Infrastructure, Agriculture, and Environment

Union Cabinet Approves Kosi Mechi Intra-State Link Project for Bihar under PMKSY-AIBP

Context: The **Union Cabinet** has approved the inclusion of the **Kosi Mechi Intra-State Link Project** under the **Pradhan Mantri Krishi Sinchai Yojana - Accelerated Irrigation Benefits Programme (PMKSY-AIBP)**. This significant project is expected to enhance **irrigation facilities** and improve **flood management** in **Bihar**. The project is slated for completion by **2029**, ensuring long-term agricultural sustainability and better water management in the region.

Overview of the Kosi Mechi Intra-State Link Project:

- **Project Goal**: The Kosi Mechi Intra-State Link Project aims to **divert surplus water** from the **Kosi River** into the **Mahananda basin** by linking it to the **Mechi River**.
- **Water Management Approach**: This will be achieved through the **remodelling** and **extension** of the existing **Eastern Kosi Main Canal (EKMC)**.

  The **EKMC** is a part of the larger **Kosi Project** initiated in **1954** between **India** and **Nepal**, designed to address the issue of the shifting course of the Kosi River.
- **Flood Control and Irrigation**: The project will **improve flood control** while also increasing **irrigated agricultural land** across Bihar, ensuring greater water availability for farming.

About PMKSY (Pradhan Mantri Krishi Sinchai Yojana):

Launched in **2015-16**, **PMKSY** is an umbrella scheme aimed at **enhancing water access** for agricultural use, thereby improving irrigation infrastructure across India. The scheme focuses on:

- **Expanding irrigated areas** to boost **agricultural productivity**.
- **Improving water-use efficiency** on farms.
- **Promoting sustainable water conservation** practices.

Key Objectives of PMKSY:

- Increase the **cultivable area** under irrigation.
- Ensure **water conservation** and enhance **irrigation efficiency** at the farm level.

Major Components of PMKSY:

1. **Accelerated Irrigation Benefit Programme (AIBP):**
   - **Launched** in **1996-97**, AIBP was merged into PMKSY in **2015-16** to provide **central assistance** to **major and medium irrigation projects**.
   - Under AIBP, the **Long Term Irrigation Fund** (LTIF) facilitates financial support for these projects with borrowings from **NABARD**.
2. **Har Khet Ko Pani (HKKP):**

- This initiative ensures that every **farm** receives adequate water for irrigation, addressing the needs of **small farmers** and ensuring equitable water distribution.

3. **Watershed Development (WD):**
    - Implemented by the **Ministry of Rural Development**, this component focuses on **water conservation** and **rainwater harvesting** to ensure a sustainable water supply in drought-prone areas.

Significance of the Kosi Mechi Intra-State Link Project for Bihar:

1. **Improved Irrigation Facilities**: The project will directly benefit **agriculture** in Bihar by expanding **irrigated land**, improving crop yields, and reducing dependency on monsoon rains.
2. **Flood Management**: By controlling the flow of water and diverting surplus from the Kosi River, the project will help mitigate the **devastating flood effects** that frequently impact **northern Bihar**.

Long-Term Agricultural Benefits:

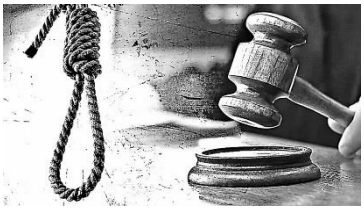
With its projected completion by **2029**, the Kosi Mechi Link Project will support **sustainable farming** practices and secure water resources for future generations.

Conclusion: A Step Toward a Resilient Agricultural Future

The inclusion of the **Kosi Mechi Intra-State Link Project** under **PMKSY-AIBP** represents a critical investment in Bihar's agricultural and environmental future. By enhancing **irrigation systems** and **flood management** mechanisms, the project will ensure that the state's agricultural sector thrives, even amidst unpredictable weather patterns and water scarcity issues. This initiative aligns with the **government's vision** of improving **water access** and **agricultural resilience** in India.

GS Paper 2 – Governance, Constitution, Polity, Social Justice

Maharashtra Establishes Dedicated Cell for Mercy Petitions



Context: The **Maharashtra government** has established a **dedicated cell** under the **Additional Secretary (Home)** to handle **mercy petitions** filed by **death row convicts**. This move follows the **Supreme Court's directive** to all states to set up such cells to **prevent delays** in the execution of death penalties, which the court noted can have a **"dehumanising effect"** on convicts.

Understanding Mercy Petitions:

What is a Mercy Petition?

A **mercy petition** is a **formal plea for clemency** filed by a convict (typically those on **death row** or serving long sentences) seeking relief in the form of:

- **Pardon**,
- **Commutation**,
- **Remission**,
- **Respite**, or
- **Reprieve**.

These petitions are directed to the **President of India** or the **Governor of a State** as a **last resort**, once all **judicial remedies** have been exhausted.

No fixed time limit is prescribed for the President's decision on a mercy petition.

Constitutional & Legal Provisions:

Relevant Articles:

- **Article 72 (President)**: Grants power to grant **pardons, reprieves, respites, remissions**, and **commutations** of sentences for:
    - Offenses against **Union laws**.
    - Cases involving **court-martial**.
    - **Death sentences**.
- **Article 161 (Governor)**: Empowers the Governor to grant **clemency** for offenses against **State laws**, excluding **court-martial cases**.

Key Judgment:

- **Maru Ram vs. Union of India (1981)**: The **Supreme Court** established that the **President must act based on the advice of the Council of Ministers** in mercy petitions.

Philosophy Behind Mercy Petitions:

1. **Right to Life (Article 21)**:Mercy petitions safeguard the **fundamental right to life and personal liberty** by allowing for **compassionate reconsideration**.
2. **Rectification of Judicial Errors**: They provide an opportunity to correct **judicial oversights** or errors, ensuring fairness in justice.
3. **Adherence to International Norms**: Aligns India with **global conventions** promoting **human rights and dignity** (e.g., **Universal Declaration of Human Rights**).

Types of Pardoning Powers in India:

Type	What Changes?	Example
Pardon	Completely cancels conviction & sentence.	Treated as not guilty.
Commutation	Changes the sentence to a lesser one.	Death → Life imprisonment.
Remission	Reduces sentence duration.	10 years → 6 years.
Respite	Grants lesser punishment for valid reasons.	Pregnant woman given lighter sentence.
Reprieve	Temporarily delays execution.	Time granted to file a petition.

Comparison of Pardoning Powers: President vs. Governor:

Aspect	President (Article 72)	Governor (Article 161)
Authority	President of India	Governor of a State
Jurisdiction	Union laws, court-martial cases, death penalties.	Offenses under State laws.
Military Law	Can pardon or reduce sentences for court-martial.	No power over court-martial cases.
Death Sentence	Can grant pardon and commute death sentences.	Can only **commute**, not **pardon**.
Binding Advice	Acts on advice of the **Central Council of Ministers**.	Acts on advice of the **State Council of Ministers**.

Conclusion:

The creation of a **dedicated cell for mercy petitions** in Maharashtra reflects a significant step towards ensuring **fairness and humanity** in the justice system. Mercy petitions are essential to maintaining a **balance between justice and compassion**, ensuring that the system remains **aligned with constitutional values and international human rights standards**.

GS Paper 3 – Science and Technology

Neuralink's Groundbreaking 'Blindsight' Chip: Human Trials Expected by 2025

Context: Elon Musk's brain-chip company, **Neuralink**, is gearing up to initiate **human trials** of its revolutionary visual prosthesis device, **"Blindsight"**, by the end of **2025**. This **Brain-Computer Interface (BCI)** aims to **restore vision** in individuals who are **completely blind**.

What is Blindsight?

The **Blindsight** device is an **experimental artificial vision system** that offers a new approach to restoring sight.

- **Microelectrode Array Implantation:** Uses a **microelectrode array** implanted directly in the **visual cortex** of the brain.
- **Bypasses Traditional Visual Pathways:** Completely **bypasses the eyes and optic nerves**, providing an alternative route for visual data processing.
- **Camera Feed Processing:** Captures visual information from a **camera feed** and **stimulates neurons** in the brain's visual center.
- **Artificial Perception of Images:** Enables the brain to **perceive visual information** even without functional eyes.

Understanding Brain-Computer Interfaces (BCIs):

Brain-Computer Interfaces (BCIs) are advanced systems designed to **connect the brain directly to external devices**.

