

## Prelims Exam Topics

### THE ENVIRONMENTAL IMPLICATIONS OF LARGE-SCALE RITUAL OFFERINGS

#### Context

A recent ritual at the Pataleshwar Mahadev Temple in Sehore, Madhya Pradesh, involving the pouring of 11,000 litres of milk into the Narmada River, has reignited the national debate on balancing religious traditions with environmental preservation.

#### Impact of Dairy Effluents on Aquatic Ecosystems

While culturally perceived as "pure," the large-scale introduction of organic substances like milk into river systems creates severe ecological stress:

- **Biochemical Oxygen Demand (BOD):** Dairy products have extremely high BOD levels, often exceeding domestic sewage. Microorganisms consume dissolved oxygen to break down the milk, leading to rapid oxygen depletion.
- **Hypoxia and Fish Kills:** As dissolved oxygen levels plummet, aquatic life (fish and micro-fauna) effectively suffocate.
- **Eutrophication:** Nutrient enrichment from offerings can trigger **algal blooms**, which further degrade water quality and disrupt the light penetration necessary for underwater biodiversity.
- **Microbial Proliferation:** Organic offerings accelerate microbial activity, adding to the cumulative pollution load of the river.

#### The Status of India's Rivers: CPCB Data

The **Central Pollution Control Board (CPCB)** 2025 assessment paints a grim picture of river health:

- **Polluted Stretches:** 296 polluted stretches identified across 271 rivers.
- **BOD Thresholds:** Safe bathing limits require a **BOD < 3 mg/l**. In contrast, stretches of the Yamuna in Delhi have recorded levels as high as **83 mg/l** (27 times the limit).
- **Ritual Impact:** Monitoring of festivals like Chhath Puja, Durga Puja, and Kumbh Mela consistently shows sharp spikes in heavy metals and solid waste, rendering some stretches ecologically "dead."

#### Legal and Constitutional Framework

The conflict between Article 25 (Freedom of Religion) and environmental protection is mediated through several legal pillars:

- **Article 21 (Right to Life):** The Supreme Court has interpreted this to include the right to a clean and healthy environment.
- **The Precautionary Principle:** A core tenet of Indian environmental law, mandating that the state must anticipate and prevent causes of environmental degradation.
- **The Water (Prevention and Control of Pollution) Act, 1974:** Provides the statutory framework for maintaining and restoring the "wholesomeness" of water bodies.

- **NGT Mandates:** The National Green Tribunal has historically intervened in cases of idol immersion and waste dumping, emphasizing that religious practice is subject to public health and environmental safeguards.

## POILA BOISAKH

### Context

Poila Baisakh, marking the first day of the initial month (Baisakh) of the Bengali solar calendar, is celebrated with traditional fervor across West Bengal, Tripura, and Bangladesh.

### Historical Evolution of Poila Boisakh

- **The Mughal Link (Akbar):** Most historians credit the Mughal Emperor **Akbar** with the formalization of the calendar.
  - To ease tax collection, Akbar combined the Islamic lunar calendar (*Hijri*) with the Hindu solar calendar.
  - The new calendar, **Fasli San**, allowed farmers to pay taxes after the spring harvest, aligning the fiscal year with the harvest cycle.
- **The Vikramaditya Theory:** Some traditions link the calendar to the King **Vikramaditya**, dating back to 57 BC, suggesting much older roots in the regional solar calendar system.
- **The Shashanka Connection:** Another school of thought attributes the calendar to the 7th-century King **Shashanka** of the Gauda Kingdom, marking the start of his reign.

### Regional variants

Region	Festival Name
Punjab	Baisakhi
Assam	Bohag Bihu
Kerala	Vishu
Tamil Nadu	Puthandu
Odisha	Maha Vishuva Sankranti

