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Monthly Magazine



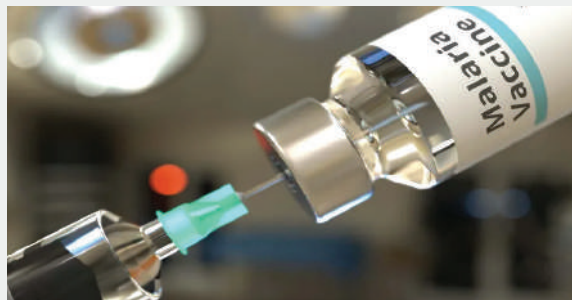
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PREFACE

Current Affairs UPSC CSE Prelims 2026

This high-quality monthly compilation of Current Affairs for Civil Services Exam Prelims 2026 is designed to help Civil Services Exam aspirants by:

1. **Saving preparation time:** Consolidates key current affairs from multiple sources for CSE Prelims.
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Details of our Current Affairs Test Series are on the back cover and inside this magazine.

Our team of content developers have worked rigorously to create this high-quality compilation, and we hope that all Civil Services and other competitive exam aspirants will make the best use of it. All the Best!

R. C. Reddy IAS Study Circle
Hyderabad



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SCAN TO ACCESS OUR
NEW TELEGRAM CHANNEL

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**SCAN TO ACCESS OUR
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POLITY

1. Phone Tapping

Context: The Madras High Court refused to expand the scope of Section 5(2) of the Indian Telegraph Act of 1885, and permit the Central and State governments to resort to phone tapping as a covert measure to detect crimes. The HC held that legislature, not judiciary, is responsible for expanding such laws.

Phone Tapping

- Phone tapping refers to the **interception of telephone conversations** by a third party, often by government agencies, to gather information.
- It is a form of surveillance and, if misused, **can violate individual privacy and constitutional rights**.

Legal Framework in India

- **Indian Telegraph Act, 1885 – Section 5(2):** Allows the Centre or State to intercept messages on two grounds: Public emergency and public safety
 - Requires recording of reasons in writing and a formal authorization.
 - Must be reviewed by a **Review Committee** (as per Telegraph Rules and Supreme Court guidelines).
- **Indian Telegraph (First Amendment) Rules, 1999:** In pursuance of the PUCL judgment, the Government of India framed rules to provide a statutory backing to the safeguards laid down by the Supreme Court.
 - These rules regulate the procedures for interception, and define authorities, duration, and review mechanisms for lawful interception under the Indian Telegraph Act.
- **Information Technology Act, 2000 – Section 69:** Similar rules were framed under the Information Technology Act, 2000 in 2009.
 - These govern the interception of electronic communication such as emails, chats, and online data.

- **The 2009 IT Rules mirror the principles laid down in the PUCL judgment, ensuring:** Authorization by a competent authority, defined time limits, strict purpose limitation, and oversight by a Review Committee.

SC Guidelines under the PUCL v. Union of India (1996):

- It is the first major judgment **linking phone tapping to the right to privacy**. The Supreme Court issued procedural safeguards:
 - **Approval:** Only by Home Secretary or the Home Secretary of the concerned State Government.
 - **Time Limit for Validity of Order:** The order for interception shall cease to be valid after **two months** from the date of issue unless it is renewed.
 - Even if renewed, no order can remain in force **beyond six months** in total.
 - **Destruction of Intercepted Material:** All copies of intercepted communication must be destroyed as soon as their retention is no longer necessary under the terms of Section 5(2).
 - **Delegation in Urgent Cases:** In urgent cases, the power of authorization may be delegated to an **officer not below the rank of Joint Secretary** in the Home Department of either the Central or State Government.
 - **Formation and Role of Review Committee:** The Court mandated the constitution of a Review Committee at both the Central and State levels:
 - **Functions of the Review Committee:** The Committee must review all interception orders within two months of issuance.
 - If the Committee finds that the interception was not in accordance with Section 5(2), it shall declare the order as invalid, and direct destruction of all intercepted material collected under that order.
 - The Madras High Court correctly held that the **scope of Section 5(2) cannot be**

expanded by the judiciary to include general crime detection under phone tapping.

- Under **separation of powers**, it is **the legislature, not the judiciary**, responsible for expanding or amending surveillance laws to adapt to societal and technological changes.
- While phone tapping does infringe upon fundamental rights, the primary right it infringes upon is the **Right to Privacy**, which has been recognized as an integral part of **Article 21 (Right to Life and Personal Liberty)** by the Supreme Court (e.g., in Justice K.S. Puttaswamy (Retd.) vs Union of India).

2. Custodial Death

Context: The recent custodial death in Sivaganga district in Tamil Nadu, has once again drawn national attention to the issue of custodial practices and the treatment of individuals in police custody.

What is Custodial Death?

- Custodial death refers to the death of an individual **while in police or judicial custody**. This may occur **before trial, during police interrogation, or after conviction**.
- The death may be caused by torture, negligence, denial of medical aid, or even under suspicious circumstances.
- **It Violates the Constitutional Rights of;**
 - **Article 20(1):** No person shall be punished beyond what is prescribed in law.
 - **Article 20(3):** Protection against self-incrimination; any confession made under duress is inadmissible.
 - **Article 21:** Ensures protection of life and personal liberty, including in police/judicial custody.
- **Issue of Custodial Death in India:** According to parliamentary data, **11,656 custodial deaths** were recorded between 2016-17 and 2021-22, across India.

- Uttar Pradesh topped the list with **2,630 deaths**, while **Tamil Nadu (490)** reported the highest number among the southern States.
- However not all custody deaths are due to police excess.

Reasons of higher Custodial Deaths in India

- **Legal Vacuum:** India has signed but not ratified the **UN Convention Against Torture (UNCAT), 1997** meaning it is not legally bound to implement its provisions.
 - **The Prevention of Torture Bill (2010)** **lapsed** in Parliament, and subsequent efforts to introduce legislation have been shelved or diluted.
- **Procedural Flaws and Delays:** Supreme Court of India, in **K Basu vs. State of West Bengal (1997) Case**, laid down crucial guidelines to prevent custodial abuse.
 - However, Courts often rely on magisterial inquiries, procedures riddled with procedural flaws and delays.
- **Institutional Incentives:** Confessions extracted through violence are still treated as evidence, despite being inadmissible under **Section 25 of the Indian Evidence Act**.
- **Weak Accountability:** Investigations into custodial deaths are typically conducted by the same department involved.
 - Even where judicial inquiries are initiated, they are often slow, opaque, and inconclusive.
- **Political Interference:** Policing in India is often influenced by political pressures, which weakens impartial action and shields errant officers.
- India signed the United Nations Convention Against Torture (UNCAT) in 1997, but it has **not yet ratified it**. Ratification is the crucial step that legally binds a country to the treaty's provisions. While India has introduced legislation (like the Prevention of Torture Bill) in the past, none has been enacted into law to give effect to UNCAT, and thus, India remains a signatory but not a ratifying state.