Key Functions:

- **Signal Acquisition:** Capturing **brain signals** through electrodes or sensors.
- **Signal Analysis:** Processing the acquired data to **interpret neural activity**.
- **Command Translation:** Converting brain signals into actionable **commands**.
- **Device Control:** Sending commands to external devices to execute a desired action.

Types of BCIs:

BCIs can be categorized into three main types based on their **level of invasiveness:**

1. Invasive BCIs:

- **Direct implantation of electrodes** into the brain tissue.
- Offers the **highest signal quality** and precision.
- Associated with **surgical risks** such as infection, inflammation, and damage to brain tissue.
- **Applications:** Restoring motor function in paralyzed individuals, artificial vision systems like **Blindsight**.

2. Non-Invasive BCIs:

- Uses **external sensors**, such as **EEG headsets**, placed on the scalp.
- **Safer and more accessible** but suffers from **lower signal quality** due to interference from the skull and scalp.
- **Applications:** Communication devices, gaming, neurofeedback, and some medical diagnostics.

3. Partially Invasive BCIs:

- **Electrodes are placed inside the skull**, but outside the brain tissue.
- Provides a **compromise between safety and signal quality**.
- **Applications:** Cochlear implants, visual prosthesis development, etc.

Extra Insights: The Future of BCIs:

- **Rapid Advancements:** Companies like **Neuralink** and **Synchron** are pushing the boundaries of BCI technology.
- **Ethical Considerations:** Privacy, autonomy, and consent remain critical issues as these technologies advance.
- **Security Concerns:** BCIs are vulnerable to potential **cybersecurity threats**, emphasizing the need for robust safeguards.
- **Potential Beyond Medicine:** BCIs could enable **new forms of communication, education, and entertainment**, reshaping human-computer interaction.

Why This Matters:

Neuralink's **Blindsight** technology is a bold step toward **merging biology and technology**, offering hope to millions worldwide with visual impairments. As we approach **2025**, the world watches eagerly to see if this ambitious vision becomes a reality.

GS Paper 3 – Environment & Sustainable Development

Energy Statistics India 2025

Context: The **Ministry of Statistics and Programme Implementation (MoSPI)** has released its annual publication, **'Energy Statistics India 2025'**, through the **National Statistics Office (NSO)**. This comprehensive report provides insights into **India's evolving energy landscape** and future projections.

India's Energy Scenario in 2025:

Total Energy Supply and Demand:

- **Supply:** Approximately **1,800 Million Tonnes of Oil Equivalent (MToE)** — an annual increase of **4.5%** compared to 2024.
- **Demand Drivers:**
  - **Industrial Growth: 40%**
  - **Transportation: 25%**
  - **Residential Consumption: 20%**

Energy Mix (Sources and Shares):

- **Coal: 48%** (Dominant but declining gradually)
- **Oil: 28%** (Mainly for transportation and industrial use)
- **Natural Gas: 8%** (Growing, especially for cleaner energy initiatives)
- **Renewables (Solar, Wind, Hydro, Biomass): 12%** (Rapid growth, especially solar and wind)
- **Nuclear: 4%** (Stable but with planned expansion)

Fossil Fuel Reserves and Production:

Coal:

- **Total Reserves: 320 billion tonnes**.
- **Top States:**
  - **Odisha: 25.47%**
  - **Jharkhand: 23.58%**
  - **Chhattisgarh: 21.23%**
  - **West Bengal: 8.72%**
  - **Madhya Pradesh: 8.43%**
- **Concentration:** Approximately **85%** of total reserves are in these states.
- **Annual Production: 950 million tonnes** (meeting **85% of domestic demand**).
- **Global Rank: 2nd largest coal producer**, after China.

Lignite:

- **Total Estimated Reserves (as of April 2024): 47.30 billion tonnes**.
- **Top State: Tamil Nadu** (**79%** of total reserves).

Crude Oil:

- **Highest Reserves: Western Offshore region** (**32% of total reserves**).
- **Other Key Areas: Assam region** (**22% of total reserves**).

Natural Gas:

- **Largest Reserves: Western Offshore region** (**31%**).
- **Followed By: Eastern Offshore region** (**24%**).

Renewable Energy Growth:

Potential by Source:

- **Wind Power: ~55%** of total renewable potential.
- **Solar Energy and Hydro:** Also significant contributors.

Geographical Distribution:

- **Top States:**
  - **Rajasthan: 20.3%**
  - **Maharashtra: 11.8%**
  - **Gujarat: 10.5%**
  - **Karnataka: 9.8%**
- **More than 50% of renewable potential** concentrated in these states.

Capacity Expansion (2024-2025):

- **Solar Power: 175 GW** (Up from **150 GW** in 2024).
- **Wind Power: 50 GW** (Up from **45 GW** in 2024).

Hydro and Biomass Energy:

- **Hydropower: 52 GW** (**12%** of total electricity generation).
- **Biomass & Waste-to-Energy: 15 GW**, promoting sustainable practices in rural areas.

Electricity Generation and Consumption Trends:

- **Installed Capacity: 450 GW** (Increased from **420 GW** in 2024).
- **Total Electricity Generation: 1,700 TWh (terawatt-hours)**.
- **Per Capita Consumption: 1,500 kWh/year** (Reflecting economic growth and urbanization).
- **Transmission Losses:** Reduced to **17%** during FY 2023-24 (compared to **23%** in FY 2014-15), thanks to **Smart Grid Initiatives**.

Energy Efficiency and Sustainability Measures:

Government Policies and Initiatives:

- **National Hydrogen Mission:** Promoting **Green Hydrogen** for industrial use.
- **Perform, Achieve, and Trade (PAT) Scheme:** Encouraging energy-efficient technologies across industries.
- **FAME-III:** Accelerating the adoption of **Electric Vehicles (EVs)** and developing charging infrastructure.

Carbon Emissions and Climate Targets:

- **Projected Emissions (2025): 2.9 billion tonnes of CO_2** — a **4% decline** due to increased renewable usage.
- **Net-Zero Goal:** Commitment to achieving **net-zero emissions by 2070**.

Future Outlook (2026-2030):

Projections:

- **Renewable Share:** Expected to reach **25%** by **2030**.
- **Energy Demand Growth:** Projected **5% annual increase**, driven by **economic expansion**.

Challenges Ahead:

- **Dependence on Fossil Fuels:** Continued reliance on **coal and imported crude oil**.
- **Energy Security Risks: Geopolitical uncertainties** affecting oil and gas imports.
- **Infrastructure Bottlenecks:** Urgent need for **grid modernization** and **renewable storage solutions**.

GS Paper 1 – Geography

Place in News: Gas Pipeline Burst in Malaysia

Context: A **gas pipeline explosion** in **Putra Heights, central Selangor state, Malaysia** has left **several individuals injured**. The incident highlights the **infrastructure vulnerabilities** in one of Malaysia's rapidly developing regions.

Political Features of Malaysia:

Location and Division:

- **Region: Southeast Asia**, **north of the Equator**.
- **Division:** Malaysia is divided by the **South China Sea** into:
  - **Peninsular Malaysia (West Malaysia)**.
  - **East Malaysia** (*located on Borneo Island*).

Land Bordering Countries:

- **Thailand** (to the north of Peninsular Malaysia).
- **Indonesia** (to the south and west of East Malaysia).
- **Brunei** (located entirely on the island of **Borneo**, sharing borders with **East Malaysia**).

Maritime Bordering Countries:

- **Singapore** (separated by the **Strait of Johor**).
- **Philippines** (to the northeast across the **Sulu Sea**).
- **Vietnam** (to the north across the **South China Sea**).

Surrounding Water Bodies:

- **Strait of Malacca** (One of the world's busiest maritime trade routes).
- **Celebes Sea** (Southeast of East Malaysia, crucial for biodiversity).
- **South China Sea** (Vital for trade, energy resources, and maritime disputes).

Geographical Features of Malaysia:

Highest Peak:

- **Mount Kinabalu** (**4,095 meters / 13,435 feet**), located in **Sabah**, **East Malaysia** — A popular site for **mountaineering and biodiversity research**.

Important Rivers:

- **Rajang River:** Longest river in **Malaysia**, located in **Sarawak**, East Malaysia.
- **Kinabatangan River:** Renowned for **wildlife diversity**, situated in **Sabah**, East Malaysia.
- **Pahang River:** Longest river in **Peninsular Malaysia**, essential for **agriculture and water resources**.

