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GS Paper 3 – Defence & Security

Exercise Shakti 2025: Strengthening India-France Defence Ties

Context: Exercise Shakti, the **bilateral military exercise** between **India and France**, is all set to return for its **8th edition** in **La Cavalerie, France**, beginning **June 18, 2025**. This biennial military engagement is aimed at reinforcing mutual trust, enhancing **interoperability**, and boosting cooperation in conducting **multi-domain operations**, particularly in **sub-conventional warfare scenarios**.

A Tradition of Shared Excellence:

- **Exercise Shakti** is held **every two years**, alternating between **India** and **France**.
- The **previous edition** was conducted in **India**, making the 2025 edition a return visit by Indian troops to French soil.
- The exercise includes a series of **joint drills**, **tactical exercises**, and **combat simulations**, focusing on modern warfare strategies and counter-insurgency operations.

Core Objectives of Exercise Shakti:

- **Enhance joint operational capability** of both nations' armed forces.
- Develop **shared understanding** of tactics, **techniques**, and **procedures** in combat.
- Foster **military camaraderie**, **mutual trust**, and **team spirit**.
- Promote cultural exchange and deepen **strategic partnership**.

Part of a Wider Strategic Partnership:

Apart from **Exercise Shakti**, India and France also collaborate through:

- **Exercise Varuna** – A **naval exercise** focusing on maritime security in the Indo-Pacific region.
- **Exercise Garuda** – An **air force-level drill** emphasizing aerial coordination and defense.
- **Exercise Desert Knight** – A **joint air force exercise**, highlighting **air superiority** and **tactical planning**.

Additional Insight: India-France Defence Ties

- India and France have a **long-standing defence relationship**, with France being one of India's key strategic partners in Europe.
- The collaboration spans across **defence procurement**, **technology transfer**, and **joint military training**.
- France has been instrumental in supplying advanced military hardware to India, such as the **Rafale fighter jets**.

Looking Ahead: The 2025 edition of **Exercise Shakti** not only reflects the deepening **military cooperation** between two great democracies but also underscores their **shared commitment** to global peace, stability, and **rules-based international order**. As geopolitical dynamics evolve, such exercises become vital in preparing armed forces for the **complex security challenges** of the future.

GS Paper 3 – Indian Economy

Merchant Discount Rate (MDR): A Key Component of Digital Transactions

Context: The **Merchant Discount Rate (MDR)** refers to the **fee charged to merchants** by banks or payment service providers for enabling **digital payments** through methods such as **credit cards**, **debit cards**, **UPI**, and **mobile wallets**. This fee helps maintain the digital payment infrastructure and ensure smooth, secure transactions.

Latest Update: No MDR on UPI Transactions

The **Ministry of Finance** has recently clarified that the **rumors regarding MDR being levied on UPI payments are entirely unfounded**. The government reaffirmed its policy that **UPI transactions remain completely free** for both **consumers and merchants**, in a move to **encourage a cashless economy** and support **digital inclusion**.

How MDR Works: Behind the Scenes of a Swipe or Tap

When a customer makes a digital payment, a small portion of the transaction amount—typically between **1% and 3%**—is deducted as **MDR**. This amount is distributed among:

- The **issuing bank** (which issued the card)
- The **acquiring bank** (which installed the PoS terminal)
- The **payment gateway** or **card network** (such as Visa, Mastercard, or RuPay)

These entities work together to **authenticate, process, and settle** digital payments in **real-time**, ensuring **transaction security** and **system reliability**.

Key Features of MDR:

- **Percentage-based fee**: Generally ranges from **1% to 3%**, depending on several factors.
- **Fee structure** depends on:
  - **Type of card** used (credit/debit)
  - **Volume of transactions** processed by the business
  - **Average ticket size** (average amount per transaction)
- **Pre-setup requirement**: Merchants must **enroll with a payment service provider** and agree to the MDR terms before accepting digital payments.
- **Automatic deduction**: MDR is automatically deducted from the merchant's account during the **settlement process**.
- As per **RBI regulations**, **merchants are prohibited** from passing MDR charges to customers.

Why MDR Matters for Businesses:

Merchants need to treat **MDR as a routine operating cost**, just like rent or utility bills. While it slightly reduces the net revenue from each sale, it also brings:

- **Ease of transaction**
- **Faster payments**
- **Better customer experience**
- **Wider reach**, especially in urban digital environments

Businesses that accept digital payments tend to build **greater customer trust** and enjoy **higher sales volumes**, especially from tech-savvy and cashless consumers.

UPI: India's Game-Changer in Digital Payments

- **UPI (Unified Payments Interface)** is India's fastest-growing digital payment platform, processing over **12 billion transactions per month** (as of 2025).
- UPI is maintained by **NPCI (National Payments Corporation of India)**, with **zero MDR** to ensure accessibility for **small businesses**, **kirana stores**, and **low-income users**.
- Although payment companies have advocated for compensation, **UPI continues to operate under a no-MDR policy**, supported by the **Government of India**.

Final Thoughts:

The **Merchant Discount Rate** is an essential element of India's expanding **digital economy**, helping maintain the vast infrastructure that powers instant, secure, and seamless electronic transactions. While MDR may appear as a small fee, it is a vital cog in the wheel that supports **cashless commerce** and enhances the **overall efficiency of the payment ecosystem**.

In a world moving rapidly toward digital, understanding how **MDR** works helps merchants make **informed financial decisions**, improve **pricing strategies**, and prepare for a **digitally connected future**.

GS Paper 3 – Science and Technology

Black Box: The Silent Witness in Aviation Disasters

Context: A **black box** is a crucial piece of technology installed on aircraft to **record flight data and cockpit audio**, providing vital clues in the event of an **aviation accident or incident**. Despite its name, the black box is typically **bright orange or yellow**, making it easier to locate after a crash.

Latest Update: Search for Black Box in AI171 Crash

In the aftermath of the **Air India AI171 flight crash** en route to **Gatwick**, authorities are continuing their urgent search for the **aircraft's black box**. This device is critical for reconstructing the final moments before the disaster and determining the **exact cause of the crash**.

Components of a Black Box:

Modern aircraft are equipped with **two separate recording systems**:

1. **Cockpit Voice Recorder (CVR)**
    - Captures **audio conversations** between the pilots
    - Records **radio communications**, **alarm sounds**, and **engine noises** inside the cockpit
2. **Flight Data Recorder (FDR)**
    - Stores more than **80 parameters** including:
        - **Altitude**
        - **Airspeed**
        - **Flight heading**
        - **Vertical acceleration**
        - **Pitch and roll**
        - **Autopilot activity**
        - And many more dynamic performance metrics

These recordings offer **critical evidence** that helps investigators **reconstruct the flight's timeline**, identify technical faults, and understand **pilot decision-making** under pressure.

Designed for Survival:

Black boxes are engineered to endure some of the **harshest crash conditions**. Each unit is:

- **Encased in heat-resistant and pressure-proof housing**, often made of **steel or titanium**
- **Insulated** to withstand extreme temperatures, water immersion, and forceful impacts
- Positioned toward the **rear of the aircraft**, where the damage from crashes is statistically **less severe**
- Capable of transmitting **underwater locator beacon signals** for up to **30 days**, aiding search teams

A Revolutionary Invention: The black box was invented by **Australian scientist Dr. David Warren** in the 1950s following a tragic plane crash. His idea stemmed from the need to understand what pilots were

experiencing **moments before an accident**. Today, these devices are **mandatory in most commercial aircraft** around the world and have revolutionized **air safety investigations**.

Additional Insight: Black Boxes Beyond Aviation

- Similar technology is now being used in **trains**, **cars**, and even **space missions** to monitor system performance and provide data for post-incident analysis.
- In aviation, upcoming developments aim to introduce **real-time data streaming**, allowing ground control to access flight data **mid-air**, potentially preventing disasters before they happen.

Final Thought:

The **black box** is not just a recorder—it is a **lifesaving tool** that speaks for pilots and passengers when they can't. By unlocking the truth behind aviation accidents, it has become an essential element in making **air travel safer than ever before**.

GS Paper 2 – International Relation

Middle East on Edge: Rising Tensions Between Iran, Israel, and the US Over Nuclear Talks

Context: Tensions in the **Middle East have reached a critical point**, as the long-standing nuclear dispute between **Iran**, **Israel**, and the **United States** intensifies. A recent report by **CBS News** reveals that **Israel is fully prepared to launch a military strike on Iran**, prompting the **U.S. to issue regional travel advisories** for its personnel stationed in **Iraq, Israel**, and neighboring nations.

Amid escalating threats and failed diplomacy, the risk of a **wider regional conflict** is growing, renewing fears of a potential **military confrontation** in an already volatile region.

Flashpoint: IAEA Resolution Fuels Israeli Pressure

- Israel has always viewed Iran's nuclear program as an existential threat and remains opposed to any form of **Iran–US nuclear negotiations**. The situation escalated sharply following a recent **IAEA Board of Governors resolution**, which for the **first time in two decades**, officially deemed **Iran non-compliant** with its nuclear commitments.

The resolution followed an alarming **IAEA report** that accused Iran of conducting **undisclosed nuclear activities** at three secret sites. Moreover, Iran's stockpile of enriched uranium, particularly at **60% purity**, is growing—putting it dangerously close to the **90% weapons-grade threshold**.

There are now discussions about potentially referring Iran's case to the **United Nations Security Council**, raising the specter of **international sanctions** and **diplomatic isolation**.

The JCPOA in Jeopardy: Deal Nearing Collapse

- The **Joint Comprehensive Plan of Action (JCPOA)**—commonly known as the **Iran nuclear deal**—was signed in **2015** between Iran and six world powers (**US, UK, France, Russia, China, and Germany**). It aimed to restrict Iran's nuclear capabilities in exchange for lifting economic sanctions.

Though the **U.S. withdrew from the deal in 2018** under President Trump, the JCPOA remains technically active. However, with the agreement **set to expire in October**, there's a growing push from **European signatories** (UK, France, Germany) to invoke **snapback sanctions**, a clause allowing for the **reimposition of UN penalties** if Iran is found in breach.

Iran's Firm Response: Sovereignty Over Concessions

- Iran has **rejected the IAEA's resolution**, denouncing it as **"politically biased"**, and in defiance, announced plans to **build a new uranium enrichment facility** in a heavily protected location.

Tehran has also **threatened to withdraw from the Nuclear Non-Proliferation Treaty (NPT)** — a move that would **strip international inspectors of access** and could spell the **complete breakdown of global nuclear diplomacy**.

Iranian leaders, including **Supreme Leader Ayatollah Khamenei** and **Foreign Minister Araghchi**, have reiterated their commitment to **nuclear transparency**, but emphasize that **sovereign control over uranium enrichment** is a **non-negotiable red line**.

The Core Dispute: Uranium Enrichment Rights

Since **April**, five rounds of nuclear negotiations between the **U.S. and Iran** have taken place, the most recent in **Rome on May 23**. The core issue isn't whether Iran can use nuclear energy for peaceful purposes (which the U.S. accepts), but rather **where and how uranium is enriched**.

The U.S. proposed allowing Iran **limited enrichment**, followed by fuel supply from a **multinational consortium** involving Arab states and the U.S. Iran rejected the offer, viewing it as a **violation of its sovereignty and self-reliance**.

Regional Dynamics: Arab Endorsement, Israeli Rejection

- **Arab states** support continued diplomacy, aiming to prevent another regional war.
- **Israel**, however, remains a vocal critic of any deal that allows Iran to maintain its nuclear infrastructure.

Prime Minister Benjamin Netanyahu has consistently warned that any agreement short of **total dismantling** of Iran's nuclear capabilities is a **serious security threat**. Although **not a direct party to the JCPOA**, Israel's **military actions**, **covert operations**, and **intelligence leaks** have had an **outsized influence** on the negotiating atmosphere.

High Stkes: Potential Fallout from NPT Withdrawal

If Iran follows through on its **threat to exit the NPT**, the implications will be far-reaching:

- The **IAEA would lose oversight**, eliminating a critical safeguard.
- The **U.S. would be legally barred** from offering Iran any future concessions, under the **Nuclear Proliferation Prevention Act (1978)**.
- Global trust in the **non-proliferation framework** could erode, setting a precedent for other nations.

This would mark a **point of no return**, dramatically narrowing the path for diplomacy and raising the possibility of **military conflict**.

Countdown to Confrontation: A Fragile Diplomatic Window

The geopolitical situation is **extremely volatile**, with several flashpoints that could ignite a crisis:

- A **preemptive Israeli military strike** on Iran
- The activation of **European snapback sanctions**
- **Iran's potential exit** from the NPT
- A **formal U.S. withdrawal** from ongoing negotiations

Each scenario threatens to destabilize not just the region but **global energy markets**, **diplomatic alliances**, and **non-proliferation efforts**.

Final Thought: Can Diplomacy Prevail?

As the clock ticks down on the **JCPOA's final months**, the world watches with growing concern. The balance between **diplomacy and confrontation** has never been more delicate. Whether this moment leads to **renewed negotiation or irreversible escalation** will depend on the choices made in the days ahead by leaders in **Tehran**, **Washington**, and **Jerusalem**.

GS Paper 3 – Agriculture, Science and Technology

Revolutionizing Agriculture: Heat-Resistant Pigeonpea Variety Boosts India's Pulse Production

Context: Scientists have successfully developed a **heat-tolerant pigeonpea variety** named **ICPV 25444** using an advanced technique called **speed breeding**. This innovation promises to transform **fallow lands** and significantly reduce India's dependency on pigeonpea imports, which currently cost the country nearly **USD 800 million annually**.

Key Advantages of ICPV 25444:

- **Heat Resilience:** This variety thrives in extreme heat, withstanding temperatures as high as **45°C**, making it perfect for India's **hot and semi-arid regions**.
- **Utilizing Uncultivated Lands:** It can be grown on nearly **12 million hectares of rice fallows** left idle after the kharif season due to heat and water shortages.
- **Faster Crop Cycles:** Thanks to **speed breeding**, the crop can be harvested **4 times a year**, slashing the development period from **15 years to just 5 years**.
- **Higher Productivity:** Yields have nearly doubled from **1.1–1.2 tonnes per hectare** to an impressive **2 tonnes per hectare**.
- **Reduced Harvest Time:** The crop matures in **4 months instead of 6–7 months**, enabling better crop rotation and increased farmer income.

Economic and Agricultural Impact:

This breakthrough has the potential to bridge the **1.5 million tonne gap** in domestic pigeonpea production, paving the way for **self-reliance** and saving India millions in import costs. It aligns perfectly with the **Union Budget 2025–26's Mission for Self-Reliance in Pulses**, a six-year plan aimed at making India **self-sufficient** in vital pulses like **Tur (Pigeonpea), Urad, and Masur**.

About Pulses in India:

- India is the **largest producer, consumer, and importer of pulses worldwide**.
- The **top three pulse-producing states** are **Madhya Pradesh, Maharashtra, and Rajasthan**.
- Pigeonpea (Tur Dal) is a crucial **protein-rich legume**, highly suited to tropical and semi-arid climates.
- The government supports farmers through the **Price Support Scheme (PSS)**, ensuring procurement at the **Minimum Support Price (MSP)** to protect them from price fluctuations.

Speed Breeding: Accelerating Agricultural Innovation

Speed breeding is a cutting-edge method that manipulates **light, temperature, and humidity** to accelerate plant growth. This allows breeders to grow **multiple crop generations per year**, speeding up the development of improved varieties like ICPV 25444 and fast-tracking their benefits to farmers.

Additional Insights:

- The ability to grow multiple crops annually on previously unused lands could **boost rural livelihoods** and **strengthen food security** in climate-vulnerable regions.

- With climate change intensifying heat stress and water scarcity, **heat-tolerant crops like ICPV 25444** are essential for sustainable agriculture.
- The success of this variety could serve as a model for developing other **climate-resilient pulse crops**, helping India maintain its leadership in pulse production while reducing imports.

India's agricultural future looks promising with innovations like the **heat-tolerant pigeonpea**, merging science and sustainability to empower farmers and enhance national food security.

GS Paper 3 – Environment and Ecology

Lesser Flamingos Make a Spectacular Arrival in Gujarat: A Glimpse into Their Journey and Ecology

Context: A **large flock of Lesser Flamingos** has recently been spotted at **Chhaya Pond in Porbandar, Gujarat**. These vibrant birds are preparing to migrate soon to the **Great Rann of Kutch**, near the **India-Pakistan border**, where they will begin their breeding season.

Understanding the Lesser Flamingo (Phoeniconaias minor):

- The **Lesser Flamingo** is the **smallest flamingo species** globally.
- It is native to **sub-Saharan Africa**, with populations also found in parts of **India, Pakistan, and the Arabian Gulf**.
- In India, these flamingos primarily inhabit **brackish and coastal wetlands**.
- The species is classified as **Near Threatened** by the **IUCN**.
- It is protected under **CITES Appendix II** and listed in **Schedule IV of the Wildlife Protection Act, 1972**.

Flamingos: Elegant and Social Water Birds

- Flamingos are renowned for their **long, graceful S-shaped necks** and **slender legs**.
- They are **highly social birds**, often seen in **large, noisy flocks**.
- Their preferred habitats include **shallow, nutrient-rich waters** like saline lagoons, saltpans, and alkaline lakes, where food is abundant.
- There are **six species of flamingos worldwide**, thriving mostly in tropical and subtropical regions.
- India is home to only **two species**: the **Greater Flamingo** and the **Lesser Flamingo**.