- The landmark judgment in *D.K. Basu v. State of West Bengal* (1997) laid down specific guidelines that police and other agencies must follow while making arrests and during detention to prevent custodial torture and deaths. These guidelines are mandatory and aim to safeguard the rights of arrested persons.
- The **National Human Rights Commission (NHRC)** plays a significant role in monitoring and reporting custodial deaths in India. It is mandated to inquire into complaints of violation of human rights or negligence in the prevention of such violation by a public servant.

3. Living Will

Context: India has launched its first-ever Living Will clinic in its financial capital, Mumbai. A private hospital, P D Hinduja Hospital & Medical Research Centre (MRC), has launched this dedicated clinic to help individuals make informed decisions about their future medical care in case of serious or unforeseen health circumstances.

What is a Living Will?

- A living will is basically a legal document that allows a person to state their choices of medical treatment for situations when they become unable to communicate or make decisions due to any unforeseen circumstances. This will be extremely helpful in situations like being in a coma or suffering from advanced dementia.

A list of things the living will would allow you to do:

- Mechanical ventilation
- Feeding tubes
- CPR (cardiopulmonary resuscitation)
- Dialysis
- Palliative care or pain relief only

When will it get affected?

- But, there are certain circumstances only in which this living will comes into effect. The person with the will must be in a situation where they cannot make decisions at all. It is also

applicable when they are terminally ill or permanently unconscious, depending on the laws in your country/state.

What does the law say?

- As per an order by the Indian apex court in 2018, a person can nominate at least two persons — a family member, a trusted friend or colleague — to take healthcare decisions on their behalf. The nominee must be above the age of 18 and must be aware of patients' wishes and preferences, and preferably should be geographically close to be able to reach the hospital.

Other countries that have a living will

Apart from India, several countries have a legal living will. Here's the list of countries.

- **US:** America has advanced healthcare directives, including a living will, that are recognised at the state level.
- **Canada:** Apart from India and the US, Canada also has a living will.
- **Australia:** In Australia, there are multiple states that have laws that permit living wills. It is legal in all six states.
- **France:** France also has living wills, and they are legally recognised.
- **Germany:** Living wills are legal in Germany as well.

Apart from these countries, living wills are legal in Belgium, the Netherlands, New Zealand, Colombia, Denmark, Ireland, Luxembourg, and Switzerland.

- A **Living Will** is an **advance directive** allowing individuals to specify **medical treatment preferences in case of terminal illness when they cannot express consent**.
- In **2018 (Common Cause case)**, the **Supreme Court** recognized Living Wills under Article 21, allowing passive euthanasia under strict safeguards, holding that the **Right to Die with Dignity is part of the Right to Life**.

- As per SC guidelines, a Living Will should be executed before two witnesses and countersigned by a **Judicial Magistrate of First Class (JMFC)**, and a copy is to be sent to the district and state health authorities for record.

4. Enemy Property

Context: Recently, the Madhya Pradesh High Court has dismissed actor's plea against the government's decision to label his ancestral properties worth an estimated Rs 150 billion as enemy property.

What is Enemy Property?

- The concept of "enemy property" originated from the **Defence of India Rules, 1962**, which allowed the Indian government to take over assets of people who migrated to enemy countries during wartime.
- After the **1965 India-Pakistan war**, properties left behind by those who became nationals of Pakistan or China were vested in the **Custodian of Enemy Property for India**, a government department under the **Ministry of Home Affairs**.
- The **1966 Tashkent Declaration** between India and Pakistan included discussions about returning such properties, but while Pakistan sold off Indian assets, India retained control of these properties under the 1968 Act.

Enemy Property Act, 1968

- The Act empowers the government to appropriate and manage properties in India that belonged to people who took Pakistani or Chinese nationality after the wars.
- All rights, titles, and interests over enemy property are vested in the Custodian, and transfers by the original owners are declared void, even retrospectively.
- The Act was amended several times, most notably by the **Enemy Property (Amendment and Validation) Act, 2017**, to further strengthen government control and prevent legal challenges or claims of succession by heirs of those who migrated to enemy countries.

- Enemy Property refers to properties left behind by those who migrated to **Pakistan (1947, 1965, 1971)** and **China (1962)**, vested with the **Custodian of Enemy Property for India under the Enemy Property Act, 1968**.
- The Enemy Property (Amendment and Validation) Act, 2017 explicitly bars the successors of the original owners from reclaiming such properties to prevent legal disputes and alienation.
- The concept of Enemy Property emerged under the Defence of India Rules during the 1962 war with China and was later formalized in the Enemy Property Act, 1968.

5. Zonal Councils

Context: Union Home Minister chaired the 27th meeting of the Eastern Zonal Council in Ranchi, Jharkhand.

What are Zonal Councils?

- The Zonal Councils are the **statutory bodies** established under the **States Reorganisation Act of 1956**.
- *The act divided the country into five zones (Northern, Central, Eastern, Western and Southern) and provided a zonal council for each zone.*
- **Members:** Each zonal council consists of the following members:
 - **Home minister** of the Central government, the common chairman of the five zonal councils.
 - **Chief ministers** of all the States in the zone.
 - **Two other ministers from each state in the zone.**
 - **Administrator** of each union territory in the zone.
- **Each chief minister acts as a vice-chairman** of the council by rotation, holding office **for a period** of one year at a time.
- **North-Eastern Council:** In addition to the above Zonal Councils, a North-Eastern Council was

created by a separate Act of Parliament **the North-Eastern Council Act of 1971**.