Additional Insights:

- **Biodiversity Hub:** Malaysia is part of the **Coral Triangle**, known for its **rich marine biodiversity**.
- **Economic Centers:** Kuala Lumpur (capital city), Putrajaya (administrative capital), and George Town (UNESCO World Heritage Site).

- **Energy Infrastructure:** Incidents like the **Putra Heights pipeline burst** raise concerns over **energy infrastructure safety and maintenance**.

Vibe Coding: Revolutionizing App Development Through AI

Context: Vibe Coding has become a hot topic in Silicon Valley, quickly gaining attention after being coined by **Andrej Karpathy**, co-founder of **OpenAI** and former head of AI at **Tesla**. This revolutionary concept is reshaping how apps are developed, making the process more accessible than ever before.

What is Vibe Coding?

Vibe Coding refers to using **Generative AI** not only to assist in coding but to **generate entire codebases for apps** through natural language interactions. The process involves **prompting Large Language Models (LLMs)** like **ChatGPT** to produce application code based purely on user instructions.

How It Works:

1. **Natural Language Interaction:** Users communicate their app ideas and requirements to AI using simple, natural language prompts.
2. **Automated Code Generation:** The AI generates complete codebases, handling everything from backend logic to frontend design.
3. **Instant Prototyping:** Rapid development without deep technical knowledge of programming languages or frameworks.

Why It Matters:

- **Accessibility:** Lowers the barrier to entry for non-coders, allowing **innovators and entrepreneurs** to bring their ideas to life without technical expertise.
- **Speed:** Drastically reduces development time, enabling faster prototyping and iteration.
- **Scalability:** Offers potential for rapid scaling of applications without expanding human developer teams.

Potential Risks & Challenges:

Despite its promise, **Vibe Coding** presents certain challenges:

- **Security Risks:** Generated code may have **vulnerabilities** due to lack of contextual understanding by AI systems.
- **Maintenance Issues:** The code produced could be **inefficient or costly** to maintain, especially when scaled.
- **Quality Control: AI-generated code** may lack optimization, thorough testing, or adherence to industry standards.

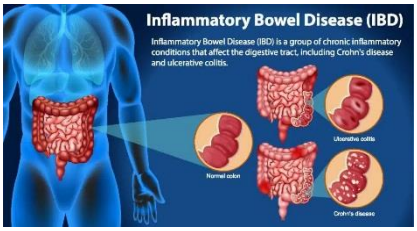
Extra Insights:

- **AI Dependence:** While **Vibe Coding** can accelerate development, it risks making developers overly reliant on AI tools without fully understanding the underlying codebases.
- **Human-AI Collaboration:** The ideal approach may be to combine **AI-driven code generation with expert oversight**, ensuring quality, efficiency, and security.

The Future of Vibe Coding: As AI continues to evolve, **Vibe Coding** could become a cornerstone of software development. However, ensuring that AI-generated code is **secure, efficient, and maintainable** will be crucial for its long-term success.

GS Paper 1 – Health and Education

Inflammatory Bowel Disease (IBD): Understanding and Managing a Chronic Condition



Context: The Jawaharlal Institute of Postgraduate Medical Education and Research (**JIPMER**) recently launched a **support group for patients with Inflammatory Bowel Disease (IBD)**, aiming to provide guidance, emotional support, and improved management strategies.

What is Inflammatory Bowel Disease (IBD)?

Inflammatory Bowel Disease (IBD) is a collective term for conditions that cause **chronic inflammation and swelling** of the digestive tract's tissues. It primarily includes two types:

1. **Ulcerative Colitis:**
    - Involves **inflammation and ulcers** (open sores) along the **lining of the colon and rectum**.
    - Symptoms often include **bloody diarrhea, abdominal pain, and fatigue**.
2. **Crohn's Disease:**
    - Causes **inflammation of the digestive tract lining**, often affecting **deeper layers of the intestinal wall**.
    - Commonly impacts the **small intestine**, but can also affect the **large intestine** or, less frequently, the **upper gastrointestinal tract**.
    - Symptoms may include **persistent diarrhea, weight loss, and abdominal pain**.

Common Symptoms of IBD:

Patients with **IBD** may experience a range of symptoms, often varying in severity. These include:

- **Abdominal Pain**
- **Diarrhea** (which may be bloody)
- **Rectal Bleeding**
- **Severe Fatigue**
- **Weight Loss**

What Causes IBD?

The **exact cause** of **Inflammatory Bowel Disease** remains unclear, but research points to several contributing factors:

- **Immune System Dysfunction:**
    - The body's immune system may **incorrectly react to environmental triggers**, such as **bacteria or viruses**, causing **inflammation of the gastrointestinal tract**.
- **Genetic Predisposition:**
    - Those with a **family history of IBD** are at a higher risk of developing the condition, suggesting a **hereditary component**.

Treatment Options for IBD:

While **IBD** is a **chronic condition**, various treatments are available to **manage symptoms and prevent flare-ups**. These include:

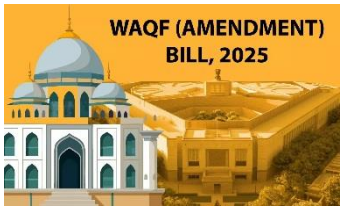
1. **Medications:**
    - **Anti-inflammatory drugs** (e.g., corticosteroids, aminosalicylates).
    - **Immune system suppressors** to reduce inflammation.
    - **Biologics** that target specific proteins involved in inflammation.
2. **Surgical Options:**
    - **Resection:** Removing the damaged portion of the digestive tract.
    - **Ileostomy or Colostomy:** Creating an opening for waste to exit the body, if necessary.

Living with IBD:

Managing **IBD** often involves a **combination of medical treatment, dietary adjustments, and lifestyle changes**. **Support groups**, such as the one launched by **JIPMER**, provide valuable assistance through **education, peer support, and practical advice** for managing symptoms.

GS Paper 2 – Governance, Constitution, Polity, Social Justice

Lok Sabha Approves the UMEED Bill, 2025: A Milestone in Waqf Property Management



Context: The **Lok Sabha** has passed the **Waqf (Amendment) Bill, 2025**, now renamed as the **Unified Waqf Management, Empowerment, Efficiency, and Development (UMEED) Bill**. Alongside this, the **Mussalman Wakf (Repeal) Bill, 2024** has also been approved, leading to the repeal of the outdated **Mussalman Wakf Act, 1923**.

Background and Objective:

In 2024, two significant bills were introduced:

1. **Waqf (Amendment) Bill, 2024**
2. **Mussalman Wakf (Repeal) Bill, 2024**

The primary objective of the **Waqf (Amendment) Bill, 2025** is to **amend the Waqf Act, 1995**, addressing challenges related to **Waqf property management** while improving the **administration and efficiency** of Waqf boards.

The **Mussalman Wakf (Repeal) Bill, 2024** aims to repeal the outdated **Mussalman Wakf Act, 1923**, thereby enhancing **uniformity, transparency, and accountability** in Waqf property management under the **Waqf Act, 1995**.

Understanding Waqf:

- **Waqf** refers to **properties dedicated exclusively for religious or charitable purposes** as per **Islamic law**. Once designated as Waqf, the **property becomes irrevocable** and cannot be sold or used for other purposes. The person who dedicates the property is known as the **wakif**, and the property is managed by a **mutawalli**.

Historical Context:

The concept of Waqf in India dates back to the **Delhi Sultanate** when **Sultan Muizuddin Sam Ghaor** dedicated villages to the **Jama Masjid of Multan**. Over the centuries, Waqf properties expanded significantly, especially during the rise of Islamic dynasties.

The **Mussalman Waqf Validating Act of 1913** legally protected the institution of Waqf in India.

Constitutional and Governance Framework:

According to the Constitution, **charitable and religious institutions** fall under the **Concurrent List**, allowing both **Parliament and State Legislatures** to make laws on this subject.

Currently, Waqf properties are governed by the **Waqf Act, 1995**, which replaced earlier laws from **1913, 1923, and 1954**.

Key Amendments in the UMEED Bill:

1. Composition of the Central Waqf Council:

- The **Union Minister in charge of Waqf** becomes the **ex-officio chairperson**.
- The council includes:
    - **Members of Parliament (MPs)**
    - **Nationally eminent persons**
    - **Retired Supreme Court/High Court judges**

- **Experts in Muslim law**

- The Bill **removes the Muslim requirement** for MPs, former judges, and eminent persons.
- **Mandates two non-Muslim members** in the council.