Other Flamingo Species Worldwide:

- **Chilean Flamingo (Phoenicopterus chilensis)**
- **American or Caribbean Flamingo (Phoenicopterus ruber)**
- **Andean Flamingo (Phoenicoparrus andinus)**
- **James's or Puna Flamingo (Phoenicoparrus jamesi)**

Diet and Distinctive Coloration:

- Flamingos feed mainly on **algae, small molluscs, and crustaceans** found in their watery habitats.
- Their iconic **pink, orange, or white plumage** results from **carotenoid pigments** in their diet, particularly from the algae and crustaceans they consume.
- The intensity of their color often indicates the bird's health and breeding readiness.

Additional Insights:

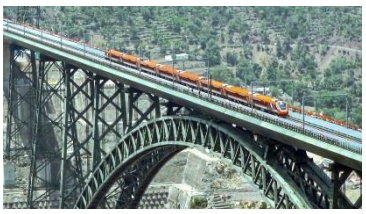
- The **Great Rann of Kutch** serves as a crucial breeding ground, offering a safe and nutrient-rich environment for flamingos.

- Lesser Flamingos play an important ecological role by maintaining the health of wetland ecosystems through their feeding habits.
- Conservation efforts for these birds are critical as habitat loss, water pollution, and climate change threaten their populations.
- Flamingos are also indicators of **wetland ecosystem health**, and their presence signals a thriving habitat.

The recent gathering of **Lesser Flamingos at Chhaya Pond** not only offers a breathtaking natural spectacle but also highlights the importance of protecting India's delicate wetland ecosystems to preserve these elegant and ecologically significant birds.

GS Paper 3 – Infrastructure and Economic Development

Historic Vande Bharat Trains Now Connect Katra to Kashmir Valley



Context: In a **historic development**, **Prime Minister Narendra Modi** flagged off two **Vande Bharat Express trains** linking **Shri Mata Vaishno Devi Katra** with **Srinagar**, effectively establishing the **first-ever direct railway connection** to the **Kashmir Valley**. This transformative move is expected to **boost economic development, tourism, trade**, and **integrate Kashmir more deeply** with the rest of India.

Tracing the Journey: From Colonial Tracks to a Modern Marvel

Early Rail Initiatives in Jammu and Kashmir:

- The **first railway line** in the region was laid in **1897** by the British, linking **Jammu and Sialkot** (now in Pakistan), covering about **40–45 km**.
- In the early 1900s, several proposals — including a **Rawalpindi–Srinagar** line and a **Jammu–Srinagar route via Reasi** — were supported by **Maharaja Pratap Singh**, but none materialized due to technical and political hurdles.

Post-Partition Isolation:

- After the **Partition in 1947**, Sialkot became part of Pakistan, severing Jammu's railway ties.
- Until **1975**, **Pathankot in Punjab** remained the closest railhead to the region.
- The **Pathankot–Jammu rail link** was inaugurated in 1975, rekindling connectivity after nearly three decades.
- **Construction of the Jammu–Udhampur line** (53 km) began in 1983, but the project was **completed only in 2004**, taking 21 years due to the difficult terrain.

Udhampur-Srinagar-Baramulla Rail Link (USBRL): India's Mountain Engineering Feat

A Project of National Importance:

- The **USBRL project** was formally **sanctioned in March 1995** with an initial estimated cost of **2,500 crore** and later declared a **'National Project' in 2002**.
- It faced massive engineering, geological, and climatic challenges, but has now been **fully completed** at a final cost of **43,780 crore**.
- It features:
  - **272 km** of high-altitude railway track
  - **36 tunnels** and **943 bridges**
  - Designed for **year-round, all-weather connectivity**

Engineering Marvels of the Himalayas: World Records and Innovations

Chenab Bridge: The Crown Jewel

- The **Chenab Bridge** is now the **world's highest railway arch bridge**, rising **359 metres** above the riverbed — **35 metres taller than the Eiffel Tower**.
- The bridge is **1,315 metres long** and constructed using **steel capable of withstanding temperatures from -10°C to 40°C**.
- Designed for a **lifespan of 120 years**, it can endure **wind speeds up to 260 km/h** and seismic shocks.

Anji Khad Bridge: India's First Cable-Stayed Rail Bridge

- The **Anji Khad Bridge**, also located in the **Reasi district**, is another milestone:
  - Spanning **725 metres**, it stands **331 metres** above the Anji riverbed.
  - Its signature **inverted Y-shaped pylon** rises **193 metres**, supported by **96 high-tensile cables**.

India's Longest Railway Tunnel:

- The USBRL project includes the **country's longest transportation tunnel** at **12.77 km**, located in **Ramban district**, enabling rail operations through some of the most geologically complex terrain in India.

Vande Bharat Trains: High-Speed Connectivity in Just 3 Hours

- The new **Vande Bharat Express trains** cut the travel time between **Katra and Srinagar** to **just 3 hours**, down from the usual **6–8 hours by road**.
- These trains are specially designed to **operate in snowbound conditions**, ensuring **uninterrupted service even during winter**.
- Plans are already in motion to **extend the service to Jammu Tawi**, enabling **direct access from across India** to **Srinagar** via Vande Bharat trains.

Economic and Cultural Impact: Transforming Lives and Landscapes

Tourism Boom Expected:

- The seamless and scenic rail journey is expected to **revolutionize tourism** in **Jammu and Kashmir**, attracting both **domestic and international travellers**.
- Destinations like **Gulmarg, Pahalgam, and Sonamarg** are now just a few hours away from major cities via rail, promising an **unprecedented influx of visitors**.

Boost for Local Trade and Agriculture:

- Local industries — including **apple farming, walnut and saffron production, pashmina weaving**, and **handicrafts** — will benefit from **faster and cost-effective transportation**.
- Reduced dependency on road transport means **lower costs** for bringing **daily essentials** into the Valley, helping both **consumers and small businesses**.

Did You Know?

- The Chenab Bridge is taller than **New York's Statue of Liberty** and can withstand earthquakes up to **magnitude 8** on the Richter scale.
- Kashmir's pashmina exports are expected to rise by **30–40%** due to improved logistics and reduced transit time.

GS Paper 3 – Governance, Constitution, Polity, Social Justice

Funds Meant for Poor Prisoners Lie Idle as States Fail to Implement MHA's Relief Scheme

Context: In a move to address the plight of **financially distressed prisoners**, the **Union Ministry of Home Affairs (MHA)** has voiced serious concerns over the **poor implementation** of the **Support to Poor Prisoners Scheme** by various **States and Union Territories**. Despite repeated advisories and dedicated funding, the scheme remains **grossly underused**, leaving thousands of poor inmates behind bars simply because they can't afford **bail or fines**.

What Is the Support to Poor Prisoners Scheme?

Launched in **May 2023**, the scheme is aimed at ensuring **access to justice** for undertrial and convicted prisoners who remain incarcerated **due to poverty**, not legal guilt. The **National Crime Records Bureau (NCRB)** has been designated the **Central Nodal Agency** for implementation, while **District Legal Services Authorities (DLSAs)** and **Empowered Committees** are tasked with identification and financial disbursement at the local level.

Key Features of the Scheme:

Eligibility and Process for Undertrial Prisoners:

- **Trigger Point:** If a prisoner is **not released within 7 days** of getting bail, **jail authorities** must inform the **DLSA Secretary**.
- **Assessment:** Within **10 days**, the DLSA—alongside **NGOs, social workers, or revenue officers**—must verify the prisoner's inability to provide surety.
- **Financial Assistance:** On approval, up to **40,000 per case** can be granted, often through **Fixed Deposits** for use by the courts.
- **Review System: Empowered Committees** meet every **2–3 weeks** to process verified applications.
- **Exclusions:** No aid is extended to prisoners booked under serious laws such as:
    - **Prevention of Corruption Act**
    - **NDPS Act**
    - **UAPA**
    - **Money Laundering laws**
    - **Other serious offenses**

For Convicted Prisoners Unable to Pay Fines:

- **Trigger Point:** If a prisoner remains in jail due to **nonpayment of court fines**, the **Jail Superintendent** must notify the DLSA within **7 days**.
- **Investigation:** The DLSA, with help from **NGOs and probation officers**, must verify financial inability within another **7 days**.
- **Sanctioned Relief:** Up to **25,000** can be sanctioned by the District Committee, while larger amounts require approval from the **State Oversight Committee**.

Why the Scheme Matters: Overcrowded Jails and Denied Justice:

The **India Justice Report 2025** paints a grim picture of the current prison system:

- India's **average jail occupancy rate** stands at a staggering **131%**.
- A shocking **76% of inmates** are **undertrial prisoners**, many held simply due to financial constraints.
- At the current pace, India's **prison population may hit 6.8 lakh by 2030**, while available infrastructure will support only **5.15 lakh**, creating an alarming shortfall.

Global Comparison:

India ranks among the countries with **the highest proportion of undertrials**. In contrast, many countries in Europe and North America maintain undertrial percentages under 30%, emphasizing the urgent need for **legal reform and implementation** of support schemes like this one.

MHA Slams States for Poor Execution and Inaction

Despite making funds available and issuing **Standard Operating Procedures (SOPs)**, the MHA has expressed **disappointment** over the failure of many States and Union Territories to:

- **Identify eligible inmates**
- **Hold regular Empowered Committee meetings**
- **Coordinate with DLSAs and NGOs**
- **Utilize central funds already allocated**

Repeated Reminders Ignored:

The MHA has conducted **multiple video conferences**, followed by official advisories and reminders. Yet, in many regions, **no significant progress** has been made. As a result, **prison overcrowding persists**, and **justice remains inaccessible** for the poorest behind bars.

What Needs to Be Done: A Call for Immediate Action:

The Ministry has **urged States and UTs** to:

- **Proactively identify eligible prisoners** through DLSAs.
- Ensure **timely and regular Empowered Committee meetings**.
- **Collaborate with NGOs**, probation officers, and civil society groups.
- **Monitor fund utilization** and provide regular updates to the Centre.

The Bigger Picture: Beyond Bail – Towards Inclusive Justice

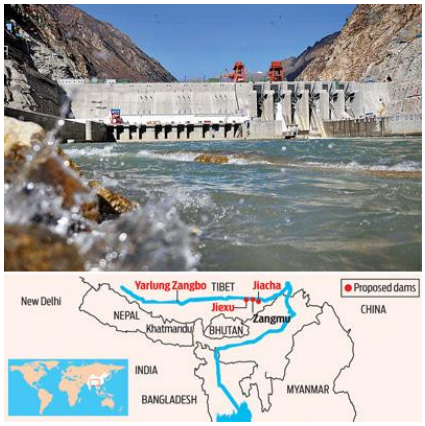
This scheme is not just about **financial aid**. It reflects a broader principle: **Justice should not be denied due to poverty**. With more than three-fourths of the prison population waiting for trials — often for petty or bailable offenses — this initiative can significantly reduce **the burden on the judiciary**, ensure **quicker reintegration**, and promote **equity in legal access**.

Did You Know?

- India has **1,300+ prisons**, but over **1 lakh inmates** are detained for want of bail or fines under 50,000.
- Inmates often stay in jail **longer than their maximum possible sentence** because they can't afford to pay the imposed fine.
- **Legal Aid Services Authorities Act, 1987** already provides for free legal aid, but the **financial arm of that aid is often neglected**.

GS Paper 3 – Environment, Security and Disaster Management

How Chinese Dams Could Influence the Brahmaputra's Flow into India: Facts, Fears, and Strategy



Context: Amid growing infrastructure developments in **Tibet**, concerns have emerged in India over how **China's dam-building on the Brahmaputra River**—known as the **Yarlung Tsangpo** in Tibet—might affect water availability downstream. Recently, **Assam Chief Minister** sought to allay fears, highlighting that **over 65% of the river's flow originates in India**, and that reduced inflow from China could actually **ease Assam's annual flood crisis**.

Originating in the Tibetan Plateau, the river flows into India through **Arunachal Pradesh as the Siang**, traverses **Assam as the Brahmaputra**, and finally enters **Bangladesh as the Jamuna**.

What China Is Building: Hydropower Projects, Not Diversion—For Now

Upstream Hydropower: Current Status:

- China has built or proposed several **hydropower projects** along the upper reaches of the Yarlung Tsangpo, but most are **run-of-the-river dams** with **minimal water storage capacity**. These are located far upstream and **currently pose no major threat** to India's water security or to flows in **Arunachal Pradesh and Assam**.

The Medog Mega-Dam: A Potential Game-Changer

- Of serious interest is China's **proposed 60,000 MW Medog Hydropower Project**, near the **Great Bend** of the river in Tibet's **Medog County**. If completed, it would be the **largest hydroelectric project in the world—three times the capacity of the Three Gorges Dam**.

While precise technical data remains undisclosed, early indications suggest the **Medog dam may have limited storage** and may focus mainly on **power generation**, not water diversion. However, even **temporary water impoundment** or sudden releases could impact **flow variability** downstream.

Is China Diverting the Brahmaputra?

The South–North Water Diversion Plan:

There have long been **speculations** about the **Western Route** of China's **South–North Water Diversion (SNWD)** scheme involving the **diversion of Brahmaputra waters** to its drought-prone northern regions. However, to date, **no official confirmation** or **feasibility study** has been made public, and such a diversion would face **massive geopolitical and environmental hurdles**.

Who Really Feeds the Brahmaputra?

India's Dominant Contribution:

Despite covering just **34.2% of the basin area**, **India contributes more than 80%** of the Brahmaputra's **total water yield**. This challenges the misconception that the river is primarily Tibetan in origin.

Why India Contributes More Water:

- The **Tibetan Plateau** receives only about **300 mm of annual rainfall**, while the **Indian part of the basin** gets a **rich monsoon rainfall average of 2,371 mm**.
- A network of **monsoon-fed tributaries** in Arunachal Pradesh and Assam, such as the **Subansiri, Dibang, and Lohit**, significantly boosts the river's volume.

- **Snowmelt from the Indian Himalayas** also adds to the river's year-round flow, especially in spring.

Potential Impacts of Chinese Dams: What's at Stake for India?

Flow Reductions: Minimal, But Not Negligible

- India's heavy rainfall and strong tributary network mean that **Chinese upstream interventions** are unlikely to cause a **major reduction in overall flow**, especially during the **monsoon**.

Seasonal Challenges and Hydropower Impacts:

- However, during the **dry season**—when India's **hydropower demand peaks**—even minor upstream flow regulation by China could affect **hydropower plants on the Siang**, such as the **proposed Upper Siang project**.

Risk of Flash Floods or Dam Breaches

Potential threats also include:

- **Sudden releases** from upstream dams
- **Dam failures**, landslides, or earthquakes in the seismically active Tibetan plateau
- These could trigger **devastating flash floods** downstream in Arunachal Pradesh and Assam.

Ecological and River Morphology Concerns:

Altered flow patterns can disrupt the **natural sediment load**, **aquatic ecosystems**, and **biodiversity** in the Brahmaputra basin. Riverine communities depending on fishing and seasonal agriculture could also be adversely affected.

India's Utilisation of the Brahmaputra Basin: Huge Untapped Potential

According to the **CWC-ISRO Brahmaputra Basin Atlas**, the river holds:

- **Over 30% of India's total water resources**
- **41% of the country's total hydropower potential**

Arunachal Pradesh: The Hydropower Hub

Arunachal Pradesh is the focal point of India's Brahmaputra hydropower strategy. Yet, progress is **slow** due to:

- **Land acquisition delays**
- **Environmental clearance hurdles**
- **Concerns over forest and habitat submergence**

India's River-Linking Vision:

India is exploring **inter-basin water transfer** options, including:

- **Manas–Sankosh–Teesta–Ganga Link**
- **Jogighopa–Teesta–Farakka Link**

These projects aim to divert **surplus Brahmaputra water to drier parts** of the **Ganga basin**, offering long-term water security in drought-prone areas.

Good News: These plans are **unlikely to be affected** by China's upstream activity, thanks to India's own dominant contribution to the river's flow.

Looking Beyond the Brahmaputra: China's Dams on Indus and Sutlej

Indus and Sutlej Origins in Tibet:

China has also developed hydropower projects on **the Indus and Sutlej**, both of which rise in Tibet.

Sutlej Impact Mitigated by Indian Infrastructure:

The **Bhakra Dam** (Gobind Sagar) acts as a large **regulatory reservoir**, buffering against Chinese flow variation. However, run-of-the-river plants like **Nathpa Jhakri** may experience **output fluctuations** depending on upstream releases.

Minimal Consumptive Use on Indus:

India's use of the **Indus River** is largely **non-consumptive**, meaning it relies more on the river for **hydropower** than for water withdrawal. Projects like **Nimoo Bazgo** in Ladakh may face seasonal changes, but **overall risk remains low**.

India's Strategic Response: Balancing Science, Diplomacy, and Infrastructure

1. **Scientific Monitoring and Impact Studies:** India must invest in **high-resolution hydrological models**, **remote sensing**, and **climate-linked river behavior assessments** to fully understand any flow manipulation upstream.
2. **Strengthening Diplomatic Channels:** Engaging China through **bilateral mechanisms** and international platforms can ensure **access to crucial hydrological data**, especially during emergencies like floods.
3. **Establishing Real-Time Data Sharing Protocols:** India should pursue formal **data-sharing agreements**, particularly during the **monsoon** and **dry seasons**, to manage **early warning systems** and prevent disasters.

Did You Know?