- Its members include **Assam, Manipur, Mizoram, Arunachal Pradesh, Nagaland, Meghalaya, Tripura and Sikkim**.
- **The zonal councils are only deliberative and advisory bodies. They aim at;**
 - **Promoting cooperation and coordination** between states, union territories and the Centre.
 - **Discuss and make recommendations** regarding matters like economic and social planning, linguistic minorities, border disputes, interstate transport, and so on.
- **Each Zonal Council has also constituted a Standing Committee at the level of Chief Secretaries.**

6. Ordinarily resident

Context: The Election Commission's Special Intensive Revision (SIR) of electoral rolls in Bihar has reignited debate over the eligibility of migrant workers as 'ordinarily resident' for voter registration.

Who is 'ordinarily resident'?

- The term "**ordinarily resident**" is defined and interpreted through the Representation of the People Act, 1950 (RP Act), under Section 19 and Section 20.
- **Section 19** of the RP Act requires that a person is 'ordinarily resident' in a constituency for inclusion in its electoral roll.
- **Section 20** provides the **meaning** of the term 'ordinarily resident'.
 - It specifies that mere ownership or **possession of a house does not make one ordinarily resident**.
 - However, a person temporarily absent from their place of residence will still be considered ordinarily resident there.
 - Specific categories of individuals (e.g., armed forces, government officials posted outside

India, constitutional office holders) are deemed to be ordinarily resident in their home constituency despite being physically away.

- **Registration of Electors Rules, 1960 (RER)** framed under the RP Act, governs the procedures for inclusion, exclusion, and corrections in electoral rolls.
 - The rules are executed by **Electoral Registration Officers** and supervise the application of the term "ordinarily resident."
- **The Gauhati High Court in the Manmohan Singh case (1999)**, indicated that the term 'ordinarily resident' shall mean a habitual resident of that place.
 - It must be permanent in character and not temporary or casual. It must be a place where the person has the intention to dwell permanently.

Challenges for Migrant Workers

- India has a large migrant workforce, especially from poorer regions like Bihar, Uttar Pradesh, Odisha, Jharkhand, and Chhattisgarh.
- **The Periodic Labour Force Survey (2020-21)** estimates that around **11%** of Indians migrate for employment, which amounts to over **15 crore** people. Key Issues are;
 - **Temporary Nature of Migration:** Most labourers migrate for short-term work and live in makeshift homes or worksite camps without permanent addresses.
 - **Voter Identity and Registration Gaps:** Many migrants fail to register as voters in their place of work due to lack of documentation and mobility.
 - **Reluctance to Shift Voter Registration:** Migrants have stronger social and economic ties with their home villages or towns. They choose to vote where their families live and their properties exist.
 - **Disenfranchisement Risk:** Removal from rolls in the original constituency, combined with no registration at the new workplace, may leave many completely disenfranchised.

7. Parole

Context: The Delhi High Court ruled that prison authorities can decide on parole or furlough requests of convicts whose appeals are pending in the Supreme Court.

Parole

- **Parole** is a conditional release granted to a prisoner **for a specific purpose or emergency for a short duration**. It is not a right, but a **privilege** granted under defined conditions.
 - It is granted to maintain social relations with family and the community in order to fulfil familial and social obligations and responsibilities.
 - The prisoner has to spend extra time in prison for the period spent by him outside the Jail on parole.
- **Parole may be of the following two types:** Emergency Parole and Regular Parole.
- **Legal Framework:** Governed by **State Prison Rules** (as prison is a State subject under the Seventh Schedule of the Constitution).

Furlough in India

- **Furlough** means release of a prisoner for a short period of time after a gap of a certain qualified number of years of incarceration by way of motivation for him maintaining good conduct and remain disciplined in the prison.
 - This is purely an **incentive for good conduct in the prison**.
 - Therefore, the period spent by the prisoner outside the prison on furlough **shall be counted towards his sentence**.
- **Legal Basis:** Also governed by State Prison Rules, and varies slightly between states.
- **Under trial prisoners are not eligible** for regular parole and furlough, and may be released only on emergency parole, that too by the order of the concerned trial court.
- Parole can be granted even when an appeal is pending, subject to the discretion of authorities and applicable prison rules. Parole is temporary

release for specific reasons and can be granted irrespective of pendency of appeal.

- Neither parole nor furlough is an absolute right. Furlough is not a right but can be claimed based on good conduct, subject to the discretion of prison authorities. Parole is also not a right, granted under specific grounds like family emergencies.
- Both furlough and parole may be denied to prisoners convicted under serious crimes including terrorism, dacoity, or under preventive detention laws, depending on state-specific prison manuals and the nature of the crime. Thus, this is not a unique distinguishing feature between parole and furlough.

8. Central Adoption Resource Authority

Context: The Central Adoption Resource Authority (CARA) has directed State Adoption Resource Agencies to strengthen structured counselling across pre-, during, and post-adoption stages, ensuring emotional well-being of all stakeholders.

Central Adoption Resource Authority (CARA):

- The **Central Adoption Resource Authority (CARA)** is the statutory, autonomous body of the Ministry of Women & Child Development, Government of India, tasked with overseeing and regulating adoption of Indian children both within the country and internationally.

Key Facts about CARA:

- **Established:** 1990, made statutory under the Juvenile Justice (Care and Protection of Children) Act, 2015.
- **Role:** Nodal agency for all matters concerning the adoption of orphaned, abandoned, or surrendered children in India. It issues guidelines and monitors the entire process for both domestic and inter-country adoptions.
- **International Mandate:** CARA serves as the designated Central Authority for inter-country adoptions in line with the Hague Convention on

Inter-country Adoption (1993), which India ratified in 2003.

- **Adoption Laws:** While traditional adoption laws like the Hindu Adoption and Maintenance Act (HAMA), 1956, apply to specific communities, CARA mainly functions under the Juvenile Justice Act for cases of orphaned, abandoned, and surrendered children.
- **Function:** Ensures ethical, standardized, and transparent adoption procedures; expands adoption services nationwide; expedites rehabilitation of children; and maintains a centralized online database (CARINGS portal) for children and prospective adoptive parents.
- **Support Structures:** Works with a network of recognised agencies — Specialised Adoption Agencies (SAA), State Adoption Resource Agencies (SARA), District Child Protection Units (DCPU), and Authorised Foreign Adoption Agencies (AFAA).
- **Process:** Resident Indian parents and Non-Resident Indians, Overseas Citizens of India, and foreigners can start the adoption process by registering online via the CARINGS portal.
- **Child-Centric Principles:** The best interest of the child is paramount; preference is given to placing children within their own socio-cultural context as far as possible.
- CARA maintains the **Child Adoption Resource Information and Guidance System (CARINGS)**, a centralized database for **monitoring and processing in-country and inter-country adoptions**.
- Under the **Hague Convention on Inter-country Adoption**, CARA verifies **eligibility and suitability of prospective adoptive parents** for inter-country adoptions involving Indian children.
- Under Indian law, inter-country adoptions cannot proceed via private direct arrangements between biological and prospective adoptive parents. All inter-country adoptions must be routed through CARA and recognized adoption agencies as per the **Juvenile Justice Act, 2015 and Adoption Regulations, 2022**.