2. Composition of Waqf Boards:

- **State governments** are empowered to **nominate one person from each group**.
- **Non-Muslim members required: two.**
- **Inclusivity measures:**
  - At least one member each from **Shias, Sunnis, and Backward Muslim classes**.
  - **Two Muslim women members**.

3. Composition of Tribunals:

- **Removes the expert in Muslim law.**
- Comprises a **District Court judge (Chairman)** and a **Joint Secretary rank officer**.

4. Appeal Mechanism:

- Allows **appeals against Tribunal decisions** to the **High Court** within **90 days**, unlike the previous provision where decisions were **final**.

5. Survey and Property Management:

- The **Survey Commissioner** will be replaced by the **District Collector** or other senior officers to oversee the **survey of Waqf properties**.
- **Government properties identified as Waqf** will no longer be treated as such.

6. Financial Transparency:

- Waqf institutions earning over ₹**1 lakh** will undergo **state-sponsored audits**.
- Establishes a **centralized portal** for **Waqf property management**, ensuring **efficiency and transparency**.

7. Property Dedication and Women's Rights:

- Only **practicing Muslims (for at least five years)** can dedicate property, restoring **pre-2013 rules**.
- Women must **receive inheritance** before the Waqf declaration, with **special provisions for widows, divorced women, and orphans**.

Concerns Raised:

- **Non-Muslim Members in Waqf Boards:** Critics argue that including **non-Muslim members** could result in **non-Muslim dominance**, unlike boards for **Hindu and Sikh endowments**.
- **Expertise in Waqf Tribunals:** Removal of **Muslim law experts** may hinder effective resolution of **Waqf-related disputes**.
- **Five-Year Requirement:** The criterion for **creating Waqf** after practicing Islam for five years is seen as **arbitrary**.

Conclusion: The **UMEED Bill, 2025** is a significant move towards **modernizing Waqf property management**. By addressing **administrative challenges** and promoting **gender inclusion**, the bill aims to create a **more transparent and efficient Waqf management system**. However, the inclusion of **non-Muslim members** and removal of **Muslim law experts** have sparked debates regarding its potential **impact on community representation**.

GS Paper 3 – Economic Development

Domestically Manufactured Iron & Steel Products Policy (DMISP) – 2025

Context: The **Central Government** has introduced the **Domestically Manufactured Iron & Steel Products (DMISP) Policy – 2025**, focusing on **self-reliance and enhanced domestic value addition** in the Indian steel sector. This policy is a key component of the **"Atmanirbhar Bharat" (Self-Reliant India) vision**.

Objectives & Significance:

Promote Self-Reliance:

The policy aims to encourage **domestic production and consumption** of iron and steel, reducing dependency on imports.

Curb Imports:

Addressing the rising trend of steel imports, the policy seeks to safeguard the **Indian steel sector from foreign competition**.

Protect Domestic Industry:

By providing preference to **domestic manufacturers**, the policy aims to **shield local steel producers** from **unfair foreign competition**, especially in **government contracts and infrastructure projects**.

Enhance Domestic Value Addition:

The policy emphasizes **increasing local sourcing** of capital goods used in steel manufacturing, thereby **strengthening the domestic manufacturing ecosystem**.

Key Highlights of the DMISP Policy – 2025:

1. Preference for Domestic Steel:

- All **government ministries, departments, PSUs, trusts, and statutory bodies** are required to procure **locally manufactured iron and steel products**.
- Applies to all **procurement contracts exceeding ₹5 lakh**.
- Includes **infrastructure projects under centrally sponsored and central sector schemes**.

2. "Melt & Pour" Requirement:

- To ensure core production occurs within India, all products must be **melted and poured into solid form domestically**.
- Applicable to a wide range of products, including **flat-rolled products, bars, rods, and railway steel**.

3. No Global Tenders Under 200 Crore:

- **Global Tender Enquiries (GTE)** are **banned for contracts below ₹200 crore** unless explicitly approved by the **Department of Expenditure**.

- Promotes **domestic participation** in government projects by reducing competition from foreign players.

4. Reciprocal Clause:

- Suppliers from countries that **restrict Indian firms from participating in their public procurement** will be **barred from bidding in Indian government steel tenders**, unless permitted by the **Ministry of Steel**.
- This clause aims to ensure **fairness and reciprocity** in **international trade**, with **China** believed to be a primary target.

5. Emphasis on Domestic Value Addition:

- For **capital goods used in steel production** (e.g., **furnaces, rolling mills**), a **minimum of 50% domestic value addition** is mandatory.
- Bidders must **self-certify**, with false claims risking **blacklisting and forfeiture of earnest money deposits**.
- **Auditor certification** is required for capital goods to **verify value thresholds**.

Significance of the DMISP Policy – 2025:

1. **Boosts Self-Reliance:** Aligns with the **"Atmanirbhar Bharat" vision**, promoting indigenous manufacturing and consumption of steel.
2. **Strengthens Domestic Industry:** Provides a **level playing field** for Indian manufacturers by restricting foreign competition in government projects.
3. **Encourages Technological Upgradation:** The policy emphasizes **domestic value addition**, encouraging technological advancements within the country.
4. **Improves Trade Fairness:** The **reciprocal clause** ensures that **international trade practices remain equitable**.

Conclusion:

The **DMISP Policy – 2025** marks a bold step towards fostering **self-reliance in the Indian steel sector**. By prioritizing **domestic production, curbing imports, and enhancing local value addition**, the policy aims to **secure India's strategic interests and strengthen the indigenous steel industry**.

GS Paper 1 – Geography, Border Disputes

Katchatheevu Islands: Renewed Calls for Retrieval by Tamil Nadu Assembly

Context: The **Tamil Nadu Legislative Assembly** has **unanimously adopted a resolution** urging the **Union government** to **retrieve Katchatheevu from Sri Lanka**. The call reflects ongoing concerns over **fisheries rights, historical claims, and cultural significance**.

About Katchatheevu Islands:

Location:

- **Katchatheevu** is a **285-acre uninhabited island** located in the **Palk Strait** between **India and Sri Lanka**.
- Situated **33 km northeast of Rameswaram (India)** and **62 km southwest of Jaffna (Sri Lanka)**.

Strategic Importance:

- Serves as a **maritime boundary marker** between India and Sri Lanka.
- **Fisheries-rich zone**, crucial to **Tamil Nadu's fishing economy**.
- Houses **St. Anthony's Church**, a place of **religious significance for fishermen** from both nations.

Historical Ownership of Katchatheevu:

- The island emerged due to a **volcanic eruption in the 14th century**.
- Initially ruled by the **Jaffna Kingdom (Sri Lanka)**, later controlled by the **Ramnad Zamindari under the Nayak dynasty of Madurai**.
- During the **British colonial era**, both **British India and Sri Lanka** claimed the island.
- The dispute was resolved in Sri Lanka's favor under the **1974 Indo-Sri Lankan Maritime Boundary Agreement**.

International Maritime Boundary Line (IMBL):

- The **IMBL between India and Sri Lanka** was delineated in **1974** through the **Indo-Sri Lankan Maritime Boundary Agreement**.
- Established based on the **United Nations Convention on the Law of the Sea (UNCLOS)**.
- **Maritime boundaries** are often defined by the **equidistance principle**, ensuring a **medial line equidistant from both nations' coasts**.
- The IMBL determines zones such as:
    - **Exclusive Economic Zones (EEZs)**
    - **Territorial Waters**
    - **Other Maritime Zones**

- The **1974 agreement** adjusted the **equidistant line**, placing **Katchatheevu under Sri Lanka's sovereignty**.

Other Maritime Disputes Involving India:

1. Sir Creek Dispute (With Pakistan):

- Dispute over the **demarcation of a 96 km estuary** located in **Gujarat**.
- Remains unresolved with **contentious claims over territorial waters and maritime boundaries**.

2. New Moore Island Dispute (With Bangladesh):

- Known as the **South Talpatti dispute**.
- Permanently settled in **Bangladesh's favor** following a **2014 ruling by the Permanent Court of Arbitration**.

Conclusion:

The **Katchatheevu Islands issue** remains a **contentious topic**, particularly for **Tamil Nadu's fishing community**. While the **1974 agreement ceded the island to Sri Lanka**, the **Tamil Nadu government's repeated resolutions** highlight the **ongoing socio-economic and cultural concerns** associated with the island.