- The **Yarlung Tsangpo Grand Canyon** in Tibet, where the Brahmaputra bends into India, is **deeper than the Grand Canyon** in the USA.
- If constructed, the **Medog Dam** could potentially displace tens of thousands of people in one of China's most remote and biodiverse regions.
- India already receives **hydrological data from China** during the flood season—but only on selected rivers and for a limited time.

Ranthambore Tiger Reserve: A Royal Wilderness Under Protection

Context: In a significant conservation boost, the **Supreme Court of India** has directed the **Rajasthan government** to **immediately ban all mining activities** within the **core zone** of the **Ranthambore Tiger Reserve (RTR)**. This move aims to protect critical tiger habitats from ecological degradation and ensure long-term survival of wildlife in one of India's premier tiger reserves.

Where Nature Meets Heritage: About Ranthambore Tiger Reserve

Located in **Sawai Madhopur district**, in **southeastern Rajasthan**, the **Ranthambore Tiger Reserve** stands as a majestic blend of **history and wilderness**. It gets its name from the **iconic Ranthambore Fort**, a **UNESCO World Heritage Site**, nestled within the park's boundaries.

The reserve is **cradled between the Aravalli and Vindhya hill ranges**, and is known for its **picturesque landscapes**, featuring **rugged hills, plateaus, rivers, and ancient ruins** that echo its regal past.

Once a **royal hunting ground for the Maharajas of Jaipur**, Ranthambore was declared a **Wildlife Sanctuary in 1955**, and became part of **Project Tiger in 1973**. Today, it is recognized as one of **northern India's largest and most visited tiger reserves**, covering an area of about **1,411 sq. km**.

Geography and Water Bodies: Life Lines of the Reserve

- The park is **bounded by the Banas River** to the north and the **Chambal River** to the south.
- It is dotted with several scenic lakes, including:
  - **Padam Talab**
  - **Raj Bagh Talab**
  - **Malik Talab**

These **wetlands** not only support a rich diversity of flora and fauna but also serve as popular watering holes for wildlife, making them prime tiger-spotting zones.

Vegetation: The Beauty of the Dry Deciduous Forests

Ranthambore is dominated by **dry deciduous forests**, interspersed with **open grasslands**, particularly on elevated plateaus. The terrain creates a visually captivating contrast of **rocky outcrops and sparse greenery**.

- The forest is largely composed of **Dhok trees** (*Anogeissus pendula*), which thrive in arid conditions.
- Other plant species found here include:
  - **Acacia**
  - **Zizyphus**
  - **Capparis**
  - **Prosopis**

The **biodiversity of vegetation** plays a critical role in supporting herbivores and the predators that depend on them.

Wildlife: A Haven for Tigers and Beyond

While **Bengal tigers** are undoubtedly the star attraction, Ranthambore is home to a wide variety of **wildlife species**, making it a **biodiversity hotspot**.

Notable Fauna:

- **Leopard**
- **Caracal** – A rare, elusive wild cat
- **Jungle cat**
- **Sambar deer**
- **Chital (spotted deer)**
- **Chinkara (Indian gazelle)**
- **Wild boar**

Birdwatchers are also drawn to Ranthambore for its **diverse avian population**, including **crested serpent eagles, parakeets, kingfishers**, and **peacocks**.

Did You Know?

- Ranthambore is one of the best places in the world to see **tigers in the wild**, especially **during the day**—a rarity among tiger reserves.
- The **Ranthambore Fort**, dating back to the **10th century**, stands as a testament to Rajput valor and is **a fortress within a jungle**, offering panoramic views of the reserve.
- The park was once visited by **President Bill Clinton** and many other global dignitaries, adding to its international fame.

Conservation Challenges and the Way Forward:

Despite its success in tiger conservation, Ranthambore faces ongoing challenges such as:

- **Mining and habitat encroachment**
- **Human-wildlife conflict in buffer zones**
- **Tourism pressure on core habitats**

The **Supreme Court's mining ban** is a critical step in reinforcing the protection of core areas. For long-term sustainability, experts emphasize the need for:

- **Enhanced patrolling and monitoring**
- **Community-based eco-tourism**
- **Expansion of buffer zones**
- **Habitat corridor connectivity** with neighboring reserves like **Sariska** and **Mukundra Hills**

Ranthambore is more than just a tiger reserve—it's a living archive of India's natural and cultural heritage. As the majestic roar of the tiger echoes through its ancient valleys and forts, it serves as a reminder of the delicate balance between conservation and development.

GS Paper 3 – Science and Technology

DRUM Web App: IIT Kharagpur's Smart Solution for Clean and Efficient Urban Travel

Context: In a noteworthy development, a team of **students and an associate professor from IIT Kharagpur** has developed a cutting-edge tool for sustainable urban mobility—the **DRUM Web App** (**Dynamic Route Planning for Urban Green Mobility**). This innovative platform is designed to help users **navigate city routes not just by speed or distance**, but also by **air quality and energy efficiency**, setting a new benchmark in eco-conscious travel technology.

What is the DRUM Web App?

Think of it as an **environmentally intelligent version of Google Maps**. The **DRUM app** empowers users to choose travel routes based on **multiple environmental and efficiency factors**, enabling smarter, healthier urban commuting.

Key Features of the DRUM App:

The DRUM platform offers **five intelligent route choices**:

1. **Shortest Route** – Minimizes distance
2. **Fastest Route** – Minimizes travel time
3. **LEAP (Least Exposure to Air Pollution)** – Prioritizes cleaner air
4. **LECR (Least Energy Consumption Route)** – Optimizes energy use
5. **Suggested Route** – A balanced choice combining the best of all four criteria

Unlike conventional maps that refresh data periodically, **DRUM fetches live pollution and traffic data** at the exact moment a user enters a route—**ensuring maximum accuracy** in real-time navigation.

How It Works: The Tech Behind DRUM

- **Routing Engine**: DRUM is built using **GraphHopper**, a high-performance **Java-based routing library** known for its scalability and flexibility.
- **Real-Time Updates**: **Mapbox** provides dynamic traffic data, while pollution insights come from the **Central Pollution Control Board (CPCB)** and the **World Air Quality Index (WAQI)**.
- **Pollution Interpolation Strategy**: To tackle areas with **limited sensor coverage**, the app uses a **segment-wise interpolation technique**. Routes are broken down into smaller parts, and pollution levels are **estimated using nearby sensor data**, ensuring **complete coverage**.
- **Simulation and Testing**: The app was successfully tested on various corridors across **Delhi (East, West, North, and Central)**, each with differing **road, traffic, and pollution conditions**. The results revealed that traditional routes—though faster or shorter—**often passed through highly polluted zones**, reducing their overall benefit.

Why DRUM Stands Out: Smarter Choices for Urban Living

Traditional navigation apps focus on time and distance. **DRUM introduces a game-changing perspective**: **your route impacts your health and the environment**. With rising urban air pollution and traffic congestion, this app offers a **scientifically backed tool** for choosing routes that balance **convenience with sustainability**.

Did You Know?

- A **10-minute detour** through cleaner routes could **reduce air pollution exposure by up to 40%**, according to pilot studies.

- The **transport sector contributes nearly 18% to urban PM2.5 pollution levels** in major Indian cities—better route planning can significantly lower individual carbon footprints.
- DRUM can be scaled to **other metro cities like Mumbai, Bengaluru, and Kolkata**, offering **nationwide potential** for eco-conscious commuters.

Future Potential and Way Forward:

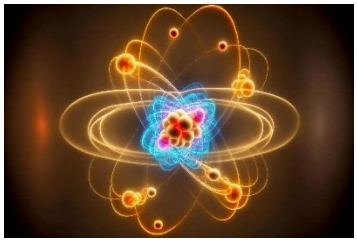
The DRUM team envisions integrating more features such as:

- **Public transport route mapping**
- **EV route optimization based on charging station availability**
- **User feedback loops for route refinement**

With increasing emphasis on **sustainable smart cities**, DRUM could become a **core component in green mobility planning** and urban policy-making.

DRUM is more than just a navigation tool—it's a conscious step toward a cleaner, healthier, and smarter future for India's urban travelers.

Proton Emission: Unveiling a Rare Form of Radioactive Decay



Context: In a remarkable scientific advancement, an **international team of researchers** has successfully **measured the half-life of the heaviest known proton emitter**—the **Astatine-188 (^{188}At) isotope**. This unstable isotope of **astatine** was observed to decay by **emitting a single proton**, offering deeper insights into the exotic realm of **proton-rich nuclei** and advancing the field of **nuclear physics**.

What is Proton Emission? A Rare Decay Phenomenon

Proton emission, also referred to as **proton radioactivity**, is a **rare and exotic type of radioactive decay** in which an **unstable atomic nucleus expels a proton** to achieve a more stable configuration.

This form of decay typically occurs in **extremely proton-rich nuclei**—nuclei that lie **beyond the proton drip line**, where **proton separation energy becomes negative**. In such cases, the proton is **no longer bound** within the nucleus and **escapes by quantum tunneling** through the nuclear potential barrier.

How Does It Differ from Other Types of Radioactive Decay?

Radioactive decay is the **natural transformation** of an **unstable atom** into a **more stable one**, often by **releasing subatomic particles and energy**. Here's how **proton emission** compares with more common types:

- **Alpha Decay**: Releases an **alpha particle** (2 protons and 2 neutrons). Common in heavy nuclei like uranium and thorium.
- **Beta Decay**:
  - **Beta-minus (β^-)**: A neutron transforms into a proton and emits an **electron**.
  - **Beta-plus (β^+)**: A proton converts into a neutron and emits a **positron**.
- **Proton Emission**: Ejects a **single proton** from the nucleus, either:
  - **Directly from the ground state**, or
  - **Following beta decay**, known as **beta-delayed proton emission**.

When and How Does Proton Emission Occur?

Proton emission only occurs in **nuclei that are highly proton-rich**, and typically **not found in nature**. Such isotopes are **synthesized artificially** in laboratories using **particle accelerators** and **nuclear reactions**.

To emit a proton:

- The **proton separation energy must be negative**, meaning the proton is **energetically unbound**.
- The emission rate depends on:
  - The **nuclear potential**
  - The **Coulomb barrier** (electrostatic repulsion)
  - The **centrifugal barrier**, which increases with the proton's **orbital angular momentum**

Why Half-Life Matters in Proton Emission:

The **half-life** of a radioactive isotope is the **time required for half of a sample to decay**. For proton emitters:

- The **shorter the half-life**, the **more unstable** the nucleus.

- The **proton's energy** and **angular momentum** directly affect how fast it escapes the nucleus.

The detection of **Astatine-188**'s half-life gives physicists **valuable data** on nuclear forces and helps **refine nuclear models** near the **limits of stability**.

Scientific and Practical Relevance:

Though **proton emission** has no direct application in daily life, it plays a **crucial role in nuclear research**, helping scientists:

- Understand the **structure of nuclei** at the edge of the **nuclear landscape**
- Explore **fundamental interactions** between nuclear particles
- Improve **theoretical models** used in **nuclear astrophysics**, especially for understanding **nucleosynthesis in stars**

GS Paper 2 – Health

Rising Demand for Compulsory Licensing in India: A Lifeline for Rare Disease Patients

Context: A growing number of **rare disease patients in India** are calling on the government to **invoke compulsory licensing** provisions under the **Indian Patents Act, 1970**, in a desperate effort to gain access to affordable and often life-saving treatments.

What is Compulsory Licensing?

Compulsory licensing (CL) is a legal mechanism outlined in **Section 84 of the Indian Patents Act, 1970**, allowing the manufacture and sale of a **patented product or process** by someone other than the patent holder—**without their consent**—under specific conditions.

It serves as a vital tool to **balance public health needs** with intellectual property rights. A compulsory license may be issued **three years after a patent is granted** if any of the following conditions are met:

- The patented drug is **not available to the public at a reasonable price**.
- The **public's needs are not being adequately met**.
- The patent is **not being utilized** effectively within Indian territory.

This provision plays a crucial role in **ensuring access to essential medicines**, especially when high prices create barriers for the most vulnerable populations.

India's Progressive Patent Framework:

India's legal framework has historically supported **affordable healthcare** through innovative patent policies:

- Initially, the **Patents Act of 1970** recognized **only process patents**, enabling Indian companies to develop affordable generic alternatives. This led to India's reputation as the **"Pharmacy of the World"**.
- **Section 3(d)** of the Act discourages **"evergreening"**, a practice where pharmaceutical companies make **minor changes** to extend patent life and delay generics.
- India allows both **pre-grant and post-grant opposition** to challenge questionable patents, enhancing transparency and public interest protections.

International Obligations and Flexibilities:

As a **WTO member**, India is bound by the **TRIPS Agreement (Trade-Related Aspects of Intellectual Property Rights)**. This agreement mandates product and process patents but includes **flexibilities** for public health emergencies.

The **Doha Declaration on TRIPS and Public Health (2001)** affirmed that:

- Public health concerns, including rare diseases, can justify the use of **compulsory licensing**.
- An emergency **is not a prerequisite** for issuing a CL.
- Nations have the **sovereign authority** to define their own grounds for licensing.
- The patent holder is entitled to **adequate remuneration**, based on the economic value of the license.

A **2003 waiver** (made permanent in 2017) enables countries to **import affordable drugs** produced under compulsory licenses from other nations, thereby supporting **global access** to essential medicines.

Understanding Rare Diseases:

Rare diseases, also called **orphan diseases**, are conditions that affect a **very small segment of the population**—often less than 1 in 2,000 individuals. They typically exhibit:

- **Low prevalence**
- **Limited research**
- **Scarce or non-existent treatment options**

There are over **7,000 known rare diseases** globally, but fewer than **5% have approved treatments**, according to the **World Health Organization (WHO)**.

Due to the **high cost of orphan drugs**, many patients—especially in developing countries—remain untreated.

India's Efforts for Rare Disease Management:

India has launched several initiatives to support individuals suffering from rare diseases:

- **National Policy for Rare Diseases (NPRD), 2021**: Offers **financial aid up to ₹50 lakh** for treatment at **designated Centres of Excellence (CoEs)**.
- **Digital Crowdfunding Portal**: Allows **individual donors** to contribute to patient care, directly selecting both **CoE and patient** for targeted support.
- **Rare Disease Funds**: Each CoE manages its own fund, utilized with appropriate approvals for patient treatment.
- **PLI Scheme for Pharmaceuticals**: The **Department of Pharmaceuticals** offers incentives under the **Production Linked Incentive (PLI) Scheme** to encourage **domestic manufacturing of orphan drugs**, reducing dependence on costly imports.

The Urgent Case for Compulsory Licensing in Rare Diseases:

For many patients with rare diseases, time is running out. The **cost of treatment** for some conditions can run into **crores of rupees annually**, making it impossible for most families to afford without intervention. Moreover, **global pharma companies** often do not launch these therapies in India due to **low commercial incentive**, despite high unmet need.

Compulsory licensing, in such cases, emerges as a **moral and legal imperative**, especially when:

- The patent holder is **not supplying the drug in India**.
- The prices are **exorbitantly high** and unaffordable.
- No **domestic manufacturing** or technology transfer has been initiated.

Global Examples and Precedents:

India issued its **first compulsory license in 2012** to Natco Pharma for the cancer drug **Nexavar**, originally priced at 2.8 lakh per month. Natco offered it at just **₹8,800**, demonstrating the **life-saving impact** of CL.

Countries like **Brazil, Thailand**, and **South Africa** have also used compulsory licenses to **improve access** to critical medicines.

Conclusion: A Call for Equity in Healthcare

As **rare disease patients in India** continue their fight, invoking **compulsory licensing** could pave the way for **greater access, affordability, and justice in healthcare**. It's a **lifesaving policy tool** that needs stronger political will, faster decision-making, and active public support to ensure that **no life is lost due to the inaccessibility of medicine**.

GS Paper 3 – Economy

India Set to Update Base Year for Key Economic Indicators by 2026

Context: In a major move aimed at making economic data more **relevant and reflective of current realities**, the **Ministry of Statistics and Programme Implementation (MoSPI)** has announced that new **base years for GDP, IIP, and CPI** will be adopted beginning **early 2026**. This recalibration is crucial for **capturing structural changes**, **shifting consumption patterns**, and ensuring more accurate economic policy planning.

Advisory Panel Formed to Guide Transition:

To oversee this transition, MoSPI has constituted a **26-member Advisory Committee on National Accounts Statistics**, chaired by renowned economist **Dr. Biswanath Goldar**. This expert group will provide recommendations on the appropriate methodologies and structural adjustments needed to **revise national data series**.

New Base Years: What's Changing and When:

1. **Gross Domestic Product (GDP):**
    - **New Base Year: 2022–23**
    - **Scheduled Release: February 27, 2026**
    - The revised GDP will better reflect the **current economic composition**, including **emerging sectors**, **technological advancements**, and **digital services**.
2. **Index of Industrial Production (IIP):**
    - **Proposed New Base Year: 2022–23**
    - **Expected Rollout:** From **financial year 2026–27**
    - This will offer a more **contemporary picture of industrial output**, accounting for newer industries and shifts in manufacturing trends.
3. **Consumer Price Index (CPI):**
    - **Revised Base Year: 2024**
    - **First Release:** Expected in **Q1 of 2026**
    - Based on the latest **Household Consumer Expenditure Survey (HCES) 2023–24**, the revised CPI will incorporate changes in the **item basket** and **weightages**, capturing more accurately the **cost of living and retail inflation**.