9. Term of Office of VP

Context: The Vice-President of India, Jagdeep Dhankhar becomes the third Vice-President in India's history to resign before completing his term, after V.V. Giri and R. Venkataraman in accordance with Article 67(a) of the Constitution of India.

Term of Office of VP:

- The Vice-President holds office for a term of five years and can resign at any time by addressing the resignation letter to the President.
 - He is also eligible for re-election to that office.
- **Constitutional Provisions for Removal:** Under Article 67(b), the Vice President can be removed through a resolution passed by a majority in the Rajya Sabha and subsequently agreed upon by the Lok Sabha.
- A 14-day notice is mandatory before such a resolution can be moved.
- If the office falls vacant by **resignation, removal, death** or otherwise, then an election to fill the vacancy should be held **as soon as possible** after the occurrence of the vacancy.
 - The newly elected vice-president remains in office for a **full term of five years** from the date he assumes charge of his office.

10. Presidential Reference

Context: The Supreme Court will take up the reference made to it by the President under Article 143 of the Constitution on July 22, following the apex court's verdict on setting timelines for the President and Governors to act on Bills passed by state Assemblies.

What is a Presidential Reference?

- A Presidential Reference is a constitutional mechanism under Article 143 of the Indian Constitution, wherein the President of India seeks the advisory opinion of the Supreme Court on important questions of law or fact.

- This power enables the executive to seek judicial clarity on complex constitutional matters without initiating litigation.
- **There are two components of Article 143:**
 - Article 143(1) allows the President to refer any question of law or fact of public importance to the Supreme Court for its advisory opinion.
 - Article 143(2) pertains to disputes involving pre-Constitutional treaties and agreements, permitting the President to refer such matters for legal clarification.
- **Nature of Opinion:** The Supreme Court's opinion is not binding on the President. It does not carry precedential value but holds strong persuasive authority and is usually followed by the executive and judiciary.
- **Historical origin:** The provision originates from the Government of India Act, 1935, which empowered the Governor-General to refer legal matters to the Federal Court.
- **Procedure for Reference:** The President refers to the advice of the Union Council of Ministers. As per Article 145, a minimum 5-judge Bench of the Supreme Court must hear the matter.
- **The court's discretion:** The Supreme Court may choose whether or not to answer the reference. It can refuse to respond if the question is vague, hypothetical, or outside judicial purview.
- **Global comparisons:**
 - **Canada:** Allows similar advisory references to the Supreme Court of Canada.
 - **United States:** It does not permit advisory opinions, and it respects the strict separation of powers.
- The consultative nature of Article 143 allows the judiciary to participate in shaping constitutional understanding without interfering in executive decisions. This **complements the doctrine of separation of powers** by fostering inter-institutional dialogue rather than conflict.
- While the President *may* seek advice, the **executive is not constitutionally obligated** to act on it, nor is the judiciary bound to offer it. Article

143 **does not restrict** the executive from acting independently in all matters. Moreover, the **opinion is not binding** on the President.

11. Foreigners' Tribunals

Context: The quasi-judicial Foreigners' Tribunals (FTs) in Assam have become routine instruments of exclusion by disregarding due process and constitutional safeguards, a comprehensive study of these tribunals and the broader legal crisis of India's citizenship adjudication has found.

Foreigners' Tribunals (FTs)

- **Foreigners' Tribunals (FTs)** are quasi-judicial bodies established primarily in Assam to determine the citizenship status of individuals suspected of being illegal foreigners under Indian law. Their main role is to decide whether a person is an Indian citizen or a foreigner, with profound implications for the rights, identity, and legal status of the individuals concerned.

Legal Basis and Formation

- **Origin:** FTs were constituted under the Foreigners (Tribunals) Order, 1964, issued by the Central Government using powers under Section 3 of the Foreigners Act, 1946.
- **Applicability:** While the legal framework technically covers all India, FTs are practically functional only in Assam due to the region's unique historical and demographic context, especially issues surrounding illegal immigration from neighboring Bangladesh.

Purpose and Function

- **Primary Function:** To determine whether a person suspected of being a foreigner is actually a foreigner as per Indian law.
- **Authority to Refer Cases:** District Magistrates or border police can refer cases of suspected foreigners to the tribunals. Additionally, "Doubtful" (D) voters (those whose citizenship is in doubt) and those left out of the NRC (National Register of Citizens) are often referred.

- **Appeals:** After a 2019 amendment to the Foreigners (Tribunals) Order, individuals themselves can approach FTs for redress, not just government authorities.

Structure and Membership

- **Composition:** Each tribunal comprises a member with judicial experience—typically a retired district judge, advocate, or senior civil servant.
- **Current Status:** There are around 100 functioning FTs in Assam, though as many as 300 were at one point sanctioned due to NRC-related work.

Procedure

1. **Notice:** Upon receiving a case, the FT must serve notice to the person alleged to be a foreigner within 10 days, in English or the state's official language.
2. **Response and Evidence:** The individual has 10 days to reply and an additional 10 days to provide relevant evidence.
3. **Powers:** FTs can summon witnesses, examine evidence, and require document production, akin to a civil court.
4. **Burden of Proof:** Under Section 9 of the Foreigners Act, the individual ("proceedee") must prove they are not a foreigner, reversing the normal burden of proof in most criminal or civil cases.
5. **Time Limit:** FTs are required to decide the case within 60 days of receiving the reference.

Outcomes

- **Decision:** If the tribunal finds the individual to be a foreigner, they may be detained in a "transit camp" (detention center) pending deportation or further legal process.
- **Ex-parte Orders:** Many individuals have been declared foreigners ex-parte if they fail to appear or defend their case, raising concerns about fairness and due process.

- **Appeals and Revisions:** While there are avenues for review and appeal, many decisions have faced critique for lacking procedural safeguards.