GS Paper 3 – Environment, Biodiversity, and Ecologygy

Euphaea wayanadensis: A Newly Discovered Jewel of the Western Ghats

Context: A new species of **damselfly**, named **Euphaea wayanadensis**, has been discovered in the **Wayanad region** of the **Western Ghats, Kerala**. This exciting discovery, published in the **peer-reviewed journal ENTOMON**, marks **Kerala's 191st recorded odonate species** and the **223rd documented species from the Western Ghats**.

Taxonomic Classification:

- **Family:** *Euphaeidae* (Commonly known as Gossamerwings)
- **Genus:** *Euphaea*
- **Species:** *Euphaea wayanadensis*

Historical Sightings & Identification:

- **First Sightings: 2013** at the **Kalindi River, Thirunelli** in **Wayanad district, Kerala**.
- **Further Sightings:**
  - **2013 to 2019:** Continued observations in Wayanad.
  - **2019 to 2023:** Additional sightings in **Aralam (Kannur, Kerala)** and the **western slopes of Coorg (Karnataka)**.

Identification Challenges

- Initially **misidentified as *Euphaea pseudodispar***, a species commonly found in **Maharashtra**.
- Later confirmed as a distinct species through **detailed morphological study and genetic analysis**.

Key Morphological Features:

1. Distinctive Hind Wing:

- Features a **longer black patch** compared to closely related species, making it a key identification marker.

2. Striking Colouration:

- **Males** exhibit **broader and uninterrupted humeral and antehumeral stripes**.
- The **brilliant metallic blue or green body** contrasts sharply with their dark wings, enhancing visibility.

3. Unique Genital Structure:

- The **male genital vesicle** displays structural traits that are **distinct from related species** in the *Euphaea* genus.

Habitat and Distribution:

Preferred Habitat:

- Thrives in **fast-flowing streams** with **rocky beds** and **abundant aquatic vegetation**.
- Commonly found in **evergreen and semi-evergreen forest regions** along stream banks.

Geographical Distribution:

- Highly restricted to the **Western Ghats**, primarily in the **Wayanad region (Kerala)**, **Aralam (Kannur, Kerala)**, and **western slopes of Coorg (Karnataka)**.

Seasonal Activity:

- Active throughout the year except during the **dry seasons of March and April**.

Conservation Concerns:

- **Highly Restricted Distribution:** Makes it particularly **vulnerable to habitat loss** and **climate change**.
- **Habitat Fragmentation:** Increasing **deforestation and human encroachment** threaten its natural habitat.
- **Water Pollution:** Contaminants from agricultural run-off and urbanization pose significant threats to its survival.

Additional Facts & Knowledge:

1. **Ecological Role:**
    - As a **predator of small insects**, *Euphaea wayanadensis* helps maintain **ecosystem balance** by controlling pest populations.
2. **Indicator Species:**
    - Damselflies and dragonflies are **excellent bioindicators** due to their **sensitivity to changes in water quality and habitat conditions**.
    - The presence of *Euphaea wayanadensis* signifies a **healthy freshwater ecosystem**.
3. **Western Ghats Biodiversity Hotspot:**
    - The **Western Ghats** is recognized as one of the **world's eight "hottest hotspots" of biological diversity**.
    - It harbors approximately **160 species of odonates (dragonflies and damselflies)**, with **many endemic to the region**.
4. **Conservation Status:**
    - While *Euphaea wayanadensis* is **newly discovered**, its **restricted distribution and specialized habitat preferences** could warrant a **"Vulnerable" or "Endangered" status** if formally assessed under **IUCN criteria**.

Conclusion:

The discovery of **Euphaea wayanadensis** not only enriches the biodiversity catalog of the **Western Ghats** but also highlights the urgent need for **conservation measures**. As a **bioindicator species**, its presence and health are vital signs of the region's **ecological well-being**.

Chandrayaan-3: Surface Thermophysical Experiment (ChaSTE)

Context: The **Surface Thermophysical Experiment (ChaSTE)**, part of **Chandrayaan-3's Vikram lander**, has become the **first instrument to measure in situ temperatures near the Moon's south pole**. This breakthrough is significant as it provides **unprecedented insights into the thermal properties of the lunar regolith**, especially in a region considered **crucial for future exploration and colonization**.

How ChaSTE Works:

- **Deployment:**
  - ChaSTE is integrated into the **Vikram lander**, which successfully touched down on the **lunar south pole on August 23, 2023**.
  - Utilizes a **rotation-based deployment mechanism** instead of traditional hammering devices, which has been a critical factor in its success.
- **Temperature Sensors:**
  - The thermal probe is equipped with **10 temperature sensors**, placed **1 cm apart** along its length.
  - These sensors are highly sensitive and capable of detecting minute temperature changes in the lunar regolith.
- **Penetration Process:**
  - The probe is gradually rotated downward by a motor, which ensures a **controlled and steady descent**.
  - **No hammering mechanism:** This prevents potential damage to the probe or alteration of the lunar surface during penetration.
  - Successfully **reached a depth of 10 cm** in the Moon's regolith.
- **Data Collection Period:**
  - Continuously monitored temperature variations from **August 23 to September 2, 2023**.
  - Provided critical data on **temperature gradients**, thermal conductivity, and heat capacity of lunar soil.

Comparisons with Previous Missions:

Mission	Year	Target Body	Instrument	Purpose	Outcome
Chandrayaan-3	2023	Moon (South Pole)	ChaSTE	Measure thermal properties	Successfully penetrated and measured temperature.
ESA's Philae	2014	Comet 67P	MUPUS	Surface & subsurface temperature	Failed due to awkward landing; probe not deployed properly.
NASA's InSight	2018	Mars	HP3 ("The Mole")	Heat flow measurement	Encountered low friction; unable to burrow deep enough.

Why ChaSTE's Success is Groundbreaking:

1. **New Measurement Techniques:** Unlike previous missions that relied on **hammering mechanisms** (which often failed due to unpredictable soil properties), ChaSTE uses a **rotation-based method** that **minimizes disturbance** to the regolith.
2. **Superior Sensor Arrangement:** With **10 sensors placed 1 cm apart**, ChaSTE provides **high-resolution temperature profiles**. This setup allows researchers to **understand thermal conductivity and heat capacity** more accurately.
3. **Crucial Data for Future Missions:** The temperature readings gathered by ChaSTE are essential for determining the **presence and stability of water ice deposits**, a key resource for future **lunar bases and exploration missions**.
4. **Significance of the Lunar South Pole:**
    - The **South Pole region** is of special interest due to its **permanently shadowed areas** where water ice may be preserved.
    - Understanding thermal properties is critical for **resource extraction and habitat construction**.

Additional Facts & Knowledge:

1. **Lunar Soil Composition:**
    - The **regolith** is composed of **fine dust and small fragments** from meteorite impacts.
    - Its thermal properties can vary dramatically with **depth, grain size, composition, and compaction**.
2. **Thermal Conductivity Challenges:**
    - Due to the Moon's lack of atmosphere, **heat transfer primarily occurs via conduction and radiation**, making accurate measurement challenging.
    - The **extreme temperature variations** between day and night (ranging from **+127°C during the day to -173°C at night**) make thermal studies critical.
3. **Importance of Water Ice Detection:**
    - Water ice can provide **drinking water, oxygen, and hydrogen for fuel**, making it essential for **sustainable lunar exploration**.
    - It could also serve as a **natural shield against cosmic radiation** for future lunar habitats.
4. **Comparison with Artemis Program:** NASA's **Artemis missions** also aim to study the lunar South Pole, but **Chandrayaan-3's ChaSTE experiment provides a head-start** in gathering in situ thermal data.
5. **Data Utilization:** ChaSTE's findings will assist in designing **thermal insulation and protective measures** for future **lunar bases, rovers, and human missions**.

Conclusion: ChaSTE's success is a monumental achievement for **ISRO's Chandrayaan-3 mission** and global lunar research. By providing valuable data on **lunar soil's thermal properties**, it offers critical insights for **future resource utilization and habitat design** on the Moon.

GS Paper 3 – Environment, Pollution, and Disaster Management

Fluoride Contamination in India: A Growing Concern

Context: The **Uttar Pradesh Jal Nigam** has reported **excessive fluoride levels** in the groundwater of **120 hamlets**, affecting nearly **2 lakh people**. Some villages recorded fluoride concentrations of **2 mg/L or more**, exceeding the **safe limit of 1-1.5 mg/L**.