Understanding the Base Year: Why It Matters

A **base year** is the **reference year** used in statistical and economic calculations to compare present-day values. It sets the benchmark index value—**usually at 100**—against which all subsequent data is measured. Changing the base year ensures that:

- **Inflation-adjusted (real) growth** is accurately calculated.
- New and **relevant goods and services** are included in measurements.
- Data reflects the **current economic structure and consumer behavior**.

Typically, countries revise their base year every **7 to 10 years** to maintain the relevance and reliability of official statistics.

Why the Update is Necessary Now:

India's current base years—**2011–12 for GDP and IIP**, and **2012 for CPI**—are now **over a decade old**. Since then, the economy has undergone transformative changes:

- A **surge in digital services**, e-commerce, fintech, and gig economy.
- **Consumption patterns** influenced by rising income, urbanization, and lifestyle changes.
- **New products and services** have entered the market while many older ones have declined in relevance.
- **Industrial diversification**, driven by schemes like **Make in India** and **PLI (Production Linked Incentive)**.

Updating the base years ensures that economic indicators remain **robust tools** for both **policy design** and **economic forecasting**.

Key Economic Indicators: A Quick Refresher:

1. **Gross Domestic Product (GDP):**

Measures the **total monetary value** of all goods and services produced within the country in a given period.

- Helps understand **overall economic performance**.
- Current base year: **2011–12**
- Released by: **National Statistical Office (NSO)**

2. **Index of Industrial Production (IIP):** Tracks the **volume of industrial output**, including manufacturing, mining, and electricity.
   - Reflects **industrial growth trends**.
   - Base year: **2011–12** (soon to be revised)
   - Released monthly by: **NSO**
3. **Consumer Price Index (CPI):** Monitors **retail inflation** by tracking price changes in a **fixed basket of goods and services**.
   - Key indicator for assessing **cost of living**.
   - Current base year: **2012**
   - Released monthly by: **NSO**

Global Practice: Keeping Data Up to Date:

Countries around the world regularly **revise their statistical frameworks** to keep pace with dynamic economies. For instance:

- The **United States** updates its **GDP benchmarks every 5 years**.
- **Japan** and **Germany** have moved toward **chained volume indices** to avoid abrupt shifts in economic readings.

India's shift is in line with such international practices and will enhance the **credibility and comparability** of its economic data globally.

Conclusion: A Timely and Strategic Shift:

By adopting **new base years for GDP, IIP, and CPI**, India is taking a timely step to **modernize its statistical systems** and ensure that economic indicators are **accurate, up-to-date, and policy-relevant**. This revision will help policymakers, analysts, and investors gain **better insights** into the health of the Indian economy and enable more **targeted interventions** for inclusive growth.

GS Paper 3 – Environment & Ecology

Kerala Seeks Wildlife Act Amendment to Tackle Escalating Human-Animal Conflicts

Context: Amid growing incidents of **human-wildlife conflict**, the **Kerala government** has urged the **Union Ministry of Environment, Forest and Climate Change** to revise the **Wildlife (Protection) Act, 1972 (WLPA)**. The demand aims to **simplify procedures** for managing aggressive and invasive wildlife, particularly species that pose a direct threat to **human life, livestock, and agriculture**.

Kerala's Key Requests to the Central Government:

1. **Simplify Culling Procedures**: Kerala wants the law amended to allow for **faster decision-making** and **reduced bureaucracy** when dealing with **man-eating or dangerous wild animals** that enter human settlements.
2. **Declare Wild Boars as 'Vermin'**: The state seeks to include **wild boars** under **Section 62 (Schedule V)** of the Act, which would allow **controlled hunting** in specified zones and for limited durations.
3. **Downgrade Bonnet Macaques from Schedule I**: By removing **bonnet macaques** from **Schedule I**, the state would gain flexibility to **capture, relocate, or control** their populations without navigating through intense legal barriers.

Why Human-Wildlife Conflict is on the Rise:

The increasing number of **wild animal incursions** into farmlands and villages is not random—it is the result of deep-rooted ecological and anthropogenic issues:

- **Shrinking Natural Habitats**: Rapid **deforestation**, **urban expansion**, and **infrastructure projects** have caused massive habitat fragmentation, forcing animals to venture into human spaces.
- **Population Surge of Certain Species**: Species like **wild pigs** and **bonnet macaques** have seen a rapid rise in numbers due to **lack of natural predators** and **favorable human-dominated landscapes**.
- **Agricultural Practices**: **Cattle grazing** in forest zones and changes in **crop patterns** (e.g., planting fruit-bearing trees) are inadvertently attracting wildlife.
- **Collapse of Predator Populations**: A significant drop in apex predators such as **leopards and tigers**, often due to **past hunting practices** or habitat loss, has led to **unchecked growth** in prey species.

Understanding the Wildlife (Protection) Act, 1972:

The **WLPA** was enacted to **protect India's rich biodiversity** and prevent illegal hunting and trade. It classifies animals into **six schedules**, each offering varying degrees of protection:

- **Schedules I & II**: Highest protection (e.g., tigers, elephants). Offences attract **severe penalties**.
- **Schedule V**: Animals declared as **'vermin'** (e.g., rats, fruit bats) can be **legally hunted**.

How Can a Species Be Declared as Vermin?

1. **State Government Proposal**: States must submit a formal request if an animal is causing **major agricultural damage**, **threatening human lives**, or **disturbing local ecosystems**.
2. **Centre's Approval**: The **Central Government** can issue a **temporary notification**, declaring the animal as **vermin** for a specific region and period.
3. **Loss of Legal Protection**: Once declared vermin, the species can be **culled without legal consequence**, but only under defined conditions.

Concerns Around Wildlife Culling:

While Kerala's demand stems from growing frustration among farmers and rural communities, several **ecological, ethical, and procedural concerns** surround the culling of wild animals:

- **Ecological Consequences**: **Mass removal** of a species can disturb the **delicate food chain** and may trigger **unintended consequences** like increased crop damage from secondary species.
- **Risk to Other Wildlife**: **Lethal traps** set for wild boars, for instance, have unintentionally harmed **leopards and tigers** in states like Karnataka.
- **Lack of Reliable Data**: Many policy decisions are made **without scientific population assessments**, conflict mapping, or studies on the **actual extent of crop damage**.
- **Ethical and Moral Issues**:
    - **Right to Life**: Unjustified killing raises questions about the **intrinsic value of animal life**.
    - **Species Bias**: Labelling certain animals as 'vermin' may lead to **indiscriminate extermination**, driven more by convenience than conservation.
    - **Welfare Concerns**: Inhumane methods of killing cause **immense suffering**, affecting both **targeted and non-targeted species**.

A Balanced Approach is Needed:

Rather than immediate culling, experts advocate for **humane, data-backed, and ecologically sound strategies** such as:

- **Translocation and Sterilization Programs** for overpopulated species.
- Use of **early warning systems**, **electric fencing**, and **crop insurance** schemes.
- **Community-based conservation** that empowers local people while protecting biodiversity.

Conclusion: The Dilemma of Coexistence

Kerala's request reflects a **genuine struggle** faced by many Indian states where **rural livelihoods** and **wildlife conservation** increasingly come into conflict. However, any amendment to the **Wildlife Protection Act** must **balance ecological integrity with human safety**.

As India moves forward, it's vital to promote **science-driven policies**, **public participation**, and **ethical standards** in managing its incredible yet increasingly fragile wildlife heritage.

GS Paper 3 – Environment & Disaster Management

India Leads Global Push for Climate-Resilient Infrastructure at International Conference 2025

Context: Prime Minister Narendra Modi addressed the **International Conference on Disaster Resilient Infrastructure (ICDRI) 2025**, highlighting the need for global cooperation in making infrastructure more resilient to **climate change and natural disasters**. The conference, for the **first time held in Europe**, brought together a wide spectrum of stakeholders including **governments, international organizations, civil society, academia, and the private sector**.

Focus on Coastal Resilience: A Timely Theme

The 2025 conference is themed **"Shaping a Resilient Future for Coastal Regions"**, placing a spotlight on the **heightened vulnerability of coastal and island communities** to extreme weather events.

Recent global calamities such as **Cyclone Remal** (India and Bangladesh), **Hurricane Beryl** (Caribbean), **Typhoon Yagi** (Southeast Asia), **Typhoon Usagi** (Philippines), **Cyclone Chido** (Africa), and **Hurricane Helene** (United States) have illustrated the **growing threat posed by climate-related disasters** to both human lives and physical infrastructure.

This theme aligns with international platforms like the **UN Office for Disaster Risk Reduction's Global Platform (GPDRR)** in Geneva and the **Third UN Ocean Conference (UNOC3)**, emphasizing integrated solutions for **climate resilience** and **sustainable development**.

India's Leadership and Contributions:

Prime Minister Modi reflected on India's long journey in disaster preparedness, citing significant milestones such as:

- The devastating **1999 Odisha Super Cyclone**
- The catastrophic **2004 Indian Ocean Tsunami**

In response, India developed robust mechanisms including **cyclone shelters**, an **advanced tsunami warning system**, and **community-based disaster preparedness programs**.

At the conference, PM Modi laid out **five strategic priorities** for the global community:

1. **Mainstream disaster resilience into education and capacity building**
2. **Establish a global digital repository** of best practices and resilient infrastructure standards
3. **Promote innovative financing mechanisms**, especially for **developing countries**
4. **Support Small Island Developing States (SIDS)**, which face disproportionate risks
5. **Strengthen early warning systems** to reduce loss and enable timely response

African Union Joins the Coalition for Disaster Resilient Infrastructure (CDRI):

A landmark moment during the conference was the **African Union's entry** into the **Coalition for Disaster Resilient Infrastructure (CDRI)**—a testament to the growing **global relevance** of this India-led initiative.

What is the Coalition for Disaster Resilient Infrastructure (CDRI)?

- **Launched in 2019** by the **Government of India** with support from the **UN Office for Disaster Risk Reduction (UNDRR)**
- A **multi-stakeholder global partnership** comprising **governments, UN agencies, financial institutions, academic institutions**, and **private entities**

CDRI's objective is to promote the **resilience of infrastructure systems** against climate change and disaster risks, contributing to the achievement of:

- The **Sustainable Development Goals (SDGs)**
- The **Paris Climate Agreement**
- The **Sendai Framework for Disaster Risk Reduction**

Through technical support, capacity building, and research, the CDRI enables countries to **upgrade existing infrastructure** and **develop new systems** that can **withstand future shocks**.

Conclusion: A United Global Vision for Resilient Infrastructure

The **ICDRI 2025** underscores the **urgent need for resilient and adaptive infrastructure systems** in the face of a changing climate. India, through initiatives like the **CDRI**, is playing a central role in **driving global collaboration**, especially for **vulnerable regions** like coastal and island communities.

As the world becomes increasingly interconnected and climate threats grow more severe, **international cooperation**, **knowledge sharing**, and **inclusive development planning** will be key to securing a **resilient and sustainable future** for all.

GS Paper 1 – Geography

Rwanda in the Spotlight: Strategic Exit from Central African Bloc

Context: Rwanda, with its capital **Kigali**, has officially **withdrawn from the Economic Community of Central African States (ECCAS)**, signaling a shift in its **regional diplomatic and economic alignment**. The country's exit from this regional bloc underscores changing political dynamics and Rwanda's growing focus on East African cooperation platforms.

About ECCAS: A Brief Overview

The **Economic Community of Central African States (ECCAS)** is a regional organization established to promote **economic integration, peace, and development** among Central African nations. Formed in 1983, ECCAS focuses on enhancing **intra-regional trade**, infrastructure development, and **political cooperation**. With Rwanda's departure, questions arise over the **cohesiveness and future influence** of this regional alliance.

Geopolitical Landscape of Rwanda:

Located in **east-central Africa**, Rwanda is a **landlocked country** positioned **just south of the Equator**. Its strategic geographical location allows it to act as a **bridge between Central and East Africa**.

- **Bordering Nations**:
  - **Uganda** to the **north**
  - **Tanzania** to the **east**
  - **Burundi** to the **south**
  - **Democratic Republic of the Congo (DRC)** to the **west**

This central positioning has historically made Rwanda a **crossroads of cultures and trade routes** in the region.

Natural and Geographical Highlights:

- **Lake Kivu**: One of Africa's renowned **Great Lakes**, **Lake Kivu** sits on the western border between Rwanda and the DRC. It is notable for its scenic beauty and vast methane gas reserves, which Rwanda is tapping into for **renewable energy production**.
- **The Great Rift Valley**: The **eastern part of Rwanda** lies within the **Great Rift Valley**, a major tectonic fault system that extends across East Africa. This region is geologically active and plays a role in the country's **diverse topography** of hills, mountains, and lakes.
- **Mineral Wealth**: Rwanda possesses significant **mineral resources**, including **cassiterite (tin ore)** and **wolframite (tungsten ore)**, both of which are vital to global electronics and manufacturing industries.

Cultural and Ethnic Composition:

Rwanda is primarily home to two major ethnic groups:

- **Hutu** (majority)
- **Tutsi** (minority, historically influential)

The country has made significant strides in **reconciliation and unity** following the **tragic 1994 genocide**, emerging as one of Africa's most **stable and rapidly developing nations**.

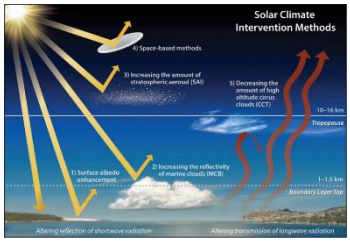
Additional Facts About Rwanda:

- **Kigali**, the capital, is known for its **cleanliness, safety, and efficient urban planning**.
- Rwanda is often referred to as the **"Land of a Thousand Hills"** due to its lush, undulating landscape.
- The country is a **leading advocate of digital innovation** in Africa, with policies promoting **technology, sustainability**, and **inclusive growth**.
- Rwanda has also been a **strong contributor to UN peacekeeping missions**, reflecting its commitment to international cooperation.

Conclusion: Rwanda's Path Forward

Rwanda's **exit from ECCAS** reflects a broader strategic realignment as the nation seeks stronger integration within the **East African Community (EAC)** and more globally connected economic partnerships. Backed by a vision of **resilient development, regional leadership**, and **technological advancement**, Rwanda continues to shape its own distinct path in the African continent and on the world stage.

Stratospheric Aerosol Injection: A Bold Climate Experiment Edges Closer to Reality



Context: A **recently published study in the journal *Earth's Future*** has shed new light on the controversial yet increasingly discussed climate intervention method known as **Stratospheric Aerosol Injection (SAI)**. The research outlines a **more affordable approach** to this technology, potentially bringing it **closer to real-world application**, even as debates around its **ethical, environmental, and geopolitical implications** continue to intensify.

What is Stratospheric Aerosol Injection (SAI)?

Stratospheric Aerosol Injection is a **geoengineering technique** designed to **cool the Earth** by **injecting reflective particles** into the **stratosphere** (the second layer of Earth's atmosphere, located about 10–50 km above the surface).

Inspired by **volcanic eruptions**, this method seeks to **mimic the natural cooling effect** observed when large quantities of **sulfur dioxide (SO_2)** are released into the atmosphere. When injected, SO_2 reacts to form **sulfate aerosols** that reflect **sunlight back into space**, thus **lowering global temperatures**.

How Nature Inspires This Technology:

The concept draws heavily from historic volcanic events:

- The **1991 eruption of Mount Pinatubo** in the Philippines released millions of tons of sulfur dioxide into the atmosphere, leading to a **global temperature drop of about 0.5°C** over the following year.
- Similarly, earlier eruptions like **Krakatoa (1883)** and **Tambora (1815)** had significant short-term cooling effects.

Scientists believe **replicating this phenomenon** artificially could offer a temporary measure to **buy time for carbon reduction** and **climate adaptation efforts**.

Understanding Aerosols: Nature's Tiny Climate Engineers

- **Aerosols** are **microscopic solid or liquid particles** suspended in air or gas.
- They occur **naturally** (e.g., sea spray, volcanic ash, fog) or **artificially** (e.g., industrial emissions, smoke).
- Aerosols are classified into:
    - **Primary aerosols**: Emitted directly (e.g., dust, soot).
    - **Secondary aerosols**: Formed from chemical reactions in the atmosphere (e.g., sulfate aerosols from SO_2).
- Typical aerosol sizes range from **a few nanometers to around 1 micrometre** in diameter.
- **Ultrafine particles** (less than 0.1 micrometre) are called **Aitken nuclei**.
- Visible effects include **haze, smog, dust clouds, and smoke plumes**.

Why the Debate Around SAI?

While the **potential benefits** of SAI are promising, the method is **highly controversial**:

- **Environmental Risks**: Unintended changes in **weather patterns**, **monsoon disruption**, and **ozone depletion**.
- **Moral Hazard**: It may **reduce urgency** in cutting carbon emissions by offering a technological fix.

- **Global Governance Challenges**: No international framework currently exists to **regulate deployment**, raising concerns over **unilateral actions** by nations or private actors.
- **Equity Issues**: Some regions might **benefit**, while others suffer **adverse consequences**, leading to global tension.

What's Next for Stratospheric Aerosol Injection?

As climate challenges grow more urgent, **SAI is gaining traction** as a **potential last-resort solution**. The new study's findings on **cost-effectiveness** could make **experimental deployment more feasible**, prompting calls for:

- **Transparent international dialogue**
- **Robust scientific modeling and monitoring**
- **Public engagement and ethical consideration**

The **United Nations Environment Programme (UNEP)** and other international agencies have urged caution, recommending **small-scale research** and **strong governance structures** before any real-world application.