## MEMRISTOR: BRAIN-INSPIRED COMPUTING DEVICE

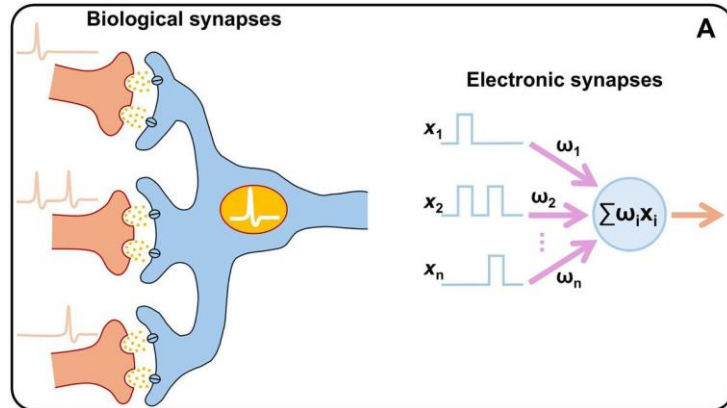
### Context:

- Recently researchers have developed a new **hafnium-based memristor** that can significantly reduce AI energy consumption.

### About the Memristor

- A memristor (memory + resistor) is a device whose **resistance changes based on past current and “remembers” it even after power is removed**, enabling storage and computation together.
- **Making (Structure):** Typically made using **metal–insulator–metal structure**:
  - Thin layer of **titanium dioxide (TiO<sub>2</sub>)** or other oxides which is sandwiched between two metal electrodes
- **Working Principle**

- Electric current changes the **internal resistance** of the device. After current is removed, it **retains this resistance (memory effect)**.
- Resistance levels represent **synaptic weight (represent data)**. Thus it has **in-memory computing (processing + storage in the same location)**.



- **Efficiency:** Eliminates **data transfer between memory and processor** thus leads to **very low energy consumption**
  - **E.g.** brain-like efficiency i.e.  $\sim 10^4$  operations/sec at  $\sim 20$  W energy where as AI systems uses hundreds–thousands times more energy

### Memristor vs Traditional Computing

Aspect	Memristor-Based Computing	Traditional Computing (Von Neumann)
<b>Memory &amp; Processing</b>	Integrated (same device performs storage + computation)	Separate units (CPU + memory → data transfer required)
<b>Energy Efficiency</b>	High (minimal data movement → low power consumption)	Lower (high energy spent on data transfer between memory and processor)
<b>Speed</b>	Faster for AI tasks (parallel, in-memory processing)	Slower due to <b>memory bottleneck (data transfer delays)</b>
<b>Architecture</b>	Neuromorphic (brain-inspired, synapse-like devices)	Von Neumann architecture (sequential processing)

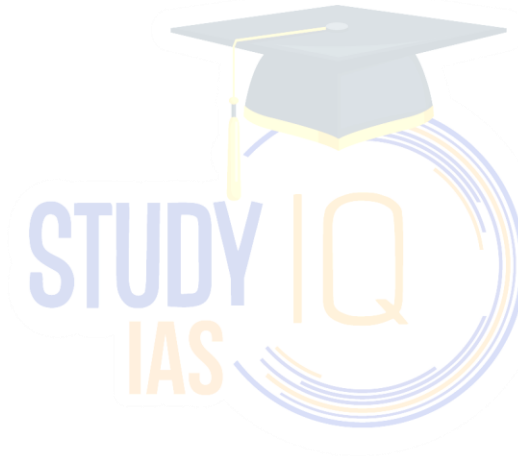
### Issues in Traditional Oxide-Based Memristors

- **Filament-Based Instability:** Rely on **conductive filament formation inside oxide layer (e.g., TiO<sub>2</sub>)**, which is **random and difficult to control**, leading to unreliable switching.
  - **Filament formation** refers to the creation of a **tiny conductive path (filament)** inside the memristor’s insulating layer when voltage is applied.
- **High Switching Energy:** Filament creation requires **relatively high voltage/current**, increasing overall energy consumption.
- **Abrupt Switching Behaviour:** Exhibit **binary (ON/OFF) switching**, limiting **fine analogue control** needed for neuromorphic computing.

### New and Improved Memristor (Hafnium-Based)

- **Design Innovation:** Uses **hafnium oxide + titanium oxynitride forming p–n junction (acts as adjustable electronic gate)** instead of unstable filament mechanism.