What is Fluoride?

- **Fluoride** is a **naturally occurring element** commonly found in **groundwater** due to the **weathering of rocks and minerals**.
- It is beneficial for **dental health** in small amounts but becomes **toxic at higher concentrations**.

Safe Limit: 1-1.5 mg/L (as per the Bureau of Indian Standards - BIS). **Harmful Levels:** Above 1.5 mg/L can cause **serious health issues**.

Health Risks of Excessive Fluoride Consumption

1. **Skeletal Fluorosis:**
   - Weakening of bones and joints.
   - Stiffness, pain, and deformities in severe cases.
2. **Dental Fluorosis:**
   - Discoloration and pitting of teeth.
   - More harmful during the **developmental stages of children**.
3. **Neurological Damage:**
   - High exposure over time can affect **cognitive development in children**.
4. **Other Risks:**
   - Possible links to **thyroid problems, kidney damage, and reproductive issues**.

Other Groundwater Contaminants in India:

Contaminant	Affected States	Health Risks
Arsenic	West Bengal, Bihar, Jharkhand, Uttar Pradesh	Skin lesions, cancer, cardiovascular diseases
Uranium	Punjab, Haryana, Rajasthan, Gujarat (12 states)	Kidney damage, bone toxicity
Iron	Rajasthan, Jharkhand, Assam	Liver damage, heart diseases
Other Metals	Antimony, Cadmium, Copper, Barium	Toxicity, hypertension, liver & kidney damage

States with High Fluoride Contamination:

1. **Rajasthan:**
   - **Highest fluoride contamination in India.**
   - Particularly severe in **arid regions** with high rock mineral content.
2. **Telangana & Western Andhra Pradesh:**

- Fluoride contamination due to **natural geological formations**.

3. **Eastern Karnataka:**
   - Dry climate contributes to the concentration of fluoride in groundwater.
4. **Uttar Pradesh (Newly Reported):**
   - Over **120 hamlets** affected with fluoride levels exceeding **2 mg/L**.

Why is Fluoride Contamination Increasing?

- **Over-extraction of groundwater** for agriculture and industrial use.
- **Lack of adequate rainwater recharge** in arid regions.
- **Deteriorating infrastructure** for water purification and management.

Seasonal Variations:

- Fluoride levels **spike during dry, pre-monsoon months**, especially in **arid regions of Western India**.
- Reduced water availability leads to **concentration of dissolved minerals**, including fluoride.

Mitigation Measures:

1. **Rainwater Harvesting:**
   - Promotes groundwater recharge, diluting fluoride concentration.
2. **Defluoridation Techniques:**
   - **Activated alumina filtration, Nalgonda technique, and Reverse Osmosis (RO)** are effective methods.
3. **Awareness Programs:**
   - Educating communities on **safe drinking water practices** and the **health impacts of fluoride**.
4. **Monitoring and Mapping:**
   - Continuous monitoring of groundwater quality, particularly in **high-risk areas**.

Key Takeaways:

- **Fluoride contamination is a serious issue** affecting millions across India.
- Addressing this problem requires a **multi-pronged approach**, involving **policy changes, community awareness, and technological interventions**.
- The **new reports from Uttar Pradesh** highlight the need for **urgent intervention and remediation efforts**.

GS Paper 1 – Geography

The Dhansiri River: Lifeline of Northeast India

Context: The **Dhansiri River** serves as a crucial watercourse in the **Golaghat District of Assam** and the **Dimapur District of Nagaland**. Known for its rich biodiversity and cultural significance, this river is an essential tributary to the **Brahmaputra River**. However, recent environmental concerns have emerged, highlighting the urgent need for sustainable management.

Recent Environmental Concerns:

Environmentalists have raised alarms over alleged **hazardous effluent discharge** from **Numaligarh Refinery Limited (NRL)** into the **Dhansiri River**. Complaints submitted to the **Central Pollution Control Board (CPCB)** emphasize the potential for **severe ecological damage**, particularly affecting aquatic life, forest ecosystems, and communities reliant on the river.

Course and Flow of the Dhansiri River:

- **Origin:** The river originates from **Laisang Peak** in **Nagaland**, known for its lush forests and diverse wildlife.
- **Initial Flow:** For the first **40 km**, the river flows in a **northwesterly direction**.
- **Mid-Course:** After this, it changes course to flow **northeast for about 76 km** until reaching **Dimapur**, the largest city in Nagaland.
- **Later Course:** Beyond Dimapur, the river adopts a generally **northerly flow** until it reaches **Golaghat** in Assam. Here, it takes a dramatic turn **northwest** and finally merges with the **Brahmaputra River** at **Dhansirimukh, Assam**.

Vital Statistics:

- **Total Length:** Approximately **352 km** from source to outfall.
- **Catchment Area:** Spans around **1,220 sq. km**.
- **Flora and Fauna:** Flows through the **Nagaland-Assam border**, sheltering diverse ecosystems, including:
    - **Dhansiri Reserved Forest** (Assam): Renowned for its rare and endangered species.
    - **Intanki National Park** (Nagaland): A haven for wildlife, including elephants, tigers, and various bird species.

Ecological and Cultural Significance:

The **Dhansiri River** not only supports a variety of **flora and fauna** but also plays a pivotal role in the **livelihoods of local communities**. From agriculture to fishing, its waters are integral to the socio-economic fabric of the region.

Additionally, the river is part of the **Brahmaputra Basin**, which contributes significantly to the hydrological and agricultural landscape of **Northeast India**. Its natural corridors are essential for maintaining **biodiversity connectivity** between **Assam and Nagaland**.

Interesting Fact:

The **Dhansiri River Basin** is home to several **ethnic communities** whose cultures and traditions are intricately linked to the river. Festivals and rituals celebrating the river's bounty are commonplace, underscoring its **deep cultural significance**.

Call for Conservation:

Amid increasing **industrialization and pollution**, the **Dhansiri River** faces unprecedented threats. Sustainable policies, stricter regulations, and **community-based conservation efforts** are essential to preserve its ecological balance for future generations.

GS Paper 3 – Science & Technology

Artificial Rain: Engineering Rainfall to Tackle Environmental Challenges

Context: Artificial rain, a cutting-edge weather modification technique, is gaining attention as a potential solution for mitigating **drought, air pollution, and climate change**. Governments worldwide, including **India's capital Delhi**, are exploring this technology to address pressing environmental concerns.

Latest Development:

Delhi's **Environment Minister** recently held discussions with key government agencies to assess the feasibility of implementing **artificial rain through cloud seeding** as a measure to **reduce air pollution and combat extreme weather conditions**.

What is Artificial Rain?

Artificial rain refers to the **induced precipitation** process achieved through **cloud seeding**. It involves dispersing specific chemicals into clouds to enhance **rainfall** and influence **weather patterns**.

How Does It Work?

The process of cloud seeding involves:

1. **Chemical Dispersion:** Chemicals such as **silver iodide, potassium iodide, and dry ice** are released into clouds via **aircraft or helicopters**.
2. **Nuclei Formation:** These substances act as **condensation nuclei**, around which **water vapor condenses** to form larger droplets.
3. **Rainfall Production:** As droplets combine and grow, they eventually become heavy enough to fall as rain.

Success Factors:

- **Presence of Moisture:** Cloud seeding is only effective when adequate moisture is already present in the atmosphere.
- **Suitable Atmospheric Conditions:** Optimal temperature and humidity levels are crucial for inducing precipitation.

Types of Cloud Seeding:

1. **Hygroscopic Cloud Seeding:**
    - Involves the dispersion of **salt particles** to accelerate the **coalescence of droplets** within liquid clouds.
    - Particularly effective in **tropical regions** where warm clouds dominate.
2. **Glaciogenic Cloud Seeding:**
    - Utilizes **ice-forming agents** like **silver iodide** to target **supercooled clouds**.
    - Converts **water vapor into ice crystals**, which later melt into rain.
    - More suitable for **cold or mixed-phase clouds** found in higher altitudes.

Alternative Technologies:

1. **Static Artificial Rain-Inducing System:**
    - Utilizes **natural ionization technology** to stimulate precipitation.

- This method enhances rainfall by generating **charged particles** that attract moisture-laden clouds.