Criticisms and Issues

- **Due Process:** There have been significant concerns about access to legal representation, language barriers, procedural lapses, and high rates of ex-parte (without hearing) rulings.
- **Massive Impact:** FTs played a pivotal role during the NRC process in Assam, which left 1.9 million people at risk of statelessness.
- **Controversial Burden:** Placing the burden of proof on individuals, often with weak documentation, has sparked national and international criticism.
- FTs are **quasi-judicial bodies** and are **not bound by the Civil Procedure Code or Evidence Act**. They are governed by principles of **natural justice** and may lay down their own procedures (Foreigners (Tribunals) Order, 1964).
- FTs **do not take suo motu cognizance**. Referrals are made by designated competent authorities—such as the Assam Border Police or NRC authorities. There is **no legal provision** for tribunals to initiate proceedings on their own.
- As per **Section 9 of the Foreigners Act, 1946**, the **burden of proof lies on the individual** to prove that they are not a foreigner.
- FTs are not related to **Article 239AA** (which deals with **Delhi's governance**). Their legal basis is **statutory, not constitutional**, specifically under the **Foreigners Act, 1946** and the **Foreigners (Tribunals) Order, 1964**.

12. Vishaka Guidelines

Context: A young student's self-immolation at a college in Balasore, Odisha has put the spotlight on the Internal Complaints Committee (ICC) which failed to validate her complaints of sexual harassment against her head of the department.

More on the news:

- The victim's family alleges:

- **ICC members lacked proper training.**
- The **environment was biased** in favor of the accused.

What is the Law Behind the ICC?

- The idea originated from the **1997 Vishaka judgment** of the Supreme Court, following the **Bhanwari Devi case**.
- The **Vishaka Guidelines**:
 - Defined sexual harassment at the workplace.
 - Mandated **complaint committees** with:
 - A woman as **chairperson**.
 - **At least 50% women members**.
 - **Third-party representation** to ensure neutrality.
- Post the **2012 Nirbhaya case**, the **POSH Act, 2013** (Sexual Harassment of Women at Workplace Act) was enacted:
 - It **superseded the Vishaka Guidelines**.
 - Required **ICCs in all workplaces** with more than **10 employees**.
 - Women in **informal/small setups** could approach **Local Committees** set up by district authorities.

What are the Powers of an ICC?

- **Composition:**
 - Headed by a **senior woman employee**.
 - At least **two employees** with experience in law/social work.
 - One **external member** from an NGO or someone familiar with the issue.
 - **Minimum 50% women** in the committee.
- **Functioning:**
 - Any **aggrieved woman** may file a **written complaint** within **three months** of the incident(s).
 - Committee may attempt **conciliation** (on request) or conduct a **formal inquiry**.
- **Legal Powers:**
 - Same as a **civil court** under the **Code of Civil Procedure**.
 - **Inquiry must be completed within 90 days**.
 - Can recommend **disciplinary action** if the complaint is proved.

- Employer must **assist the victim** in filing a criminal case if she desires.

- **Confidentiality:**

- Mandatory for all details: names, addresses, proceedings, and outcomes.

What is the Status of Their Implementation?

- Despite a decade since enactment, **ICCs are not universally implemented**.
- In **December 2024**, the **Supreme Court criticized poor enforcement**, terming it a “**sorry state of affairs**”.
- Directed:
 - **Immediate compliance** by government bodies.
 - **Survey** of both public and private sector organizations.
- **Monitoring concerns:**
 - District officers are to collect compliance reports, but **follow-up is unclear**.
 - **Ministries involved:**
 - **Women and Child Development** – Nodal ministry for POSH.
 - **Labour and Industries Ministries** – Engage with workplaces, creating **accountability gaps**.
- The ICC must have at least one **external member** from an NGO or someone with expertise in sexual harassment matters to ensure neutrality.
- ICCs are **civil/quasi-judicial bodies**, not criminal courts; they cannot punish under IPC but can recommend action, including disciplinary measures.
- The Act explicitly mandates **confidentiality** regarding the identity of the complainant, respondent, and details of the inquiry.
- While the **Women and Child Development Ministry** is the **nodal ministry**, the **Labour and Industries Ministries** interface with workplaces—creating a jurisdictional challenge.



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ECONOMY

1. Electricity Futures

Context: In June, the MCX got the markets regulator's nod to launch electricity futures. These futures contracts will strengthen the power trading ecosystem and provide market participants a structured mechanism to hedge against electricity price volatility.

Understanding Electricity Futures

- **Nature of Electricity Pricing:**
 - Electricity cannot be stored economically on a large scale.
 - Pricing and supply are inherently volatile.
 - Demand varies widely across hours, days, and seasons.
- **Role of Electricity Futures:**
 - Financial derivatives designed to manage price volatility and aid planning.
 - Standardised contracts to buy/sell electricity at pre-determined future prices.
 - Distinct from spot markets where transactions occur for immediate settlement.
- **Need for Futures:**
 - Spot electricity prices (Jan 2016 - May 2025) showed high monthly volatility (20.4%).
 - Futures help hedge price risks for generators, distribution companies, industrial consumers, and traders.

Price Discovery, Investments & Planning

- **Market Transparency:**
 - Futures reflect collective market expectations of future supply-demand conditions.
 - Supports informed decision-making beyond short-term spot trends.
- **Enabling Investments:**
 - Provide certainty over future returns, aiding long-term investments in generation and transmission.
 - Serve as benchmark contracts for project viability, financing, and power purchase agreements.

• Risk Mitigation:

- Generators can secure minimum selling prices.
- Industrial consumers can lock in future power purchase costs to avoid price spikes.
- Utilities can plan procurement schedules, manage peak-load costs, and budget effectively.

The Global Experience

- **United States:**
 - PJM Interconnection contributes to organised electricity markets.
 - Futures traded on NYMEX linked to hub prices, reducing price volatility and enhancing market depth.
- **Europe:**
 - Nord Pool and EEX facilitate electricity derivatives trading, with contracts up to six years.
 - EEX is integrated with EU carbon markets and operates across multiple European nations.

Monthly Base Load Contracts on MCX

- **MCX Electricity Futures Launch:**
 - Marking a key development for India's power sector post-regulatory approvals.
 - Aimed at supporting risk management and price discovery amid rising renewable integration and demand volatility.
- **Contract Structure:**
 - Monthly Base Load contracts with a four-month tenure.
 - Introduced on the first business day of each month, trading until the business day before expiry month-end.
 - Financially settled based on VWAP of Day-Ahead Market Unconstrained Market Clearing Prices (DAM-UMCPs) on IEX during the expiry month.
- **Objective:**
 - Strengthen India's power trading ecosystem.