- **Improved Working:** Controls resistance via **ion movement** (smooth, predictable switching instead of abrupt filament formation).
- **Efficiency Gain:** Requires  $\sim 10^6$  times less current for switching  $\rightarrow$   $\sim 70\%$  reduction in AI energy consumption.
- **Industrial Advantage:** Hafnium oxide already used in **CMOS chips**  $\rightarrow$  easier integration into existing semiconductor manufacturing.
- **Limitations:** High fabrication temperature ( $\sim 700^\circ\text{C}$ ) and still far from matching **full brain complexity**.



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## Mains Exam Topics

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### DELIMITATION EXERCISE

#### Context

Southern states have raised apprehensions that the delimitation process may adversely impact their share of representation in Parliament.

#### About delimitation exercise

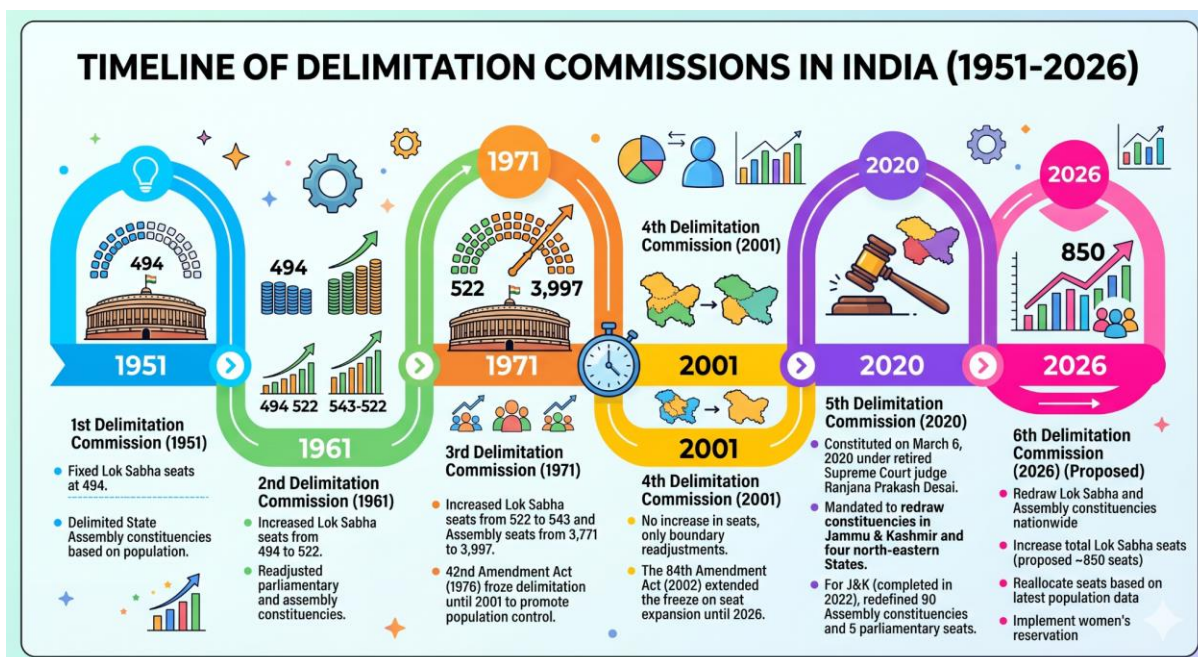
- **Delimitation** is the process of **redrawing boundaries of Parliamentary and Assembly constituencies** to ensure **equal representation** based on population changes.
- It also involves **fixing the number of seats** allocated to each state in **Lok Sabha and State Assemblies**.
- The process is carried out by an independent body called the **Delimitation or Boundary Commission**.

#### Legal and Constitutional basis for delimitation commission

- **Article 82**: Requires Parliament to **revise the allocation of Lok Sabha seats** among states **after every Census**.
- **Article 170**: States that the **number of seats in State Legislative Assemblies** must also be readjusted.
- **Delimitation Act**: Passed **whenever delimitation is needed**, and a **Delimitation Commission is set up**.
- Till date **4 Delimitation Commissions** have been formed in **1952, 1963, 1973 & 2004**. (UPSC Prelims 2024)

#### Related Constitutional Amendments

- **42nd Amendment (1976)**: **Froze the number of Lok Sabha and Assembly seats** until the **2001 Census** to encourage **population control**.
- **84th Amendment (2002)**: Extended the freeze on Lok Sabha and Assembly seats until 2026.