Conclusion: Innovation Meets Controversy

Stratospheric Aerosol Injection remains one of the most **ambitious and contentious ideas** in the fight against climate change. While recent research offers hope for **practical implementation**, the technique raises **complex questions** about ethics, safety, and geopolitics.

As the climate clock ticks, the world must weigh **technological innovation** against the need for **equitable and sustainable solutions**—balancing short-term relief with long-term responsibility.

GS Paper 2 – Governance Polices

NHAI Unveils Its First Asset Monetisation Strategy for the Road Sector

Context: The **National Highways Authority of India (NHAI)** has made a landmark announcement by unveiling its **first-ever "Asset Monetisation Strategy for the Road Sector"**. This strategic framework marks a significant step towards transforming public infrastructure into sustainable sources of private investment and long-term revenue.

Understanding Asset Monetisation:

Asset Monetisation, also known as **capital recycling**, is a global best practice in public asset management. It involves granting a **limited-period license or lease** of a government-owned asset to private entities in exchange for upfront or periodic returns. The objective is to **unlock capital** tied up in existing assets and **reinvest it in creating new infrastructure**, thereby initiating a **virtuous investment cycle**.

Key Highlights of NHAI's Monetisation Efforts:

Through innovative models such as **Toll-Operate-Transfer (ToT)**, **Infrastructure Investment Trusts (InvITs)**, and **securitisation of toll revenues**, NHAI has already raised over **1.4 lakh crore**, covering more than **6,100 km of National Highways**. These initiatives are a core part of the **National Monetisation Pipeline (NMP)**.

Core Pillars of the Strategy

1. **Value Maximization**– Aims to develop a structured approach to **identify and auction high-potential assets**, ensuring **maximum returns** for the government.
2. **Transparency** – Seeks to embed **clear and codified processes** to enhance **transparency** within NHAI and improve **investor confidence**.
3. **Market Development** - Focuses on **broadening the investor base** by attracting institutional and retail investors.– Promotes **stakeholder engagement** to build awareness and strengthen credibility of the monetisation process.

Monetisation Models at Work:

1. Infrastructure Investment Trusts (InvITs):

- Introduced in **2014** and regulated by **SEBI**, InvITs are **pooled investment vehicles**.
- **How it Works**:
  - NHAI transfers **revenue-generating road assets** to a trust.
  - Investors purchase units and earn returns via **toll revenue**.
  - Operated by an **Investment Manager** (focused on returns) and a **Project Manager** (focused on asset upkeep).

2. Toll-Operate-Transfer (ToT) Model:

- Launched in **2016**, this is a **Public-Private Partnership (PPP)** initiative.
- **How it Works**:
  - Private entities pay an **upfront lump sum** for the **right to operate and collect tolls** from already completed highways.
  - They are also responsible for **maintenance and operations** throughout the concession period.

3. Securitisation of Toll Revenues:

- This involves using **future toll income** to raise immediate funds.
- **How it Works**:
    - NHAI sets up a **Special Purpose Vehicle (SPV)** and uses expected toll revenues as **collateral** to raise capital.
    - Example: The **Delhi-Mumbai Expressway SPV** successfully raised over **40,000 crore** using this model.

Strategic Way Forward:

- **Expanding Scope**: NHAI plans to include more **highway and expressway projects** under its monetisation umbrella.
- **Building Investor Confidence**: Through **policy clarity, transparency**, and **regulatory consistency**, NHAI seeks to attract **long-term private participation**.
- **Institutional Strengthening**: Emphasis will be placed on enhancing **internal capacity**, project design, and **deal structuring capabilities** to manage complex monetisation models.

About NHAI: The Backbone of India's Highway Infrastructure

- Established in **1995**, the **National Highways Authority of India** is an **autonomous body** functioning under the **Ministry of Road Transport and Highways (MoRTH)**.
- It was constituted under the **NHAI Act of 1988** with a clear mandate to **develop, manage, and maintain** the **National Highway network** across the country.
- As of 2025, NHAI manages over **1.45 lakh kilometers** of highways, making it one of the largest infrastructure managers globally.

Additional Insight:

- India's **National Monetisation Pipeline (NMP)**, launched in 2021, aims to monetise **6 lakh crore** worth of brownfield assets across various sectors by **FY 2025**.
- The road sector alone contributes **approximately 27%** of the total target, making it the **largest contributor** to the pipeline.
- Global institutions such as the **World Bank** and **Asian Development Bank** have shown interest in India's monetisation model due to its potential to bridge **infrastructure financing gaps**.

Conclusion:

The unveiling of NHAI's **first Asset Monetisation Strategy** signifies a bold move towards making **India's infrastructure self-sustaining**. By marrying **institutional efficiency with private capital**, the strategy lays down a robust roadmap for **future-ready highways**, economic growth, and **investor-driven development**.

GS Paper 3 – Economy

Government Notifies Major SEZ Reforms to Accelerate Semiconductor and Electronics Manufacturing

Context: In a significant policy shift aimed at strengthening India's position in the global electronics supply chain, the **Union Government has announced key amendments** to the **Special Economic Zones (SEZ) Rules, 2006**. These reforms are strategically designed to **attract investments**, reduce regulatory bottlenecks, and foster the **growth of semiconductor and electronics component manufacturing units**.

Key Amendments in SEZ Rules:

1. Reduced Minimum Land Requirement:

- **Rule 5** has been amended to reduce the **minimum land requirement** for setting up SEZs focused on **semiconductors and electronics components** from **50 hectares to 10 hectares**.
- **Impact**: This will **significantly lower entry barriers** and promote **greater participation by small and mid-sized firms**, accelerating the growth of high-tech clusters across India.

2. Flexibility in Land Encumbrance Conditions:

- Under the revised **Rule 7**, the **Board of Approval** now has the authority to **relax the requirement** that SEZ land must be **free of encumbrances**.
- **Impact**: This change aims to **ease land acquisition issues**, especially in urban and semi-urban areas, thereby making it more feasible for developers and investors to establish new manufacturing hubs.

3. Inclusion of Free Goods in NFE Calculations:

- The amendment to **Rule 53** now permits **free-of-cost goods** to be counted in **Net Foreign Exchange (NFE)** earnings.
- **Impact**: This will benefit SEZ units by **increasing their NFE credits**, especially those involved in complex manufacturing or export-linked R&D, where sample shipments or free parts are common.

What Are SEZs?

- **Special Economic Zones (SEZs)** are **designated areas** where **business and trade laws differ** from the rest of the country to encourage **investment, exports, and employment**.
- **Origin in India**: India adopted the **Export Processing Zone (EPZ)** model as early as **1965** with the **Kandla EPZ**, making it a pioneer in Asia.
- **Legal Framework**: The **SEZ Act, 2005** provided a comprehensive legal structure to operationalize SEZs.
- **Purpose**: SEZs are established to **boost economic activity**, offer **fiscal incentives**, and serve as **engines of growth** in export-driven sectors.

Policy Reforms Rooted in Expert Recommendations:

- The **Baba Kalyani Committee (2018)** was tasked with reviewing the SEZ policy.
    - Key suggestions included:
        - Making SEZs **WTO-compliant**
        - Ensuring **optimal land use**
        - Promoting **integration with national development schemes**

- **DESH Bill (Development of Enterprise and Service Hubs)**: Proposed as a **replacement to the SEZ Act**, this upcoming legislation is intended to **modernize and simplify** SEZ governance, enabling **multi-sectoral service hubs** in addition to manufacturing zones.

Key Government Initiatives in Semiconductor & Electronics Ecosystem:

1. **India Semiconductor Mission (ISM):** Launched in **December 2021**, ISM acts as the **nodal body** for implementing semiconductor and display manufacturing schemes, aiming to build a **globally competitive semiconductor ecosystem**.
2. **Design Linked Incentive (DLI) Scheme:** This scheme provides **financial support and design infrastructure** for semiconductor development, encouraging **home-grown design companies** and startups.
3. **PLI for Large-Scale Electronics Manufacturing:** Introduced in **April 2020**, it offers a **4%–6% incentive** on incremental sales of electronics manufactured in India over a base year.
    - It has attracted major global players like **Apple, Samsung**, and **Foxconn** to expand production in India.
4. **Semiconductor Laboratory (SCL), Mohali:** A key facility under modernization to enhance **R&D, design validation**, and **fabrication capabilities**, supporting the domestic chip ecosystem.

The Road Ahead: India's Tech Manufacturing Aspirations:

With global demand for **semiconductors and electronics** skyrocketing due to advancements in **AI, EVs, and 5G**, India is positioning itself as a **reliable alternative to East Asian hubs**.

- These SEZ reforms will:
    - **Strengthen India's manufacturing competitiveness**
    - Enhance **supply chain resilience**
    - Attract **foreign direct investment** in high-tech industries
    - Enable **integration into global value chains**

India's proactive regulatory reforms combined with focused incentive schemes are turning the country into an **emerging global hub for electronics and semiconductor innovation**.

Did You Know?

- The global semiconductor market is projected to cross **$1 trillion by 2030**, and India aims to capture at least **10% of this market** through domestic production and export.
- India currently imports over **90% of its semiconductors**—hence domestic manufacturing is not just an economic opportunity, but a **strategic necessity**.

Conclusion:

The **latest reforms in SEZ rules** reflect a forward-looking approach by the government to **align regulatory frameworks** with evolving global technology demands. By **easing land requirements**, **simplifying processes**, and **incentivizing exports**, India is laying the groundwork to become a **semiconductor and electronics manufacturing powerhouse** in the coming decade.

GS Paper 3 – Environment & Ecology

Indravati National Park: A Vital Wildlife Sanctuary Amidst Rising Security Concerns

Context: Indravati National Park, located in **Chhattisgarh's Bijapur district**, has recently been in the news due to **anti-Naxal operations** being conducted by **security forces** in and around the park area. Given its **dense forest cover and remote terrain**, the region has long been a strategic location for insurgent groups. Authorities are now stepping up surveillance and action to ensure the park's **ecological safety and public security**.

An Overview of Indravati National Park:

Declared a **Tiger Reserve in 1983** under India's prestigious **Project Tiger**, **Indravati National Park** stands as one of the most significant wildlife conservation areas in **central India**. Named after the **Indravati River**, which flows east to west and marks the park's **northern boundary with Maharashtra**, this park is a **biodiversity hotspot** and a critical corridor in India's central tiger landscape.

Geographical and Ecological Features:

- **Location**: Situated in **Bijapur district**, Chhattisgarh
- **Altitude**: The park features **undulating hilly terrain**, with elevation ranging between **177 m to 599 m** above sea level.
- **Connectivity**: It is part of a larger network of tiger habitats, with ecological links to:
  - **Kawal Tiger Reserve** (Telangana)
  - **Tadoba-Andhari Tiger Reserve** (Maharashtra)
  - **Kanha Tiger Reserve** (Madhya Pradesh)

This strategic connectivity makes Indravati crucial for the **migration and genetic flow** of large carnivores like tigers and leopards.

Vegetation and Forest Types:

The national park is covered primarily by **deciduous forests**, categorized into three main types:

1. **Moist Mixed Deciduous Forest with Teak**
2. **Moist Mixed Deciduous Forest without Teak**
3. **Southern Dry Mixed Deciduous Forest**

Flora: A Diverse Botanical Landscape

Indravati boasts a **rich floral diversity**, including several **economically and ecologically valuable species**, such as:

- **Teak**, **Shisham**, **Semal**, **Achar**, **Kullu**, **Arjun**, **Haldu**, **Bel**, and **Jamun**

These species form the backbone of the park's ecological stability and provide habitat and nutrition to a wide variety of wildlife.

Fauna: A Haven for Endangered Species

Indravati is one of the few remaining habitats of the **rare and endangered wild buffalo (Bubalus arnee)**, making its conservation even more critical. The park also shelters a vibrant array of other wildlife:

- **Large Herbivores**: **Sambar**, **Chital**, **Nilgai**, **Gaur**, **Blackbuck**

- **Carnivores**: **Tiger**, **Leopard**, **Sloth Bear**
- **Other Species**: Jungle cats, hyenas, porcupines, and numerous reptiles and bird species

Its role as a **tiger reserve** also adds to its national and international importance in wildlife conservation.

Did You Know?

- **Indravati National Park** is one of the few protected areas in **India's Red Corridor**, which faces challenges from **left-wing extremism**.
- The **wild water buffalo**, found here, is **listed as Endangered on the IUCN Red List**, and India houses about **95% of the global population**—with Indravati being a vital habitat.

Conclusion:

Despite the recent challenges from insurgent activities, **Indravati National Park remains a treasure trove of biodiversity**, offering a crucial sanctuary for some of India's most endangered wildlife. Strengthening **conservation efforts**, improving **security infrastructure**, and promoting **eco-tourism** can collectively ensure that this **ecological jewel** continues to thrive while also contributing to the well-being of local communities and national environmental goals.

GS Paper 3 – Environment and Ecology, Infrastructure

Ken-Betwa River Linking Project: Development at the Cost of Ecology?

Context: The ambitious **Ken-Betwa River Link Project** has recently come under scrutiny, as **experts and conservationists** have raised serious concerns about its **impact on the Panna Tiger Reserve** in **Madhya Pradesh**. Ongoing construction activities—particularly in **Phase I** of the project—are feared to cause **severe habitat loss** and disruption to the region's **delicate wildlife ecosystem**.

What is the Ken-Betwa Link Project?

The **Ken-Betwa Link Project** is India's **first river interlinking initiative**, aimed at **transferring surplus water** from the **Ken River** in Madhya Pradesh to the **water-deficient Betwa basin** in Uttar Pradesh. Both rivers are **tributaries of the Yamuna**, and the project is designed to tackle **chronic water shortages** in the **Bundelkhand region**, one of India's most drought-prone areas.

Project Highlights: Bridging Rivers for Regional Growth

Phase I: Daudhan Dam and Canal System

- **Daudhan Dam**: A **77-meter-high** dam being constructed in the Panna region of Madhya Pradesh.
- **Canal Network**: A **221 km long canal**, including a **2 km tunnel**, will divert water from Ken to Betwa.
- **Power Generation**: The project is expected to produce **103 MW of hydropower** and **27 MW of solar energy**, aiding the regional energy supply.
- **Water Distribution**: Utilizes **4,543.52 MCM** of water, benefitting:
    - **Madhya Pradesh**: **2,350 MCM**
    - **Uttar Pradesh**: **1,700 MCM**
- **Usage**: The water will support **irrigation, drinking water**, and **industrial needs**, boosting agricultural and urban development in the region.

Phase II: Expanding Water Infrastructure

- Involves the construction of the **Lower Orr Dam**, **Kotha Barrage**, and the **Bina Complex Projects**.
- These additions aim to **further enhance water storage and distribution** capabilities, increasing overall project efficiency.

Ecological Concerns: A Threat to Panna's Wildlife

One of the **most contentious issues** surrounding the project is the **submergence of nearly 6,000 hectares** of the **core zone of Panna Tiger Reserve**, a critical habitat for **tigers, leopards, vultures**, and numerous **endemic and migratory species**.

- **Impact on Wildlife**:
    - Fragmentation of **tiger corridors**
    - Disruption to **nesting and breeding grounds**
    - Threat to the population of **vultures**, **gharial**, and **sloth bears**

- Conservationists argue that such loss **defeats the purpose of wildlife protection** under **Project Tiger**, under which Panna was revitalized after its tiger population had nearly vanished a decade ago.

The Development–Conservation Dilemma:

While the **Ken-Betwa Project** promises **agricultural prosperity**, **water security**, and **clean energy**, it also poses a **serious environmental trade-off**. The **fragile biodiversity** of the **Vindhya landscape**—home to rare and endangered flora and fauna—is at risk of irreversible damage.

Efforts to **mitigate the ecological impact**, such as proposing **compensatory afforestation** and **wildlife relocation**, have faced criticism for being **insufficient** or **ineffective** in replicating the lost natural habitats.

Did You Know?

- The **Ken River** is known for its **crystal-clear water** and runs through the **Raneh Falls Canyon**, a site of geological significance.
- **Panna Tiger Reserve**, once declared tiger-less in 2009, became a global conservation success story with the **reintroduction of tigers** through a scientifically planned translocation program.

Conclusion: Balancing Progress and Preservation

The **Ken-Betwa Link Project** is a powerful symbol of India's efforts to **tackle water scarcity** and **energize regional economies**. However, without **robust environmental safeguards** and **community engagement**, the project risks **undoing years of conservation progress** in one of India's key ecological zones. The need of the hour is a **balanced approach** that allows for **development without compromising biodiversity**—a vision where rivers not only link geographies, but also **sustain ecosystems**.

GS Paper 3 – Environment and Ecology

Spathaspina noohi: A Striking New Beetle Species Discovered in Meghalaya

Context: A fascinating new species of beetle, **Spathaspina noohi**, has recently been discovered in the lush, **biodiversity-rich forests of Meghalaya**, specifically in the **Umran area of Ri Bhoi district** at an altitude of **781 metres**. This discovery adds to the growing list of unique insect species found in India's Northeast, a region known for its ecological richness.

What is Spathaspina noohi?

Spathaspina noohi is a newly identified member of the **weevil family**, scientifically known as **Curculionidae**, which is one of the largest families within the beetle order, encompassing over **60,000 known species** across the globe.