- Provide structured mechanisms to hedge against price volatility.

Future-Ready with Power Derivatives

- **Growing Electricity Demand:**
 - Driven by urbanisation, industrialisation, digital infrastructure, and heating/cooling needs.
 - Per capita consumption rose to 1,538 kWh in FY25 from 1,395 kWh in FY24.
- **Market Growth Potential:**
 - The electricity derivatives market is poised for significant growth as demand surges.
 - Effective price risk management will be critical amid renewable integration and spot market volatility.
- **Strategic Importance:**
 - Futures will unlock a multi-billion-dollar opportunity in energy trading.
 - Will become integral for economic planning and energy security amid decarbonisation, digitisation, and decentralisation.
- The launch of Monthly Base Load Electricity Futures on MCX will aid risk management, price discovery, and structured hedging, strengthening India's power trading ecosystem.
- MCX Electricity Futures are financially settled, not physically delivered. Settlement is based on VWAP of DAM-UMCPs on IEX, not physical delivery to consumers.

2. Dollar Settlement Bank

Context: CCIL IFSC Ltd, a subsidiary of The Clearing Corporation of India Ltd (CCIL) has entered into an agreement with Standard Chartered Bank, whereby Standard Chartered Bank will act as the Settlement Bank for the Foreign Currency Settlement System (FCSS) of CCIL IFSC Ltd in Gift City, Gujarat, an official statement said here June 28.

What is a Dollar Settlement Bank?

- A **Dollar Settlement Bank** is a financial institution that facilitates the clearing and settlement of transactions denominated in US

dollars. It acts as an intermediary, ensuring that payments and transfers involving the US dollar are processed efficiently and securely between parties—often across borders or within specialized financial zones.

Key Functions

- **Transaction Processing:** Handles real-time or end-of-day settlement for dollar-denominated trades, including securities, forex, and commercial transactions.
- **Clearing and Settlement:** Ensures the safe exchange of funds between buyers and sellers, reducing settlement risk and improving transaction speed.
- **Payment Infrastructure:** Provides the technological and operational backbone for dollar settlements, often integrating with global payment networks and central banks.
- **Liquidity Management:** Supports the movement and management of large sums in US dollars, crucial for international trade and investment.

How Does Dollar Settlement Work?

1. **Initiation:** A transaction (such as a trade or payment) is initiated in US dollars.
2. **Clearing:** The settlement bank verifies and matches payment instructions between counterparties.
3. **Settlement:** The actual transfer of dollar funds occurs, with the settlement bank ensuring that the seller receives payment and the buyer receives assets or services.
4. **Confirmation:** Both parties are notified once the transaction is complete and the funds are available.

Importance in Global Finance

- **Facilitates International Trade:** By enabling efficient dollar settlements, these banks support global commerce, investment, and capital flows.
- **Reduces Risk:** Centralized settlement reduces the risk of failed trades and payment delays, especially in high-value transactions.

- **Enhances Market Access:** Essential for financial hubs and international business centers, such as India's GIFT City, where real-time dollar settlements attract global investors.

Example: Dollar Settlement Bank in India's GIFT City

- Standard Chartered Plc has been chosen as the dollar settlement bank for real-time settlement of all dollar-denominated trades in India's Gujarat International Finance Tec-City (GIFT City). This move is designed to speed up transactions and attract more foreign investment as India integrates with global financial markets.

3. Financial Fraud Risk Indicator

Context: The Reserve Bank of India (RBI) has advised all banks to integrate the Financial Fraud Risk Indicator tool.

The Financial Fraud Risk Indicator (FRI)

- It was launched by the **Department of Telecommunications (DoT) Intelligence Unit** in May 2025.
- It is a **risk-based metric** that classifies a mobile number to have been associated with Medium, High, or Very High risk of financial fraud.
 - This classification is an outcome of inputs obtained from various stakeholders including reporting on Indian Cyber Crime Coordination Centre (I4C's) National Cybercrime Reporting Portal (NCRP), DoT's Chakshu platform, and Intelligence shared by banks and financial institutions
- It **helps banks, NBFCs, and UPI providers prioritize** actions against high-risk numbers by declining suspicious transactions and issuing alerts.
 - Major institutions like PhonePe and ICICI Bank are already using FRI, enhancing fraud prevention in India's digital payments ecosystem.

Importance

- This technology-driven initiative supports the government's Digital India vision by strengthening digital trust, enabling real-time fraud detection, and fostering collaboration between telecom and financial sectors.
- This move strengthens the fight against cyber financial frauds through inter-agency collaboration and highlights the importance of API-based real-time data exchange between banks and DoT to improve fraud risk detection.

4. Weather Derivatives in India

Context: The National Commodity and Derivatives Exchange Ltd (NCDEX) on Thursday said it has inked an agreement with the India Meteorological Department (IMD) that will lay critical groundwork for launching India's first weather derivatives.

Weather Derivatives in India

- **Weather derivatives are financial instruments that allow businesses and individuals to hedge against the financial risks posed by unpredictable weather events.** Unlike traditional insurance, which compensates for actual losses, weather derivatives provide payouts based on objective weather indices—such as rainfall, temperature, or humidity—measured at specified locations and times.

Importance in India

- India's economy is highly sensitive to weather, especially rainfall, due to its large agrarian base. Agriculture contributes significantly to the country's GDP and employs a substantial portion of the population. Over 50% of Indian agriculture depends on rainwater irrigation, making it particularly vulnerable to monsoon variability. Weather derivatives offer a market-based solution to manage these risks, providing financial protection against adverse weather conditions.

Key Sectors Impacted

- **Agriculture:** Farmers and agribusinesses can hedge against poor monsoons or unseasonal rains.
- **Energy:** Power producers and distributors can mitigate risks from temperature fluctuations affecting demand.
- **Tourism & Transport:** These sectors can manage losses from extreme weather events.

Recent Developments

- In 2025, India took a significant step by initiating its first weather derivatives market. The National Commodity & Derivatives Exchange (NCDEX) partnered with the India Meteorological Department (IMD) to launch weather-indexed futures, starting with rainfall-based derivatives. These products are designed to help farmers, traders, and allied sectors hedge against climate-related risks like erratic rainfall, heatwaves, and unseasonal weather events.