### Composition of delimitation commission

<b>Appointment</b>	The delimitation commission is appointed by the President of India and works in collaboration with the Election Commission of India
<b>Members</b>	<ul style="list-style-type: none"> <li>● A retired/working Supreme Court judge (Chairperson)</li> <li>● Chief Election Commissioner.</li> <li>● State Election Commissioners of the concerned states</li> </ul>

### Significance of the delimitation exercise

- **Proportional Representation:** The delimitation process ensures that each segment of the population is represented fairly. The Delimitation Commission redraws constituencies based on latest Census data so that each seat represents an equal number of people.
- **Prevents Political Imbalance:** Without delimitation, some areas may have **more MPs per voter**, leading to **under-representation** elsewhere.
- **Reservation for SCs and STs:** The exercise also designates constituencies to be reserved for Scheduled Castes (SCs) and Scheduled Tribes (STs) in regions with significant populations from these communities, ensuring their political inclusion.
- **Neutral and Independent Process:** Although established through legislation, the Delimitation Commission functions autonomously, free from political influence. Its decisions are final and cannot be challenged in Parliament or courts, safeguarding its impartiality.
- **“One Vote, One Value”:** The process reinforces the democratic ideal of equal weight for every vote by ensuring uniformity in population distribution across constituencies.

### Challenges associated

- **Redrawing the Political Map:** The new delimitation framework removes the earlier freeze based on the 1971 Census and mandates seat allocation according to population proportions. Under Article 81(2)(a), representation must reflect population share rather than maintaining historical balance.
- **Regional Redistribution of Power:** The most significant gains are concentrated in northern States such as Uttar Pradesh, Bihar, and Rajasthan.
  - Collectively, the Hindi heartland's share in the Lok Sabha is projected to rise from 38.1% to 43.1%.
- **Decline of Southern and smaller states**
  - Southern States' share falls from 24.3% to 20.7%
  - North-Eastern States decline from 4.4% to 3.8%
  - Eastern States also see a marginal reduction
- **Demography vs Development:** A key issue emerging from the delimitation exercise is the tension between population size and developmental performance.
  - States such as Kerala and Tamil Nadu, which invested heavily in health, education, and family planning, now face a reduction in their parliamentary share. Meanwhile, States with higher fertility rates, such as Bihar and Uttar Pradesh, stand to gain.
- **Expansion of the Lok Sabha:** Increasing the Lok Sabha's size to 850 seats has wide-ranging implications:
  - Larger States gain a disproportionate number of additional seats
  - National policymaking may become more influenced by a few populous regions
  - While the expansion improves representation numerically, it also risks concentrating political influence geographically.
- **Impact on Federal Balance:** The proposal alters the balance between the two Houses of Parliament:
  - The Lok Sabha will become significantly larger, while the Rajya Sabha remains unchanged
  - In joint sittings, the Lok Sabha's numerical dominance increases from 2.2 times to about 3.3 times that of the Rajya Sabha.
- **Flexibility in Delimitation Decisions:** The proposed constitutional amendment gives Parliament the authority to:
  - Decide the timing of delimitation
  - Choose which Census data to use
  - Since these decisions require only a simple majority, the ruling government gains significant influence over the delimitation process. This raises concerns about the potential politicisation of representation.
- **Link with Women's Reservation:** The delimitation exercise is closely tied to implementing 33% reservation for women in the Lok Sabha under the Nari Shakti Vandan Adhiniyam, 2023.
  - While this marks a progressive step toward gender inclusion, it also means that the regional redistribution of seats and gender representation will occur simultaneously, compounding political shifts.

- **Impact on Parliamentary Functioning:** A larger Lok Sabha presents operational challenges:
  - Reduced opportunities for individual MPs to participate in debates and lower chances of being selected for questions or discussions due to limited sitting days (fewer than 70 annually)
- **Expansion of the Executive:** The size of the Council of Ministers is capped at 15% of the Lok Sabha and with 850 seats, the Council could expand significantly, leading to a larger executive.