While many weevils are notorious as **agricultural pests**, this newly found species may actually contribute positively to the ecosystem by helping **control invasive plant species** and aiding in **ecological balance**.

Anatomical Marvel: A Spine Like a Sword

What sets **Spathaspina noohi** apart is its **distinctive sword-like spine** protruding from its back. This remarkable and **unusual anatomical feature** prompted researchers to place the beetle in an entirely **new genus** within the subfamily **Ceutorhynchinae**.

- The name **Spathaspina** is derived from Latin:
  - **"Spatha"** meaning *sword*
  - **"Spina"** meaning *spine*

This new genus highlights the **morphological uniqueness** of the species and underlines the **rich evolutionary adaptations** present in forest ecosystems like those of Meghalaya.

About the Ceutorhynchinae Subfamily:

- The subfamily **Ceutorhynchinae** includes just over **1,300 species** globally.
- They are absent from **New Zealand, Oceania, Antarctica**, and **southern South America** (below central Argentina and Chile).
- The **Palaearctic Region** (including Europe, North Africa, and parts of Asia) harbors the **highest diversity**, followed by the **Oriental Region** (South and Southeast Asia).

Key Features of Ceutorhynchinae Beetles:

- **Compact and sturdy bodies**
- A snout (**rostrum**) that can be tucked between their front legs while resting
- Visibility of the **mesanepimera** (a part of the thorax) from the back—though this is absent in some genera like **Cyphosenus** and **Ceutorhynchoides**

Why It Matters: Conservation and Discovery

The discovery of **Spathaspina noohi** serves as a reminder of the **untapped biodiversity** of India's northeastern forests. It also underscores the need for:

- **Continued exploration and documentation** of forest fauna
- **Conservation of native habitats** under threat from deforestation and human activity
- Recognizing the **ecological roles** of lesser-known species in maintaining forest health

Did You Know?

- **Weevils** make up nearly **10% of all described beetle species**.
- Some weevils are used in **biological control programs** to manage invasive plant species without the use of harmful pesticides.
- Meghalaya is part of the **Indo-Burma Biodiversity Hotspot**, one of the **world's 36 recognized hotspots**, known for its **high species richness and endemism**.

Conclusion: Nature's Tiny Warrior with a Spine of Steel

The identification of **Spathaspina noohi** not only adds a new chapter to India's entomological records but also highlights the **importance of preserving forest ecosystems**. Each discovery like this reaffirms that the natural world still holds **many secrets waiting to be unveiled**, especially in **less-explored regions** like Meghalaya.

Shubhanshu Shukla's Axiom-4 Mission: India's Bold Step Toward Human Spaceflight

Context: Indian astronaut Shubhanshu Shukla is preparing to launch aboard the **Axiom-4 mission** to the **International Space Station (ISS)**—a momentous development that significantly advances **India's ambitions in human space exploration**. While this is not a mission led by ISRO, it is **deeply connected** to India's upcoming **Gaganyaan human spaceflight programme**, offering **valuable real-time insights and experience**.

Shukla's flight reflects India's growing footprint in space, following high-profile missions like **Chandrayaan-3**, and demonstrates that **India is readying itself for crewed missions and beyond**.

From Rakesh Sharma to Shubhanshu Shukla: A Generational Leap

When **Rakesh Sharma** flew to space in **1984** aboard a Soviet spacecraft, it was a symbolic milestone. At that time, **India's space programme** was in its infancy, and there was no long-term vision for sustained human space exploration.

Today, the scenario is vastly different:

- **Shubhanshu Shukla's Axiom-4 mission** marks a transition from symbolic spaceflight to **strategic space exploration**, at a time when **ISRO** is executing **complex, high-precision missions** and planning for sustained human presence in space.

Gaganyaan Mission: A Giant Leap for ISRO

- **Gaganyaan**, India's first indigenous human spaceflight mission, was initially planned for **2022** but has faced delays due to its complexity. Unlike robotic missions, crewed spaceflight demands **extreme safety protocols**, **life-support systems**, and **advanced astronaut training**.

Shukla's participation in **Axiom-4** provides **critical operational experience**, helping ISRO refine its approach for Gaganyaan and future missions.

Why Shubhanshu Shukla's Role Matters:

As the **pilot** of the Axiom-4 mission, Shukla will gain **first-hand knowledge** in:

- **Orbital navigation**
- **Real-time decision-making**
- **Spacecraft operations**
- **Life aboard a space station**

Currently, only **Rakesh Sharma** has such experience—but with outdated technology. **Shukla's insights will be based on modern systems**, providing ISRO with relevant feedback for Gaganyaan and beyond.

First Indian Astronaut on the International Space Station:

Shukla will also become the **first Indian to set foot on the ISS**. This is a historic moment, as it:

- **Builds foundational knowledge** for India's future **space station plans**
- Offers an **inside view of international space collaboration**
- Helps India understand the dynamics of **long-duration space stays**

This experience will be pivotal for India's long-term goal of establishing an **independent space station by 2035** and a **human Moon mission by 2040**.

India's First Tailored Space Experiments in Orbit:

- The Axiom-4 mission also offers **ISRO a first-time opportunity** to conduct **customised experiments aboard a space station**, focused on Indian needs.

Zero-Gravity Muscle Study:

- One biological experiment investigates **muscle deterioration in microgravity**, aiming to unlock new insights into **human health and aging**—both in space and on Earth.

Space Agriculture Research:

Experiments involving **moong dal sprouts** and **microalgae** are being conducted to explore **space farming and food sustainability**. This is vital for:

- **Long-term space missions**
- **Future lunar or Martian bases**
- Enhancing food production technologies on Earth

Laying the Groundwork for India's Space Future:

Shukla's mission is more than a personal milestone—it lays a foundation for India's **institutional knowledge base** in crewed space missions. Countries with mature space programs have **astronauts who mentor future crews**, helping refine **training, mission planning**, and **system design**.

India's Vision: Space Economy and Global Leadership

Expanding the Space Ecosystem:

India is building a vibrant space ecosystem that combines:

- **Government research** (led by ISRO)
- **Private sector innovation**
- **Startup participation and global collaboration**

This will reduce costs, foster **cutting-edge innovation**, and **accelerate technology development**.

Tapping into the $1 Trillion Opportunity:

The **global space economy** is valued at around **$500 billion**, expected to double by **2030**. India currently holds just **2%** of this market, with a vision to expand its share to **10%**, unlocking **economic and strategic benefits**.

Inspiring the Next Generation:

Just as Rakesh Sharma inspired a generation in 1984, **Shubhanshu Shukla's journey** will ignite the imagination of **millions of young Indians**. With increased accessibility to science, education, and space technology, **today's youth can dream of becoming astronauts, scientists, and space entrepreneurs**—not just in imagination, but in reality.

Conclusion: A Bold Chapter in India's Space Saga

The **Axiom-4 mission** is not just a spaceflight; it is a **strategic investment in India's human spaceflight future**. From aiding Gaganyaan to strengthening ISRO's vision for a space station, **Shubhanshu Shukla's mission represents a leap forward** in capability, ambition, and global positioning. As India charts its path to the **Moon and beyond**, this moment will be remembered as a **critical turning point** in its journey to the stars.

GS Paper 3 – Economy

India's Insolvency and Bankruptcy Code: Striking the Right Balance Between Resolution and Recovery

Context: Over the past **eight years**, India's **Insolvency and Bankruptcy Code (IBC)** has emerged as a cornerstone of the country's credit and resolution ecosystem. Enacted in **2016**, the IBC was introduced to tackle the **growing burden of Non-Performing Assets (NPAs)** and to replace ineffective debt recovery mechanisms with a more **streamlined, time-bound** framework.

Today, the IBC stands not just as a legal tool, but as a **strategic enabler of business continuity, credit discipline**, and **financial ecosystem stability**.

IBC at a Glance: Core Objectives

The IBC was envisioned to deliver on multiple fronts:

- **Revival of Viable Businesses**: By enabling restructuring, new ownership, or strategic mergers.
- **Maximization of Asset Value**: To ensure assets are not eroded during long insolvency delays.
- **Promotion of Credit Culture**: By balancing the rights and interests of **creditors, debtors, employees**, and other stakeholders.
- **Time-Bound Resolution**: With a statutory cap of **330 days** for completing the Corporate Insolvency Resolution Process (CIRP), failing which, **liquidation** is initiated.

The Resolution Process: A Step-by-Step Mechanism

1. **Initiation**: Creditors (financial or operational) or the debtor itself can file an application before the **National Company Law Tribunal (NCLT)**.
2. **Interim Management**: Upon admission, an **Interim Resolution Professional (IRP)** takes over, and a **moratorium** is imposed on all legal and recovery actions.
3. **Claims and Creditors' Committee**: The IRP verifies claims and forms the **Committee of Creditors (CoC)**, composed primarily of financial creditors.
4. **Resolution Planning**: A **Resolution Professional (RP)**—either the IRP or a newly appointed one—invites and evaluates resolution plans.
5. **Approval**: A resolution plan must be approved by **at least 66% of the CoC**, and then confirmed by the NCLT to become binding.
6. **Liquidation**: If no viable plan is approved within 330 days, **liquidation proceedings** begin.

Key Outcomes: What Has the IBC Achieved?

- **Global Recognition**: India's **Ease of Doing Business** ranking in **"Resolving Insolvency"** improved from **136 (2016)** to **52 (2020)**, according to the World Bank.
- **Major Share of Recoveries**: As per the **RBI's Trend and Progress of Banking in India 2024**, the IBC framework accounted for **48%** of total recoveries by banks in **FY 2023–24**.
- **Market Discipline**: The IBC has introduced **accountability**, making borrowers more cautious and ensuring better credit behavior.

Persistent Challenges: Areas That Need Attention

Despite the achievements, the IBC faces multiple bottlenecks:

- **Judicial Delays**: As of **March 31, 2025**, nearly **78%** of CIRP cases exceeded **270 days**, despite the 330-day ceiling. These delays often persist even after CoC approval.

- **Judicial Overreach**: Cases like **Bhushan Power and Steel** highlight how post-resolution litigation has discouraged resolution applicants and impacted investor confidence.
- **High Haircuts**: Creditors, on average, have recovered just **33%** of their admitted claims—an average haircut of **67%**, leading to questions about the **economic efficiency** of resolutions.
- **Capacity Issues**: The **NCLT and NCLAT** are plagued with **manpower shortages** and **infrastructure constraints**, causing procedural bottlenecks.
- **Modern Enterprise Gaps**: The current IBC does not effectively address complexities like **intellectual property rights**, **employee stock ownership plans**, or **technology-dependent businesses**.

Looking Ahead: Reforms to Strengthen IBC

To enhance the effectiveness of the IBC and reduce delays, the following reforms are crucial:

- **Infrastructure Expansion**: Increase **NCLT benches**, improve digital case management, and recruit more **judicial and technical members**.
- **Pre-Pack Insolvency for MSMEs**: A wider rollout of **pre-packaged insolvency schemes** can help resolve cases more efficiently, especially for **Micro, Small, and Medium Enterprises (MSMEs)**.
- **Institutional Clarity**: Define roles and responsibilities more clearly between **regulatory bodies**, **tribunals**, and **resolution professionals**.
- **Valuation Framework**: Develop guidelines for the **valuation of intangible assets**, like data and software, in knowledge-based industries.

Global Comparison: Where India Stands

Countries like **Singapore** and **the UK** have resolution processes that offer **pre-packaged insolvency** and **out-of-court settlements**, significantly reducing time and costs. India's IBC needs to evolve towards such **hybrid models**, combining **speed, value maximization**, and **stakeholder fairness**.

Final Thoughts:

India's **Insolvency and Bankruptcy Code** has laid a strong foundation for **creditor empowerment** and **corporate accountability**. However, to fulfill its true potential, it must now focus on **speed, adaptability**, and **capacity-building**. Striking the **right balance between resolution and recovery** is not just about numbers—it's about creating a **sustainable, trustworthy, and forward-looking** insolvency ecosystem.

GS Paper 3 – Environment & Ecology

Blue NDC Challenge: Pioneering Ocean-Centric Climate Action

Context: In a significant move towards sustainable ocean governance, **France and Brazil** have jointly launched the **Blue Nationally Determined Contributions (Blue NDC) Challenge**—an international call to integrate **ocean-based solutions** into global climate commitments. The initiative was unveiled ahead of the **30th UN Climate Conference (COP30)**, scheduled to be held in **Belem, Brazil**, a region rich in marine and coastal ecosystems.

What is the Blue NDC Challenge?

The **Blue NDC Challenge** encourages countries to explicitly include **marine and coastal ecosystem protection, ocean-based mitigation and adaptation strategies** within their **Nationally Determined Contributions (NDCs)**—the national climate action plans under the **Paris Agreement**.

Supported by leading organizations such as:

- **Ocean Conservancy**
- **World Resources Institute (WRI)** through **Ocean Resilience and Climate Alliance (ORCA)**
- **WWF-Brazil**
- **Ocean & Climate Platform**

The initiative seeks to **mainstream the ocean's role** in climate action and policy-making.

Why Oceans Matter in Climate Action:

Oceans are **critical allies** in the fight against climate change. Their importance is manifold:

- **Natural Carbon Sinks**: Oceans absorb around **25% of global CO_2 emissions** and **90% of the excess heat**, effectively buffering the impacts of climate change.
- **Blue Carbon Ecosystems**: Coastal habitats such as **mangroves, seagrasses, and salt marshes** store carbon **up to five times more efficiently than terrestrial forests**.
- **Biodiversity Hotspots**: Oceans host more than **two million marine species**, playing a vital role in ecosystem resilience and planetary health.
- **Economic & Social Lifeline**: Over **3 billion people globally** rely on oceans for food, livelihoods, and economic development—particularly in **Small Island Developing States (SIDS)** and **coastal communities**.

Existing Global Efforts in Ocean Conservation:

The Blue NDC Challenge aligns with several ongoing global marine conservation efforts:

- **The Ocean Cleanup (2013)**: A non-profit initiative developing advanced technologies to remove plastic from oceans and rivers.
- **UN Decade of Ocean Science for Sustainable Development (2021–2030)**: An effort to harness ocean science for sustainable ocean governance and climate resilience.
- **High Seas Treaty (2023)**: Also known as the **BBNJ Agreement**, it is the first legally binding treaty to conserve marine biodiversity in international waters.
- **Blue Carbon Initiatives**: Focused on enhancing carbon capture through coastal ecosystems.

- **National Marine Protected Areas (MPAs)**: Countries are increasingly establishing **MPA networks** to safeguard critical marine habitats.
- **Integrated Coastal Zone Management (ICZM)**: A holistic approach to managing coastal areas, addressing challenges like erosion, overfishing, habitat loss, and pollution.

Barriers to Effective Implementation:

While ocean-based solutions offer immense potential, several **hurdles** remain:

- **Funding Shortages**: Many developing and island nations **lack access to adequate climate finance** for implementing large-scale marine conservation.
- **Scientific and Technical Gaps**: Effective ocean governance requires **cutting-edge research**, **data collection**, and **technology**—resources that are often lacking.
- **Policy Fragmentation**: Many nations still lack **integrated marine policies**, making cross-sectoral coordination difficult.
- **Limited Local Capacity**: Coastal communities need **capacity building and institutional support** to implement sustainable ocean solutions on the ground.

The Road Ahead: Embedding the Ocean in Climate Policy

The Blue NDC Challenge presents an **urgent opportunity** to reshape global climate efforts by recognizing the **ocean not just as a victim**, but also as a **solution provider**.

By integrating **marine conservation**, **coastal restoration**, and **blue carbon strategies** into climate plans, countries can:

- Enhance their **mitigation and adaptation potential**
- Protect marine biodiversity
- Strengthen coastal resilience
- Support millions of livelihoods globally

A Call to Action:

As the world prepares for **COP30**, the Blue NDC Challenge calls on all nations to act decisively. Embedding ocean priorities in NDCs is not just an environmental imperative—it is a **moral, economic, and planetary responsibility**.

GS Paper 3 – Science & Technology

Shahed Drones: Iran's Lethal Loitering Weapons in Modern Warfare

Context: Shahed drones, developed by **Iran's Shahed Aviation Industries**, have emerged as a significant force in contemporary warfare. These **unmanned aerial vehicles (UAVs)**, particularly the **Shahed-136**, are widely deployed for **surveillance and precision strikes**, most notably by **Russia in the Ukraine conflict**. Their use represents a shift toward **low-cost, high-impact warfare** in the modern battlefield.

Design and Tactical Role:

The **Shahed series**, especially the **Shahed-136**, falls under the category of **loitering munitions**—commonly known as **"kamikaze drones"**. Unlike traditional UAVs that return after surveillance, these drones are built for **one-way missions**, detonating their warhead on impact with the target.

- **Aerodynamics**: The Shahed-136 features a **delta-wing configuration**, offering better stability and longer endurance in flight.
- **Dimensions**: It weighs approximately **200 kilograms** and spans **2.5 to 3 meters** in wingspan.
- **Alias**: When deployed by Russia, the Shahed-136 is renamed **Geran-2**, often used to mask its Iranian origin.

Performance and Propulsion:

These drones are engineered for **long-range and endurance-based operations**:

- **Range**: Capable of flying between **1,000 and 2,500 kilometers**, they can strike deep into enemy territory with minimal detection.
- **Speed**: Operates at a speed of around **185 km/h**.
- **Launch System**: Deployed using **disposable rocket-assisted launchers**, after which a **piston engine** takes over—producing the now-infamous **"moped-like" buzzing sound** during flight.