2. **Stratospheric Aerosol Injection (SAI):**
   - A form of **solar geoengineering** inspired by **volcanic eruptions**.
   - Involves injecting **sulphur dioxide or reflective particles** into the atmosphere to cool the planet and reduce smog.
   - Highly controversial due to **potential adverse effects on weather patterns and ecosystems**.
3. **Diamond Dust Experiment:**
   - A futuristic approach that proposes using **diamond dust** as a **non-toxic, long-lasting alternative** to traditional aerosols for climate cooling.
   - Estimated cost: A staggering **$175 trillion**, making it economically unfeasible.

Benefits of Artificial Rain:

- **Drought Mitigation:** Provides relief to **agriculture and water-scarce regions**.
- **Air Pollution Reduction:** Artificial rain can **wash away pollutants and particulate matter**, improving air quality.
- **Climate Regulation:** Can be part of broader strategies to **combat global warming** and mitigate **extreme weather conditions**.

Challenges and Concerns:

- **Environmental Impact:** Prolonged use of chemicals like **silver iodide** may have adverse effects on **soil and water bodies**.
- **Cost and Efficiency:** High operational costs and variable success rates make **cloud seeding an expensive proposition**.
- **Ethical Considerations:** Concerns over **altering natural weather systems** and potential misuse for **geo-political purposes**.

Interesting Fact:

The concept of artificial rain dates back to **1946**, when **Vincent Schaefer**, an American chemist, successfully conducted the first cloud seeding experiment using **dry ice** over **New York's Mount Greylock**. Since then, over **50 countries** have adopted cloud seeding technologies for various purposes.

GS Paper 3 – Economic Development, Infrastructure, and Security

Bolstering India's Undersea Cable Infrastructure: Importance, Risks, and Growth Measures

Context: India's rapidly expanding internet economy demands robust and resilient **undersea cable infrastructure**. As the country enhances its connectivity with **new cable systems**, addressing risks and ensuring streamlined growth is essential for national security and economic prosperity.

India's Subsea Cable Infrastructure: Latest Developments:

India is expanding its international internet bandwidth with **new cable landing systems**:

- **Airtel's 2Africa Pearls System** (backed by Meta) – Adds a massive **100 terabits per second** of capacity.
- **SEA-ME-WE-6 Cable System** – Landed in **Chennai and Mumbai** earlier this year, further enhancing connectivity.

Understanding Undersea Cables:

What Are Undersea Cables?

Undersea cables are the **backbone of global internet connectivity**, linking **internet service providers (ISPs) and telecom operators** across continents. They provide the foundation for **fast and reliable data transmission** worldwide.

Structure and Functionality:

- These cables, though only a few inches thick, are heavily protected to withstand **harsh underwater environments**.
- Inside, they contain **fiber optic strands** that transmit data at lightning-fast speeds.

Landing Points and Stations:

- **Landing Points:** Coastal entry points where cables reach land, typically protected in **manholes buried under sand**.
- **Landing Stations:** Inland facilities where undersea cables integrate with **terrestrial networks**, ensuring seamless internet connectivity.

Critical Role in the Modern World:

According to experts, undersea cables are responsible for:

- **90% of Global Data Transmission**
- **80% of World Trade**
- **$10 Trillion in Financial Transactions**
- **Secure Government Communications**

Data Capacity:

Modern cables offer several **hundred gigabits per second** of capacity, serving **millions of users globally**.

Connection to Terrestrial Networks:

After reaching land, undersea cables connect to **terrestrial networks**, comprising **towers, buried cables, and data centers** that deliver internet services to homes and businesses.

India's Undersea Cable Hubs:

Major Hubs:

India's undersea cable infrastructure revolves around two main landing hubs:

1. **Mumbai:** Handles **95% of subsea cable traffic**, with a significant portion concentrated along a **six-kilometre stretch in Versova**.
2. **Chennai:** Serves as a critical connectivity point, especially for cables connecting to **Southeast Asia and the Middle East**.

Current Infrastructure:

- **17 International Cable Systems** currently land in India.
- **Two Domestic Projects:**
    - **CANI (Chennai–Andaman and Nicobar Islands)**
    - **Kochi–Lakshadweep Islands Project**

Planning and Cost:

Undersea cable projects are **capital-intensive**, involving:

- **Months or years of planning and execution.**
- Costs ranging from **millions to billions of dollars**.

India's Capacity:

- India accounts for **1% of global cable landing stations** and **3% of subsea cable systems**.
- While current infrastructure meets existing demand, experts warn of future shortfalls due to **rapidly increasing data usage**.

Risks Surrounding Undersea Cable Deployment in India:

Vulnerability to Cable Cuts at Sea:

- India's internet infrastructure is heavily dependent on **undersea cables**, with **more cables landing in Singapore than in India**.
- Disruption in areas like the **Red Sea** could result in a loss of **25% of India's internet connectivity**.

Impact of Cable Cuts in the Red Sea:

- In 2024, cable cuts in the **Bab-el-Mandeb Strait** (caused by Houthi rebel strikes) led to temporary issues.
- While alternative networks provided stability, a larger-scale disruption could have **catastrophic impacts** on connectivity.

Historical Dependence on Shipping Routes:

- Subsea cables traditionally follow **shipping trade routes** for easier deployment.
- This alignment exposes them to **risks from maritime activities and geopolitical conflicts**.

Measures to Strengthen India's Subsea Cable Infrastructure:

1. Streamlining Regulatory Processes:

- Companies currently face delays due to the need for **51 different approvals** from agencies like:
    - **Department of Telecom**
    - **Home Ministry**
    - **Environment Ministry**
    - **Local Municipalities**
- **Simplifying these processes** would reduce project timelines and costs, promoting faster deployment.

2. Enhancing Cable Security:

- **Physical damage from fishing trawlers and ships** poses a significant threat.
- Implementing **monitoring systems and surveillance technologies** could prevent accidental damage and enhance protection.

3. Building Domestic Repair Capabilities:

- India relies on **foreign repair vessels**, causing delays due to **lengthy approval processes**.
- Investing in **domestic repair vessels and cable storage depots** would:
    - Speed up repair work.
    - Reduce dependency on external resources.
    - Strengthen national security and economic resilience.

Interesting Fact:

The **world's longest undersea cable**, **SEA-ME-WE 3**, spans over **39,000 km** and connects **Europe, Asia, and Australia**. It plays a vital role in ensuring global connectivity, just as India's expanding infrastructure aims to do for the subcontinent.

GS Paper 2 – International Relations

India-Thailand Strategic Partnership: Reinforcing 'Act East–Act West' Synergy

Context: India and Thailand, bound by **deep cultural, historical, and economic ties**, are now charting a bold new course towards enhanced strategic collaboration. Prime Minister Narendra Modi's recent visit underscores the evolving synergy between India's **'Act East Policy'** and Thailand's **'Act West Policy'**.

India-Thailand Latest News:

Prime Minister **Narendra Modi** arrived in Thailand on a **two-day visit** to attend the **6th BIMSTEC Summit**, signaling a renewed commitment to **strengthening bilateral ties**.

Historical and Cultural Linkages:

India and Thailand share a **rich civilizational heritage**, reflected through:

- **Buddhism:** A key spiritual link as Buddhism, which originated in India, remains a major religion in Thailand.
- **Maritime Trade Routes:** Ancient trade routes enabled exchanges of **culture, religion, and art**.
- **Ramayana Influence:** Thailand's version of the Indian epic, **Ramayana**, known as **Ramakien**, is a cornerstone of Thai folklore.
- **Cultural Artifacts:** Indian influence is visible in **Thai architecture, language (Sanskrit-Pali roots), traditional medicine, and performing arts**.
- **Commemorative Gesture:** During PM Modi's **2025 visit**, Thailand released a commemorative postage stamp depicting the **Ramayana mural paintings**, highlighting the countries' shared heritage.

Political Relations between India and Thailand:

India and Thailand enjoy **strong political ties** supported by shared **historical and cultural bonds**.

- **From 'Look East' to 'Act East':** India's foreign policy evolution towards **'Act East Policy'** under PM Modi emphasizes deeper engagement with Southeast Asia.
- **Thailand's 'Act West Policy':** A complementary effort to build stronger ties with **South Asian nations**.
- **Multilateral Cooperation:** Close collaboration within regional platforms like **ASEAN, BIMSTEC, ADMM-Plus, and the East Asia Summit**.

Strategic Partnership Announcement:

During his **April 2025 visit**, PM Modi and Thai PM **Paetongtarn Shinawatra** elevated bilateral ties to a **"Strategic Partnership"**, focusing on:

- **Security Cooperation:** Establishing a **Strategic Dialogue** between security agencies to bolster **maritime and defense collaboration**.
- **Regional Cooperation:** Enhancing ties through the **Indo-Pacific Vision**, emphasizing **free, open, inclusive, and rules-based engagement**.