## DELIMITATION AND WOMEN'S REPRESENTATION

### Three major bills introduced

- **Constitution (131st Amendment) Bill, 2026:** Proposes expansion of the Lok Sabha and seeks amendments to Articles 81 and 82
- **Delimitation Bill, 2026:** Establishes a revised framework for the Delimitation Commission
- **Third Bill:** Facilitates reservation for women in State Assemblies and Union Territory legislatures

### Key provisions

#### 1. Expansion of Lok Sabha: Increase in strength from 543 seats to nearly 850

- Up to 815 seats for States
- Around 35 seats for Union Territories
- Reflects a ~50% rise in representation
- Aligns with the capacity of the new Parliament building
- Likely to result in smaller constituencies geographically

#### 2. Women's Reservation (Target: 2029 Elections)

- Although 33% reservation was approved earlier through the Constitution (106th Amendment) Act, 2023, its implementation depended on delimitation after the Census.
- Due to delays in the 2021 Census, the government proposes using 2011 Census data.
- Aims to implement reservation from the 2029 general elections.

#### 3. Redefinition of "Population" (Article 81)

- Shifts from using the "last Census" to any Census chosen by Parliament through law.
- Provides flexibility to Parliament in deciding the basis for delimitation.

### Women's Reservation vs. Delimitation

- **Evolution of Women's Reservation Policy:** The current framework differs significantly from earlier efforts and marks a move from direct empowerment to conditional empowerment, altering the original intent of the policy.
  - The 2010 Women's Reservation Bill, passed by the Rajya Sabha, proposed immediate implementation without preconditions
  - The Nari Shakti Vandan Adhiniyam, 2023, introduced conditional implementation linked to Census and delimitation
- **Delay in Representation:** Women's representation in Parliament dropped from 78 to 74 MPs after the 2024 elections
  - In State Assembly elections (2024–25), women constituted less than 10% of elected representatives

- **Triple Linkage Problem:** The proposed framework creates three interconnected conditions:
  - Delimitation based on Census data
  - Expansion of seats in Parliament
  - Reservation for women only after these steps
- **Concerns over Use of Outdated Census Data:** The Delimitation Bill mandates the use of the 2011 Census, despite significant demographic changes since then.
  - Representation may not reflect current population realities and reduces urgency for conducting a fresh Census
- **Impact on SC/ST Representation:** Delimitation also determines the number of seats reserved for Scheduled Castes (SCs) and Scheduled Tribes (STs), based on their population share. This has a cascading effect, as one-third of these reserved seats are meant for SC/ST women, thereby compounding the injustice.
- **Political Sensitivity of Delimitation:** Linking women's reservation to such a politically sensitive and disputed process risks further delays and controversies.
  - Eg: Recent State-level exercises in Assam and Jammu & Kashmir faced criticism over alleged bias in redrawing boundaries
- **Women's Reservation as a Stand-Alone Reform:** Historically, women's reservation has been viewed as an independent measure to strengthen democracy which does not require boundary redrawing and has already undergone extensive parliamentary scrutiny.

#### Solutions for balanced delimitation

- **Capping Lok Sabha Seats:** Keeping the number of MPs fixed, as done in the U.S., would **maintain the status quo** in state-wise representation and uphold the federal principle.
  - **Eg: It can help build national consensus**
- **Increasing State Assembly Seats:** To address democratic representation needs, the number of MLAs in State Legislative Assemblies can be increased based on population growth.
- **Weighted Representation Model:** A formula ensuring fair weightage for states with lower population growth can be considered to maintain regional balance.
- **Incentivizing Population Control:** States that have effectively managed their population growth should not be disadvantaged in seat allocation; a mechanism to reward them should be explored.
- **Consensus-Based Decision:** Engaging political leaders across regions to reach a balanced and widely acceptable solution can help prevent regional tensions.
- **Parliamentary Debate & Review:** A thorough discussion in Parliament, considering both numerical representation and federal equity, is essential before finalizing the new seat distribution.
- **Adopting a Hybrid Formula:** A balanced approach could incorporate factors such as population, economic contribution, demographic performance, and geographic size to ensure fairness.
- **Reforming the Rajya Sabha:** Strengthening the Upper House by ensuring more balanced state representation could help offset population-based disparities in the Lok Sabha.
- **Separating Reservation from Delimitation:** Women's reservation could be implemented independently of delimitation to avoid linking it to a contentious redistribution process.