How It Works

- **Index Creation:** Weather indices, such as the Indian Monsoon Index, track rainfall or temperature over specific periods and locations.
- **Contract Design:** Derivative contracts are settled based on the actual value of the weather index, rather than on reported losses.
- **Data Source:** High-quality, real-time, and historical weather data from IMD ensures accuracy and transparency in contract settlement.

Benefits

- **Risk Management:** Provides a hedge against weather variability, reducing income uncertainty for farmers and businesses.
- **Market Transparency:** Objective indices remove the subjectivity and delays associated with traditional insurance claim assessments.
- **Financial Inclusion:** Enables even small-scale farmers to access sophisticated risk management tools.

Challenges

- **Awareness:** Many potential users are unfamiliar with how weather derivatives work.
- **Regulation:** Effective oversight is crucial to prevent misuse and ensure market stability.
- **Data Infrastructure:** Reliable and granular weather data is essential for accurate index construction and fair settlements.

5. India's Gini Index

Context: India's Gini Index score stands at 25.5, with only Slovak Republic, Slovenia and Belarus faring better.

More on the news:

- Inequality in India has come down significantly between 2011-12 and 2022-23, making it the fourth-most equal country globally, according to a World Bank report.
- This is in addition to a sharp decrease in extreme poverty, which has dropped from 16.2% in 2011-12 to 2.3% in 2022-23, an official release said, quoting World Bank data.
- The government attributed the reduction in inequality to various initiatives and schemes pursued during the past decade.
- The only three countries that have a better Gini Index score, a measure of equality, are the Slovak Republic, Slovenia and Belarus.
- India is much better placed than countries like China, the United States and the United Kingdom.

Gini Index:

- The Gini Index helps in understanding how equally income, wealth or consumption is distributed across households or individuals in a country.
- It ranges in value from 0 to 100.
- A score of 0 means perfect equality, while a score of 100 means one person has all the income, wealth or consumption and others have none, hence absolute inequality.

- The higher the Gini Index, the more unequal a country is.
- India's score is much lower than China's 35.7 and far lower than the United States, which stands at 41.8.
- As per the World Bank's report, which has released the data for 167 countries, India falls into the "moderately low" inequality category, which includes Gini scores between 25 and 30.
- India is only a fraction away from joining the "low inequality" group.

Note: The Gini Coefficient measures income inequality, ranging from 0 (perfect equality) to 1 (perfect inequality). An increase from 0.32 to 0.48 indicates worsening income inequality.

6. Arbitrage Funds

Context: Arbitrage funds saw record inflows in May amid market volatility and tax benefits. Treated as equity for taxation, they offer short-term stability and attractive post-tax returns, especially for HNIs. Experts see continued interest due to rising cash-futures spreads and arbitrage opportunities.

What Are Arbitrage Funds?

- **Arbitrage funds** are hybrid mutual funds that primarily generate returns by exploiting price differences for the same asset in different markets, most commonly between the cash (spot) market and the futures (derivatives) market. This approach allows the fund manager to capitalize on minute price mismatches with minimal directional risk, aiming to deliver stable, low-volatility returns.

How Do Arbitrage Funds Work?

- **Identifying Opportunities:** Fund managers actively look for securities that are priced differently across the cash and futures markets.
- **Executing Trades:** The fund buys the asset in the market where it is cheaper (such as the spot market) and simultaneously sells it in the market

where its price is higher (such as the futures market).

- **Locking in Gains:** By executing these trades at the same time, the profit is "locked in" as the price difference, regardless of the overall market movement, thereby neutralizing significant market risk.
- **Repetition:** Since individual profits are small, funds make numerous such trades across the portfolio to accumulate reasonable gains.
- **Parking in Debt:** If arbitrage opportunities aren't available, funds typically allocate assets to debt or money market instruments for short durations.

Example

- If a stock trades at ₹100 in the cash market and ₹105 in the futures market, the fund manager buys it on the cash market and sells it on the futures market, ensuring a ₹5 risk-free profit per share (minus transaction costs).

Key Features

- **Hybrid Nature:** Must invest at least 65% in equities and equity-related securities (as per SEBI rules), which also enables taxation as an equity fund in India.
- **Low Risk:** Considered lower risk than pure equity funds, as profit is not dependent on market direction but on price discrepancies.
- **Hedged Exposure:** Most positions are hedged to limit risk from market movements.
- **Benefit in Volatile Markets:** Perform best during periods of heightened market volatility, when price differentials between spot and futures markets are larger.
- **Active Management:** Require skilled fund managers to continually spot and exploit arbitrage opportunities.

Types of Arbitrage Used

- While the mainstay is **cash-futures arbitrage**, other forms—such as **spatial arbitrage** (across exchanges like NSE and BSE), **index arbitrage**,

or **merger arbitrage**—can occasionally be used by such funds.

Suitability

- **Conservative Investors:** Those seeking relatively stable returns with lower risk in volatile markets.
- **Short-Term Parking:** Can serve as an alternative to liquid funds for short-term surplus funds, owing to their tax advantage and relative stability.
- **Tax Efficiency:** Taxed as equity funds in India, providing better post-tax returns for investors in higher tax brackets.

7. Regional Rural Banks

Context: Nabard Chairman Shaji KV said on July 7, IT integration of recently amalgamated Regional Rural Banks (RRBs) on the principles of 'One State One RRB' is expected to be completed by September 15.

Regional Rural Banks (RRBs):

- **Establishment:** Regional Rural Banks (RRBs) were created under the **RRB Act, 1976**, based on recommendations of the **Narasimham Committee on rural credit**.
- **First RRB:** Prathama Grameen Bank, established on **2 October 1975**.
- **Nature:** RRBs are **Scheduled Commercial Banks** operating in specific regions to serve rural needs.
- **Sponsor Banks:** Each RRB is sponsored by a major public sector bank that provides capital, technology, and managerial support.
 - Post-Merger under One State, One RRB Policy, sponsors will guide **operational integration** and **support business strategy** for the new entities.
- **Ownership Structure:** **50%** Central Government; **35%** Sponsor Bank; **15%** State Government.
 - Despite capital reforms, the **govt** retains a 50% shareholding under the One State, One RRB Policy.