Advanced Navigation and Guidance Systems:

- **Navigation**: The drones rely on **pre-programmed GPS or Russia's GLONASS** navigation systems, allowing them to maintain their trajectory even in **electronically jammed environments**.
- **Next-Gen Upgrades**: Recent versions are believed to be equipped with **AI-powered targeting systems** and **adaptive flight algorithms**, enhancing their ability to avoid detection and strike with precision.

Warhead Versatility and Combat Impact:

Shahed drones can be fitted with a **range of warhead types**, designed for **maximum lethality**:

- **High-Explosive Fragmentation**: Causes widespread damage over large areas.
- **Thermobaric Warheads**: Create high-temperature, high-pressure blasts ideal for enclosed environments.
- **Shrapnel-Filled Payloads**: Designed to injure or kill personnel and damage unarmored vehicles and infrastructure.

These payloads make the Shahed drones particularly effective against **command posts, radar stations, artillery units**, and **civilian infrastructure**—contributing to their controversial use in conflict zones.

Strategic and Global Implications:

The deployment of Shahed drones has **reshaped the dynamics of warfare** in Ukraine and beyond. Their **low cost, ease of mass production**, and **ability to bypass traditional air defenses** make them an attractive tool for nations seeking **asymmetric advantages**.

Estimated cost per Shahed-136 drone: Between **$20,000 and $50,000**—a fraction of the cost of traditional missiles or combat aircraft.

This affordability allows **saturation attacks**, where multiple drones are launched simultaneously to overwhelm defense systems.

Final Thoughts:

The **Shahed drone program** illustrates how relatively inexpensive UAV technology can **transform military tactics**, providing **non-superpower nations** with a means to challenge superior air forces and carry out long-range strikes. As these drones evolve with **enhanced AI, stealth features, and precision targeting**, their role in future conflicts is expected to expand even further.

GS Paper 1 – Geography

Gangotri National Park: A Himalayan Sanctuary Under Ecological Scrutiny

Context: Nestled in the breathtaking heights of the **Uttarkashi district in Uttarakhand**, **Gangotri National Park** is one of **India's most pristine high-altitude conservation areas**, renowned for its **majestic glaciers**, sacred rivers, and **rich Himalayan biodiversity**. Spanning an area of over **2,390 sq km**, it is a vital ecological zone and a sacred pilgrimage route.

Latest Concern: Waste Incinerator Sparks Environmental Alarm

In a recent development, **residents of Uttarkashi** have raised concerns over the installation of a **waste incinerator** within the **Gangotri National Park**, situated inside the **Bhagirathi Eco-Sensitive Zone**. The locals have appealed to the **Union government**, fearing that such a project may pose serious threats to the **fragile alpine ecosystems and glacial purity** of the region.

Geographical Significance:

- **Location**: Lies along the **upper catchment of the Bhagirathi River**, which is one of the **main tributaries of the Ganges**.
- **International Border**: The **northeastern boundary** of the park shares a frontier with **Tibet (China)**, making it of **strategic importance** as well.
- **Adjacent Protected Areas**: Gangotri National Park is flanked by **Kedarnath Wildlife Sanctuary** and **Govind National Park**, forming a continuous biodiversity corridor.

Glacial Heritage and Sacred Origins:

The park is home to the **famous Gangotri Glacier**, a **primary source of the River Ganga**, and a revered site in **Hindu mythology**. Originating from **Gaumukh**, this glacier is a focal point for spiritual seekers and scientists alike.

The **Garhwal Himalayas' Gangotri Group**, a subrange of the **eastern Himalayas**, dominates the landscape with snow-covered **towering peaks** such as:

- **Chaukhamba I, II, III**
- **Satopanth**
- **Kedarnath Main**

These icy sentinels not only offer stunning views but also support complex **alpine ecosystems** and **glacial hydrology**.

Diverse Ecosystems and Unique Biodiversity:

Gangotri National Park boasts a **rich array of flora and fauna**, adapted to its **elevated and rugged terrain**:

Flora:

- **Western Himalayan subalpine conifer forests** dominate the lower regions, featuring:
  - **Fir**, **deodar**, **oak**, **spruce**, and **rhododendrons**
- At higher altitudes, **alpine meadows** and **shrubs** take over, thriving in the **cold, wind-swept environments** below glacial zones.

Fauna:

The park shelters several **rare and endangered Himalayan species**, including:

- **Snow leopard** – the elusive apex predator of the Himalayas
- **Brown bear** and **Asian black bear**
- **Blue sheep (Bharal)** and **Himalayan tahr**
- **Musk deer** – prized for its musk gland, and **listed under CITES Appendix I**

These species rely on the park's **undisturbed habitat corridors** and **seasonal migration paths** for survival.

Conservation Challenges:

While the park is designated as a **highly protected area**, the rise in **tourism, infrastructure development**, and now, **waste disposal systems** threatens its ecological integrity. The proposed **waste incinerator project** has heightened fears of:

- **Air and soil pollution**
- Contamination of **glacial meltwater** feeding into the Ganga
- Disruption to **wildlife movement** and **breeding patterns**

Experts and conservationists stress the importance of adopting **eco-sensitive waste management practices** rather than industrial solutions in such **fragile ecosystems**.

Conclusion: A Call for Sustainable Stewardship

Gangotri National Park is not only a **biodiversity hotspot**, but also a **spiritual and ecological lifeline** for millions downstream. Protecting its **purity and sustainability** is critical—not just for **Himalayan species**, but for the **water security of northern India**.

Heeng (Asafoetida): From Imports to Indigenous Cultivation in India

Context: In a significant breakthrough, scientists at **CSIR-Institute of Himalayan Bioresource Technology (IHBT), Palampur**, have successfully reported the **first flowering and seed setting of Heeng (Ferula assa-foetida)** in Indian soil. This achievement marks a major step toward making India **self-reliant in asafoetida production**, ending centuries of dependence on imports from Central Asia.

What is Heeng?

Heeng, or **asafoetida**, is a **perennial herbaceous plant** belonging to the **Apiaceae family**. Renowned for its **pungent aroma** and **culinary flavoring properties**, it also holds immense value in **Ayurveda and traditional medicine** for its **anti-flatulent, antimicrobial, and anti-inflammatory** properties.

- The plant typically takes **five years** to reach maturity and start flowering.
- It is native to the **cold, dry highlands of Iran, Afghanistan, and Central Asia**.

Ideal Growing Conditions for Heeng:

The cultivation of Heeng demands a **unique set of climatic and soil conditions**, most commonly found in **cold desert regions**:

- **Soil**: Prefers **well-drained, sandy soil** with **low moisture content**.
- **Rainfall**: Optimal annual precipitation is **below 200 mm**, though it can adapt to **up to 300 mm** in Himalayan cultivation areas.
- **Temperature**: Grows well in **cool climates** ranging from **10°C to 20°C**, but can endure extremes from **–4°C to 40°C**.
- In **harsh winters**, the plant becomes **dormant**, which is part of its natural growth cycle.

How Asafoetida is Extracted:

The prized product—**asafoetida resin**—is obtained from the plant's **thick taproot and rhizome**, which are rich in **oleo-gum resin**:

- **Incisions** are made in the root to allow the **milky latex** to exude.
- The latex **dries and hardens** into a **resinous mass**, which is then **processed into powder or crystal form**.
- This resin contains about **40–64% of the total dry gum**, making it highly potent.

Heeng Cultivation in India: From Potential to Practice

Historically, **India has been the largest consumer of Heeng**, yet **100% of its supply was imported**—primarily from **Afghanistan, Iran, and Uzbekistan**.

- Although around **130 species of the Ferula genus** are found worldwide, only **Ferula assa-foetida** yields **true asafoetida**.
- In India, related species like **Ferula jaeschkeana** (found in Himachal Pradesh) and **Ferula narthex** (from Kashmir and Ladakh) **do not produce the oleo-gum resin** needed for commercial use.

This makes the **introduction and cultivation of Ferula assa-foetida** in India all the more critical. With **support from CSIR and ICAR**, experimental plantations in regions like **Lahaul-Spiti, Palampur, and Leh** have shown promising results.

Why This Matters:

- **Reduces import dependency**, saving **foreign exchange**.
- Encourages **agro-diversification** in high-altitude regions.
- Creates **income opportunities for Himalayan farmers**.
- Supports the **Make in India** and **Atmanirbhar Bharat** initiatives.

Final Thoughts:

The success of Heeng cultivation in India is a **game-changer**. With the right **research, climate adaptation, and farmer engagement**, India is poised to become **not just a consumer but a producer** of this globally valued spice and medicinal resin.

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

India's Declining Fertility Rate: A New Demographic Reality with Far-Reaching Implications

Context: According to the **United Nations Population Fund (UNFPA) 2025 report – State of World Population**, **India's fertility rate has declined to 1.9**, falling **below the replacement level of 2.1**. This marks a historic demographic shift, as India transitions from a high-fertility country to one experiencing sustained fertility decline.

Despite this, India continues to be the **world's most populous country**, with an **estimated population of 146.39 crore as of April 2025**. Population projections suggest India will peak at around **170 crore** over the next 40 years before entering a gradual decline phase.

A Journey from Six to Two: India's Demographic Transformation

In 1960, an average Indian woman had **six children**. Fast forward to today, improved **access to reproductive healthcare**, **greater female education**, and **empowerment initiatives** have reduced this dramatically.

Unlike coercive population control strategies seen in some countries, India's fertility reduction is seen as a **voluntary, organic transition** fueled by **public awareness campaigns** and **supportive policy measures**.

According to **NFHS-5 (National Family Health Survey)** data:

- The national fertility rate in 2022 stood at **2.0**
- Urban areas: **1.6**
- Rural areas: **2.1**

However, some states continue to report **above-average fertility**:

- **Bihar**: 2.98
- **Meghalaya**: 2.9
- **Uttar Pradesh**: 2.35
- **Jharkhand**: 2.26
- **Manipur**: 2.2

Economic Pressures Shaping Parenthood Choices:

The UNFPA report highlights that **economic insecurity** is a leading factor in family planning decisions:

- **38%** of Indians cited **financial strain**
- **21%** mentioned **job insecurity or unemployment**

This mirrors a **global trend**, where **39% of respondents** across 14 countries reported the same concern.

Interestingly, a gap has emerged between the **ideal family size** and the **expected reality**:

- **41% of women** in India say **two children** is ideal
- **7% of respondents** under 50 expect to have **fewer children** than ideal due to financial and social pressures

Evolving Social Norms and Family Dynamics:

Beyond economics, **social factors and personal relationships** are also influencing fertility rates:

- **19%** of respondents said their **partner preferred fewer children**

- **15%** cited **lack of domestic support** in childcare and housework
- **14%** said **health professionals pressured them** into limiting family size

These responses point to an emerging concern: the **erosion of reproductive autonomy**—where personal preferences are shaped or constrained by external influences, including institutional practices.

Demographic Dividend: A Window That Won't Stay Open Forever

India currently benefits from a large **working-age population (15–64 years)**—approximately **68%** of its total population. This **demographic dividend** provides an opportunity for **sustained economic growth**—but only if it is backed by **robust investments** in employment, healthcare, and education.

Meanwhile, **India's ageing population is steadily growing**:

- **Life expectancy**: 71 years (men), 74 years (women)
- **Current elderly population**: 7%
- Expected to **rise significantly** in the coming decades

The **burden of elderly care**, along with **declining fertility**, demands long-term planning in **social security, healthcare infrastructure, and retirement systems**.

The Real Issue: Fertility Intentions, Not Just Fertility Rates

The UNFPA warns that the **true crisis is not overpopulation or underpopulation**, but the **inability of individuals to achieve their desired fertility**. The focus must shift from controlling numbers to **protecting reproductive rights** and **enabling informed, supported choices** about family life.

This rights-based perspective emphasizes:

- **Reproductive agency**
- **Access to contraception and fertility counselling**
- **Support for women and couples to balance work and family**

Policy Priorities for a Changing India:

To navigate its demographic shift effectively, India must **recalibrate its population policies** toward a **people-first, rights-based approach**. Critical policy directions include:

- Promoting **women's participation** in the workforce
- Expanding **childcare and eldercare support systems**
- Reforming **workplace norms** to ease the economic pressure of parenting
- Ensuring **universal access to quality reproductive healthcare**

The much-awaited **2027 Census**, postponed from 2021, will be essential in understanding these evolving trends and crafting informed responses.

Conclusion: From Numbers to Choices

India is entering a **new demographic era**—marked by **lower fertility**, an **ageing population**, and **shifting social dynamics**. Rather than a cause for alarm, this moment offers an opportunity to build a **future centered on empowerment, equality, and sustainability**.

GS Paper 3 – Governance, Constitution, Polity, Social Justice

Surge in Juvenile Violence in India: A Growing Concern

Context: While **overall juvenile crime in India has declined**, a disturbing **surge in violent acts** committed by minors has come to light. According to **NCRB data (2023)**, the number of juveniles in conflict with the law dropped from **37,402 in 2017 to 33,261 in 2022**, but the **share of violent offences** rose significantly—from **32.5% in 2016 to 49.5% in 2022**.

Nature and Spread of Violent Juvenile Offences:

These violent crimes include **murder, rape, grievous hurt, robbery, arson, assault, and dacoity**, and do not cover non-violent acts such as theft or fraud.

Key insights from the regional data:

- **Madhya Pradesh** leads with **20%** of such crimes (2017–2022)
- Followed by **Maharashtra (18%)**, **Rajasthan (9.6%)**, **Chhattisgarh (8.4%)**, **Delhi (6.8%)**, and **Tamil Nadu (5%)**
- **Central and Eastern India** are emerging as **hotbeds of juvenile violence**, while states like **Odisha** record only **10% violent juvenile crimes**, showing regional disparity

Underlying Causes of Rising Juvenile Violence:

The spike in brutal crimes by adolescents is rooted in **complex socio-economic and psychological factors**:

- **Digital overexposure**: Young minds are being shaped by **violent online content**, including **incel ideologies**, **cyberbullying**, and **online extremism**
- **Social media misuse**: Leads to **emotional desensitisation**, imitation of violent acts, and poor impulse control
- **Neglect and broken families**: Lack of **parental support** and **guidance** during critical developmental years creates emotional voids
- **Poverty and unemployment**: Absence of **educational and vocational opportunities** for youth in marginalized areas pushes them towards **gang culture**
- **Substance abuse**: Easy access to **alcohol, drugs, and inhalants** fuels aggressive and impulsive behaviour among teens

Government Measures: Progress and Pitfalls

Several initiatives have been introduced, yet their implementation remains **patchy**:

- **Juvenile Justice (Care and Protection of Children) Act, 2015**: Allows juveniles aged **16–18** to be tried as adults for **heinous crimes**, but only after a **preliminary assessment** by the Juvenile Justice Board
- **Integrated Child Protection Scheme (ICPS)**: Aims to provide **preventive and rehabilitative support**, including family counselling and shelter
- **Digital safety drives**: CBSE, NCERT, and the Ministry of Education have launched **awareness campaigns** on **online safety, grooming, and addiction**

Challenges Undermining Juvenile Justice:

Despite strong legislative frameworks, the system faces **critical hurdles**:

- **Underfunded and overburdened** Juvenile Justice Boards and Child Welfare Committees

- Poor **rehabilitation infrastructure** and **lack of mental health professionals**
- **Social stigma** that prevents effective reintegration of reformed juveniles
- **Absence of gender-specific data**, especially regarding **girls involved in or impacted by** juvenile crime

What Needs to Be Done?

A **multi-pronged approach** is required to address the issue:

- **Early intervention in schools**: Introduce **mandatory psychological counselling**, life skills training, and emotional intelligence education
- **Juvenile justice reforms**: Enhance **funding**, infrastructure, and **specialized training** for justice board members
- **Tailored rehabilitation**: Create **individualised care plans**, offering **mental health support**, **vocational training**, and **family reintegration**
- **Community-based strategies**: Engage **local NGOs**, **youth mentors**, and **religious/community leaders** to prevent crime at the grassroots level
- **Restorative justice models**: Focus on **healing and rehabilitation** rather than retribution
- **Digital regulation and literacy**: Introduce **strict age-appropriate content guidelines** and educate teens on **safe online practices**
- **Data-driven policymaking**: Develop **region-wise, age-wise, and gender-disaggregated data** to implement **targeted interventions**

Global Perspective:

India is not alone. Countries like the **United States, Brazil, and South Africa** have also experienced similar surges in violent juvenile crime. However, **Norway and Japan** have succeeded in reducing juvenile violence through strong **rehabilitation models, family support systems**, and **community integration efforts**.

Conclusion:

The **rising tide of juvenile violence in India** signals deeper systemic cracks in our **social, familial, and digital environments**. **Punitive measures alone cannot deter young offenders**—the focus must shift to **prevention, care, and reformation**. Ensuring that **every child receives emotional support, digital awareness, educational opportunities**, and a **path to reintegration** is the only sustainable way to curb this alarming trend.

GS Paper 2 – Health Issue

Understanding Tourette Syndrome: A Neurological Puzzle

Context: Tourette Syndrome (TS) is a **neurodevelopmental disorder** characterized by **sudden, repetitive, and involuntary movements or vocalizations**, known as **tics**. These tics can **vary widely in type, intensity, and frequency**, often creating challenges in daily life, especially in social and academic settings.

The condition **typically begins in childhood**, most often between the ages of **2 and 15**, with an **average onset around 6 years of age**. It affects between **0.3% and 1% of the global population**, and is **three to four times more common in boys** than in girls.