Economic and Commercial Relations:

India and Thailand are important economic partners within **Southeast Asia**, with trade and investment ties steadily expanding.

Trade Statistics (FY 2023-24):

- **Thailand:** The **21st largest trading partner of India**.
- **Total Bilateral Trade:** Approximately **USD 14.94 Billion**.

Key Economic Initiatives:

- **India-Myanmar-Thailand Trilateral Highway:** Improving connectivity and boosting trade.
- **Mutual Investments:** Pushing for **collaboration in MSMEs** and enhancing bilateral investments.
- **ASEAN and BIMSTEC Engagement:** Leveraging regional platforms for improved trade relations.

The Indian Diaspora in Thailand:

The **Indian community in Thailand** is a significant contributor to economic and cultural ties between the two nations.

Population: Over **250,000** Indians reside in Thailand, including both **historical and recent migrants**.

Industries:

- **Trade**
- **Jewellery Business**
- **Hospitality**
- **Various Service Sectors**

Cultural Influence:

Prominent **Indian-origin associations and Buddhist spiritual networks** strengthen societal connections, enhancing **people-to-people ties**.

News Summary: Upgrading to a Strategic Partnership

Indo-Pacific Vision and Regional Connectivity:

- PM Modi reaffirmed India's support for **ASEAN Centrality and Unity** with a focus on a **free, open, inclusive, and rules-based Indo-Pacific**.
- Emphasizing **developmental cooperation (Vikaasvaad)** over **expansionism (Vistaarvaad)**, aligning with India's **evolving geopolitical stance** in Asia.

BIMSTEC's Role:

- PM Modi reiterated India's commitment to the **Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)**.
- Ahead of the **6th BIMSTEC Summit**, both nations emphasized the need for greater **regional connectivity and trade**.
- A key agenda item included the **signing of an Agreement on Maritime Cooperation**, reflecting **shared maritime interests**.

Cultural Diplomacy and Symbolic Gestures:

Gift of the World Tipitaka:

In a gesture of **soft diplomacy**, Thailand gifted PM Modi the **World Tipitaka: Sajjhaya Phonetic Edition**, a special edition published in **2016** to commemorate the **70-year reign of King Bhumibol Adulyadej**. This symbolizes the **shared Buddhist heritage** and deep-rooted cultural connections between the two nations.

GS Paper 2 – Governance, Constitution, Polity, Social Justice

Parliamentary Committee Report on Welfare of Other Backward Classes (OBCs)

Context: The Parliamentary Committee on Welfare of Other Backward Classes (OBCs) recently submitted its comprehensive report to the **Eighteenth Lok Sabha**, addressing critical issues surrounding the **Creamy Layer (CL) status** among OBCs and recommending significant policy changes.

About the Creamy Layer Concept:

The concept of the **Creamy Layer** refers to the **more socio-economically advanced members among OBCs**, who are excluded from reservation benefits to ensure affirmative action reaches the genuinely disadvantaged sections. This concept emerged from the landmark **Indra Sawhney Case (1992)**.

Key Highlights from Indra Sawhney Case (1992):

- The **Supreme Court upheld the 27% reservation** for OBCs in civil posts and services under the Government of India.
- However, it mandated the **exclusion of the Creamy Layer** to ensure equitable distribution of benefits.
- Following the judgment, the **Ram Nandan Prasad Committee** was constituted to identify criteria for determining the **Creamy Layer**.

Criteria for Creamy Layer (Based on Ram Nandan Prasad Committee Report):

The **Creamy Layer** was defined based on two categories:

1. **Occupational Criteria:** Individuals whose parents are or were employed in specific categories of government services.
2. **Economic Criteria:** Individuals with an annual income above a **prescribed threshold**.

The **threshold income limit** was last revised to **8 lakh** in **2017**.

Key Observations by the Committee:

1. Lack of Uniformity in Creamy Layer Criteria:

- The Committee observed that **uniform yardsticks** are not being followed across various states when applying the **income/wealth test** to determine **Creamy Layer status**.
- **Recommendation:** States should adopt a **uniform formula** to ensure consistency and fairness in the application of **Creamy Layer criteria**.

2. Review of the Existing Income Limit:

- The Committee noted that the current **income limit of 8 lakh** is inadequate, **depriving a significant segment** of the OBC population from reservation benefits.
- **Recommendation:** The **income limit should be substantially raised** after **consulting with relevant stakeholders** to better reflect the present socio-economic realities.

Additional Facts & Knowledge:

1. **Historical Context:** The concept of the **Creamy Layer** was introduced to ensure that economically advanced individuals within the OBC category do not corner the benefits meant for the truly marginalized.
2. **Previous Revisions:** The income limit has been periodically revised, with the last revision occurring in **2017**. Earlier limits were **1 lakh (1993), 2.5 lakh (2004), and 4.5 lakh (2008)**.

3. **Demand for Revision:** Many experts and social groups have been urging the government to raise the income limit to **12 lakh or more** to accommodate rising standards of living and inflation.
4. **Impact of Inconsistencies:** Due to disparities in applying the **Creamy Layer criterion**, genuine beneficiaries in some states remain excluded from **reservation benefits**.

GS Paper 2 – Governance, Constitution, Polity, Social Justice

Supreme Court Directs States to Follow Established Norms for Arrests

Context: The **Supreme Court of India** has recently reaffirmed the necessity for **law enforcement agencies across all states** to adhere strictly to **constitutional and statutory safeguards** during **arrests and custodial procedures**. The directive was emphasized during a ruling related to **Somnath Vs. State of Maharashtra (2023)**, where the Court reiterated its earlier guidelines from the landmark **D.K. Basu v. State of West Bengal case (1997)**.

Background & Context:

The Somnath Case (2023):

In this case, the **Supreme Court restated principles** laid down in the **D.K. Basu case (1997)**, emphasizing the need for **transparency, accountability, and protection of individual rights** during arrests. The Court expressed concern over **persistent non-compliance by police forces** and issued directives to all states to ensure adherence to established norms.

The D.K. Basu Case (1997):

The **D.K. Basu v. State of West Bengal case** was a landmark judgment that laid down comprehensive guidelines to prevent **custodial violence and protect fundamental rights**. It established safeguards aimed at enhancing **transparency and accountability** in the arrest process.

Supreme Court Guidelines in D.K. Basu Case (1997):

1. Proper Identification:

- Officers making an arrest must **clearly display identification badges** and **name tags** with their designation.
- This is essential for **accountability and transparency** during the arrest process.

2. Mandatory Arrest Memo:

- A **memo of arrest** must be prepared at the time of arrest, including **the exact time and date of the arrest**.
- The memo must be **attested by at least one witness** (preferably a family member or a respectable person from the locality) and **countersigned by the arrestee**.

3. Informing Relatives/Friends:

- **Immediate intimation** of the arrest must be given to a **relative or friend** of the arrestee as soon as practicable.
- This notification ensures **transparency and prevents wrongful detention**.

4. Inspection Memo:

- Upon request, the arrested person must undergo a **medical examination** at the time of arrest, and any injuries must be **recorded in an Inspection Memo**.
- This memo should be **signed by both the arrestee and the arresting officer** to maintain transparency.

5. Medical Examination During Detention:

- The **arrestee must undergo a medical examination every 48 hours** during detention by a **certified doctor**.
- This safeguard is essential to prevent **custodial torture and ensure physical well-being**.

6. Right to Consult a Lawyer:

- During interrogation, the arrestee must be allowed to **consult with their lawyer**, ensuring adherence to **Article 22(1) of the Indian Constitution**.

Additional Facts & Knowledge:

1. **Constitutional Safeguards:** Articles **20 and 22 of the Indian Constitution** provide protection against arbitrary arrest and detention.
2. **Custodial Deaths:** Despite guidelines, India continues to report cases of **custodial deaths and police brutality**, making adherence to these norms even more crucial.
3. **UN Guidelines:** India is a signatory to the **United Nations Convention against Torture (UNCAT)**, although the convention has not yet been ratified. Adherence to Supreme Court guidelines is crucial for upholding international human rights standards.
4. **Technological Solutions:** The use of **Body Cameras, CCTV Monitoring, and Digital Documentation** of arrests is being promoted to enhance accountability.