Types of Tics: From Subtle to Severe

Tics seen in Tourette Syndrome are broadly categorized as **motor** and **vocal**, and further divided into **simple** and **complex** types:

- **Simple Motor Tics**: Involve quick, brief movements such as **eye blinking**, **shoulder shrugging**, **facial grimacing**, or **head jerking**
- **Simple Vocal Tics**: Include **throat-clearing**, **sniffing**, **grunting**, or **barking** sounds
- **Complex Motor Tics**: Feature more **coordinated and deliberate actions** like **jumping**, **bending**, or **touching objects repeatedly**
- **Complex Vocal Tics**: May include **repeating others' words (echolalia)**, **repeating one's own words (palilalia)**, or in rare cases, **uttering socially inappropriate words (coprolalia)**

These tics often **intensify with stress, anxiety, or excitement** and tend to **lessen during calm, focused activities**. Interestingly, they **diminish during light sleep** and **disappear during deep sleep**.

A Closer Look at Associated Conditions:

Tourette Syndrome **rarely appears alone**. It often coexists with a range of **other neurodevelopmental or psychiatric disorders**, such as:

- **Attention Deficit Hyperactivity Disorder (ADHD)**
- **Obsessive Compulsive Disorder (OCD)**
- **Anxiety and Depression**
- **Learning Disabilities**
- **Autism Spectrum Disorder (ASD)**

These overlapping conditions can make diagnosis and treatment more complex, requiring **multidisciplinary intervention**.

Is There a Cure?

There is **currently no definitive cure** for Tourette Syndrome, but a combination of **therapies and medication** can help manage symptoms and improve quality of life. Treatment is typically personalized based on the **severity of tics**, their **impact on daily life**, and the presence of **comorbid conditions**.

Common Treatments Include:

- **Cognitive Behavioural Therapy (CBT)**: Especially a specialized form known as **CBIT (Comprehensive Behavioral Intervention for Tics)** has shown **notable effectiveness**

- **Medication**: Such as **antipsychotics**, **alpha-adrenergic agonists**, and **stimulants** in cases with comorbid ADHD
- **Behavioral Therapy**: Helps patients recognize and manage tics
- **Supportive Interventions**: Including **school accommodations**, **family counseling**, and **social skills training**

In rare, severe cases, **deep brain stimulation (DBS)** may be considered, though this is typically reserved for individuals who do not respond to conventional treatment.

Emerging Research and Outlook:

Advances in **genetic studies** and **neuroimaging** are shedding light on the **underlying causes** of Tourette Syndrome, pointing to **abnormalities in dopamine regulation** and **specific circuits in the brain**, particularly involving the **basal ganglia and frontal cortex**.

Recent studies are also exploring the role of the **gut-brain axis**, inflammation, and even **autoimmune responses**—like **PANDAS (Pediatric Autoimmune Neuropsychiatric Disorders Associated with Streptococcal infections)**—in the manifestation of tics.

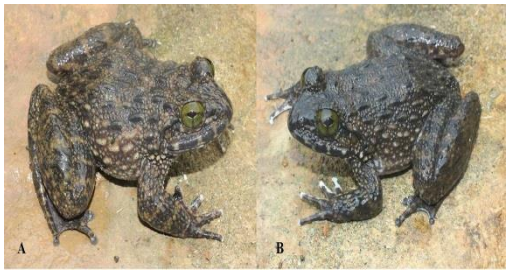
Final Thoughts: Living with Tourette Syndrome:

While Tourette Syndrome presents unique challenges, **many individuals lead fulfilling, successful lives** with the right support. Raising **public awareness**, promoting **early diagnosis**, and ensuring **inclusive education and workspaces** are vital steps in reducing stigma and enhancing life quality.

With **continued research and compassionate care**, the future for those with Tourette Syndrome is brighter than ever.

GS Paper 3 – Environment, Biodiversity, and Conservation

Ohler's Spiny Frog: A Remarkable Amphibian Discovery in Asia's Waterfalls



Context: Ohler's Spiny Frog is a **newly identified, large-bodied frog species** that has drawn attention for its **distinctive physical traits** and growing ecological importance. Recently discovered near a **remote waterfall in northern Vietnam**, this frog—measuring over **10 cm in length**—is already reshaping our understanding of amphibian diversity in Southeast Asia.

Habitat and Distribution: Mountain Streams and Hidden Forests

Belonging to the **Quasipaa genus** (or closely related groups within **Dicroglossidae**), Ohler's Spiny Frog is native to the **fast-flowing, rocky streams** of **evergreen forests** across:

- **Northern Vietnam**
- **Southern China**
- The **Himalayan foothills**

These frogs thrive in **cool, clear, oxygen-rich waters**, often hidden deep within **mountainous forest ecosystems**, which are increasingly under threat from habitat degradation.

Unique Physical Traits and Breeding Behavior:

This newly discovered frog is notable for its **muscular, robust body**, typically measuring **7–8 cm**, with some individuals exceeding **10 cm** in snout-vent length.

Key Characteristics include:

- **Spiny chest and throat** in males, especially during the breeding season—used for competing and attracting mates
- **Partially webbed toes**, adapted for navigating fast-moving streams
- **Rough skin texture**, covered with **spiny tubercles** on the chest
- **Dark brown skin** with **yellowish mottling**, and **dark green eyes**

These features are not only striking but also aid in camouflage and reproduction in their fast-flowing aquatic environments.

Ecological and Conservation Importance:

The discovery of Ohler's Spiny Frog brings more than just taxonomic excitement—it carries **broader implications** for **ecology and conservation**:

- **Biodiversity Significance**: Highlights the **rich, yet underexplored** amphibian life in Southeast Asia's waterfall and stream habitats
- **Conservation Priority**: Emphasizes the **urgent need to protect freshwater ecosystems**, especially in **Vietnam**, where many species are endemic and highly vulnerable

- **Scientific Contribution**: Enhances understanding of **Dicroglossidae evolution**, **biogeographic patterns**, and amphibian adaptation across **Indo-Asian landscapes**

Why It Matters Now:

The presence of Ohler's Spiny Frog in relatively untouched areas **underscores the importance of preserving pristine habitats**, particularly **montane forest streams**, which are often overlooked in conservation planning.

In the face of threats like **deforestation, mining, pollution, and climate change**, this discovery acts as a **biological indicator**, reminding us that these hidden ecosystems still harbor species unknown to science.

Final Thought: Nature's Secrets Still Unfold

Ohler's Spiny Frog stands as a **symbol of Earth's unexplored biodiversity**, especially within remote Asian forests. Each new discovery like this not only **enriches scientific knowledge** but also **reinforces the need to act swiftly and responsibly** to conserve the natural world—before these fascinating species disappear before our eyes.

GS Paper 3 – Economic Development, Environment

India's Green Mining Future Hinges on Policy Reform: FIMI-Deloitte Study

Context: Green mining refers to the application of **eco-conscious technologies and practices** that reduce the **environmental impact** of mining. This includes the use of **renewable energy sources**, **waste recycling**, **water conservation**, and **low-emission machinery**. With India targeting **Net Zero by 2070**, shifting to **cleaner fuel alternatives** in mining is not just a choice—it's a necessity.

India's Mining Sector: A Rapidly Growing Industry

India currently mines **95 different minerals** and holds vast reserves across various states. The **mining equipment market**, valued at **USD 6.4 billion in 2024**, is projected to reach **USD 11.34 billion by 2033**. While **surface mining** remains dominant, **underground mining is gradually expanding**, demanding **advanced, clean, and efficient machinery**.

OEMs Drive Technological Shift:

Indian **Original Equipment Manufacturers (OEMs)** are actively working on **alternative fuel-powered mining machines**, including those running on:

- **Electric batteries**
- **Liquefied Natural Gas (LNG)**
- **Hydrogen fuel**
- **Biofuels**

Though **electric and LNG-based HEMMs** are currently operational, **hydrogen-powered models** are still undergoing **testing and development**. This signals a **technology evolution** in response to sustainability imperatives.

Case Study: Surjagarh Iron Ore Mine Leading the Way

Lloyds Metals and Energy Ltd (LMEL) has taken the lead by converting the **Surjagarh Iron Ore Mine (SIOM)** in **Maharashtra** into **India's first green mine**. Their efforts include:

- **End-to-end electrification** of the mining fleet
- Use of **renewable energy sources**
- Integration of **low-emission technologies** across **drilling, hauling, loading**, and **transport**

So far, LMEL has **reduced CO_2 emissions by 32,000 tonnes annually**, with a target to achieve **50,000 tonnes** of emission reduction in the coming years.

The fleet of **Bharat Electric Vehicles** has expanded from **34 to 56 units**, with the goal of reaching **100 electric vehicles by 2025–26**—cutting fuel imports and reducing air pollution.

FIMI-Deloitte Study: Key Takeaways for Cleaner Mining

The study stresses the need for a **targeted policy framework** to enable large-scale adoption of **alternative fuel-based HEMMs**. Key recommendations include:

- **Capital subsidies**, tax reliefs, and **rebates** to counter **high upfront costs** of green HEMMs

- **Infrastructure development** like **charging stations**, and **financing support** with lower interest rates
- Creating an **ecosystem for skill development**, local manufacturing, and **battery recycling**

Roadmap for Policy Transformation:

Short-Term (0–2 Years):

- Launch **pilot projects** with Battery Electric HEMMs
- Introduce **upfront subsidies** and define **safety standards**
- Reduce **operational costs** via incentives

Medium-Term (2–5 Years):

- **Mandate zero-emission equipment** in new mining leases
- Offer **tax benefits**, implement **PLI schemes**, and promote **R&D**
- Establish **training programs** for a skilled green workforce

Long-Term (5+ Years):

- Implement **green technology mandates**
- Support through **green bonds**, **public-private partnerships**, and innovation hubs
- Build capacity for **battery recycling and hydrogen infrastructure**

Environmental Urgency: The Clock is Ticking

With the mining industry expected to **significantly scale up operations by 2035**, the demand for **fuel-intensive HEMMs** will rise, bringing with it a surge in **carbon emissions**. Without swift policy action, India's mining sector risks **falling short of its climate commitments**.

Overcoming Challenges: A Coordinated National Effort

Adopting cleaner fuel solutions is currently limited by:

- **High initial investment costs**
- **Insufficient charging/refueling infrastructure**
- **Limited availability of mature green technologies**
- **Regulatory and policy uncertainties**

Addressing these issues requires **collaboration between government, industry leaders, and financial institutions** to build a **future-ready, green mining ecosystem**.

Final Thought: Mining for a Greener Tomorrow

India stands at a **crucial crossroads** where its **economic ambitions and environmental responsibilities** must align. Accelerating the shift to **green fuel-powered mining equipment** is not only feasible but essential. With **proactive policy measures**, **technological innovation**, and **industry commitment**, India can lead the way in **sustainable mining practices**, setting a global example in climate-conscious industrial transformation.

GS Paper 3 – Economic Development

SEBI Rolls Out Verified UPI System to Combat Digital Fraud and Safeguard Investors

Context: In a landmark move to bolster **investor protection** and improve **transactional transparency**, the **Securities and Exchange Board of India (SEBI)** has announced the mandatory adoption of **verified UPI handles** for all **registered market intermediaries**. This initiative, effective **from October 1, 2025**, is a strategic effort to tackle the growing threat of **digital fraud** in the financial ecosystem.

The move is further strengthened by the launch of a new tool called **"SEBI Check"**, designed to help investors **independently verify payment credentials** and ensure funds are transferred to **authentic recipients**.

What's Changing: The Verified UPI Handle Format

Under the new guidelines, intermediaries such as **brokers, merchant bankers, investment advisors, and syndicate banks** must use UPI IDs ending with **"@valid"**—for instance, a verified broker's UPI might appear as xyz.bkr@validhdfc.

These new identifiers will be **issued and authenticated** by the **National Payments Corporation of India (NPCI)** to ensure that all verified UPI IDs are genuine, traceable, and tied to SEBI-registered entities.

Key Highlights of the Framework:

- **Mandatory Verified UPI Use**: Only UPI handles ending with **"@valid"** will be allowed for **investor-facing transactions**
- **Transition Period**: Existing UPI handles can be used until **December 11, 2026**, after which they will be deactivated
- **User Confirmation Feature**: A **green triangle icon with a thumbs-up** will appear during verified transactions, aiding even **non-English speaking users** in recognizing safe IDs

"SEBI Check" App: Verify Before You Pay

To complement the new payment structure, SEBI is introducing a **mobile application** named **"SEBI Check"**—a digital verification tool for all investors. This app allows users to:

- **Scan QR codes** or manually **enter UPI IDs**
- Access key verification details like:
  - **Account holder's name**
  - **Bank account number**
  - **IFSC code**

The app will be available on platforms like **Google Play**, and SEBI will ensure that only **authenticated versions** are distributed to prevent **spoofing by fraudsters**. This is a key step toward **investor empowerment** in an increasingly digital-first economy.

Why This Reform Is Crucial:

- The initiative comes in response to rising instances of **online payment fraud**, particularly those involving **fake UPI IDs** or **impersonation scams** on **investment platforms**. Following SEBI's **January 2025 consultation paper**, the regulator has acted on industry and consumer feedback by crafting a **secure, standardized UPI framework**.

Core Objectives of the Reform:

- **Prevent fund transfers** to unregistered or fake entities
- **Replace name-based verification**, which is prone to manipulation
- **Instill trust** in India's digital payment and investment infrastructure

Enforcement, Education, and Investor Responsibility:

To ensure successful adoption, SEBI will oversee a **multi-year awareness campaign**, educating both intermediaries and retail investors on **safe digital payment practices**. All registered intermediaries will be **required to display their verified UPI details** clearly on their apps, websites, and client communication.

Additionally:

- **Investor education** sessions will be conducted to highlight usage of "SEBI Check"
- **Systematic Investment Plans (SIPs)** and other automated payments will **continue unchanged** until final phase-out in **December 2026**
- Investors are **encouraged to verify UPI handles** before every transaction to protect themselves

A Broader Vision: Redefining Secure Digital Transactions

- This verified UPI initiative doesn't just serve capital markets—it signals a wider regulatory shift toward **"Know Your Payee" (KYP)** practices, similar to **global norms** in countries like the UK and Singapore. With over **8,000–9,000 intermediaries** expected to transition, SEBI's reform has the potential to **set industry standards** for secure payment ecosystems across **mutual funds, insurance, and fintech services**.

Final Thought: Trust is the New Currency

As digital adoption in finance accelerates, **SEBI's verified UPI mandate** represents a timely and necessary innovation. By giving investors the tools to **independently validate their transactions**, and by enforcing a **standardized, secure UPI structure**, India is laying the foundation for a **more resilient, transparent, and fraud-proof financial system**.

In an era where digital convenience must go hand-in-hand with cybersecurity, **SEBI is showing how regulatory foresight can build investor trust and protect the integrity of capital markets**.

KATRIN Experiment: Unlocking the Mystery of Neutrino Mass

Context: The **Karlsruhe Tritium Neutrino (KATRIN) Experiment** is a groundbreaking scientific endeavor based in Germany, focused on measuring the **absolute mass of neutrinos**—some of the most enigmatic and elusive particles in the universe.

What is the KATRIN Experiment?

KATRIN aims to precisely study the decay of **molecular tritium**, a radioactive isotope of hydrogen, to determine the tiny mass of the neutrino. By analyzing the energy spectrum of electrons emitted during tritium beta decay, scientists hope to place the most stringent limits on neutrino mass to date.

This experiment represents a critical step toward answering fundamental questions about the nature of matter and the universe's evolution.

Understanding Neutrinos: The Universe's Ghost Particles

Neutrinos are extraordinary subatomic particles that challenge our understanding of physics:

- **Invisible and Neutral:** They carry no electric charge and have virtually no size.
- **Minuscule Mass:** Their mass is incredibly small—so tiny that for decades, scientists believed they might be massless.
- **Elusive Interactions:** Neutrinos interact only via the **weak nuclear force**, making them exceptionally difficult to detect.
- **Abundance:** After photons, neutrinos are the **second most abundant particles** in the universe and the most common among all matter particles.
- **Unstoppable Travelers:** They pass effortlessly through ordinary matter and are unaffected by magnetic fields, traveling in straight lines from their sources, such as the sun, supernovae, or cosmic rays.

Why Neutrino Mass Matters:

Knowing the exact mass of neutrinos is vital for several reasons:

- **Cosmology:** Neutrino mass influences the structure formation of the universe and helps refine models of the Big Bang.
- **Particle Physics:** It challenges and extends the **Standard Model**, hinting at new physics beyond current theories.
- **Astrophysics:** Understanding neutrinos sheds light on energetic cosmic phenomena, including supernova explosions and neutron stars.

Fascinating Facts About Neutrinos:

- **Types of Neutrinos:** There are three known "flavors" — electron, muon, and tau neutrinos — and they can oscillate, or change from one flavor to another, as they travel.

- **Mass Mystery:** While KATRIN seeks to measure the **absolute mass**, previous experiments detected neutrino oscillations, proving they have mass but not how much.
- **Cosmic Messengers:** Billions of neutrinos pass through every square centimeter of your body each second without you noticing.

The **KATRIN Experiment** stands at the frontier of particle physics, pushing the boundaries of what we know about the universe's smallest and most mysterious particles. Its findings will deepen our understanding of both the subatomic world and the cosmos at large.