- **Sources of Funds:** RRBs are funded through owned funds, public deposits, and borrowings from NABARD, sponsor banks, SIDBI, National Housing Bank, and other approved institutions.
 - **RRB Act 2015 Amendment:** RRBs can raise capital from sources beyond govt & sponsor banks.
- **Priority Sector Lending:** As per RBI norms revised in 2016, RRBs must allocate **75%** of their total lending to priority sectors within sub-targets.
- **Regulation:** Regulated by Reserve Bank of India (RBI) and supervised by **NABARD**.
- **Management Structure:** Governed by a **Board of Directors** comprising one Chairman, up to 3 Central Govt nominees, up to 2 State Govt nominees, and up to 3 nominees from sponsor bank.
- **Past Consolidation Phases:**
 - **Initial Number:** 196 RRBs.
 - **Post-Consolidation (2020-21):** Reduced to 43 RRBs.
 - **Present Reform:** Set to reduce to 28 under this policy.
- RRBs were established under the **Regional Rural Banks Act, 1976**, not the Banking Regulation Act, 1949, and they provide both short-term and long-term credit to rural sectors, not exclusively short-term.
- The **ownership structure is 50% (Central Govt), 15% (State Govt), and 35% (Sponsor Bank)**.
- The **Narsimham Committee did not recommend amalgamation of RRBs**; this was recommended under the recommendations of the Vyas Committee and as part of the Government's strategy to strengthen **RRBs under the roadmap for financial inclusion and recapitalisation plans**.

8. Surety Bonds

Context: GIC Re, India's largest reinsurer, is strategically expanding its international operations following a credit rating reinstatement, aiming to diversify risks and boost its global footprint.

Surety Bonds:

What is a Surety Bond?

A **surety bond** is a legally binding agreement involving three distinct parties:

- **Principal:** The person or business required to perform a specific obligation.
- **Obligee:** The party (often a government agency, project owner, or client) who requires the bond as protection.
- **Surety:** The company or institution that issues the bond, guaranteeing the principal's fulfillment of obligations. If the principal fails, the surety covers losses for the obligee and then seeks repayment from the principal.

How Does a Surety Bond Work?

- The principal applies for a surety bond, and the surety evaluates their reliability and financial stability.
- The surety issues the bond, providing the obligee assurance that obligations will be met.
- If the principal fails in their duties, the surety pays the obligee for losses or completes the contract; however, the principal must ultimately reimburse the surety.
- This setup is more akin to a **form of credit** rather than insurance: surety bonds guarantee performance or payment, but the financial risk stays with the principal.

Key Features and Benefits

- **Financial Assurance:** Provides security to the obligee that contracts or legal obligations will be fulfilled.
- **Risk Mitigation:** Reduces the risk of loss due to contractor or business failure.
- **Builds Trust:** Often required by law or contract to ensure compliance and reliability in regulated industries.
- **Enables Business Opportunity:** Helps principals win contracts and enter new markets by assuring clients of performance.

Industry Applications

- **Construction:** Bid, performance, and payment bonds are basics for government and private projects.
- **Public Offices:** Many officials require bonds to guarantee honest and faithful performance.
- **Business Licensing:** Many sectors (finance, auto dealerships, contractors) require commercial surety bonds for legal operation.
- **Legal Proceedings:** Court bonds for parties involved in litigation or fiduciary roles (administrator, guardian, executor).
- Surety bonds are provided by **insurance companies to guarantee project performance on behalf of contractors** to the project owner (obligee).
- If the **contractor defaults**, the insurance company (surety) **pays compensation up to the bond amount**, recovering later from the contractor.
- Unlike **bank guarantees**, surety bonds **do not require the contractor to provide cash collateral**, thus improving liquidity for contractors, which is why they are promoted in India's infra sector.

9. Earth Intelligence

Context: The cumulative direct revenue from Earth intelligence for technology product and service providers is projected to reach \$20 billion between 2025 and 2030, according to Gartner.

What is Earth Intelligence?

- Earth intelligence refers to the **use of AI and advanced analytics on Earth observation data**—such as satellite images, drone footage, and IoT sensor data—to generate actionable insights for industries and governments.
- For Example, this technology enables:
 - Identifying fallen trees blocking railroad tracks after storms
 - Monitoring temperatures of metal refineries to assess global production
 - Counting vehicles to analyse traffic patterns and consumer trends

- In India, **Earth intelligence** is already being used for mineral exploration, disaster management, and agricultural productivity, with initiatives like AI-driven mineral targeting and drone-based land surveys.

10. Fully Convertible Warrants

Context: Zee Entertainment's proposal to issue Rs 2,237 crore worth of fully convertible warrants to its promoters, aimed at increasing their stake from 3.99% to 18.39%, has been rejected by shareholders at its EGM.

Fully Convertible Warrants

- A **fully convertible warrant** is a financial instrument that gives the holder the right, but not the obligation, to purchase a specified number of equity shares of a company at a predetermined price within a defined period, typically up to 18 months from the date of allotment. Each warrant usually converts into one equity share, and the conversion can be exercised in one or more tranches during the allowed period.

Key Features

- **Right to Buy Shares:** The warrant holder can acquire equity shares at a fixed price (termed "conversion price")—regardless of prevailing market rates at the time of conversion.
- **Upfront Payment:** Typically, 25% of the issue price is paid at the time of warrant allotment, while the remaining 75% is paid upon conversion into equity shares.
- **Exercise Period:** The warrant can be converted into shares at any time within the specified period (often 18 months) from allotment.
- **No Obligation:** If the warrant is not exercised within the period, it lapses, and the holder forfeits the opportunity to convert.
- **Dilution and Ownership:** When exercised, these warrants result in the issuance of new shares, thereby diluting existing shareholder equity.

Use Cases

- **Promoter Funding:** Companies often issue fully convertible warrants to promoters or strategic partners, allowing them to increase their stake over time at pre-agreed prices.
- **Fundraising:** Such warrants are used to raise capital without immediate equity dilution, offering companies flexibility and investors potential upside if the share price appreciates.
- **Incentive Tool:** Fully convertible warrants are sometimes used to incentivize early-stage or risk-taking investors by offering future participation in company growth.

Regulatory Framework

- As per regulatory guidelines (like SEBI's ICDR Regulations), convertible warrants must be allotted within a fixed timeline, and payments are structured in tranches.
- Conversion leads to the new equity being issued in dematerialized form, ranking pari-passu (equal) with existing shares.

Risks & Considerations

- **Market Risk:** If the share price remains below the conversion price during the warrant period, it may not be profitable for the holder to convert, rendering the warrant worthless.
- **Dilution:** Existing shareholders may face dilution if a large number of warrants are converted into equity.
- **Regulatory Conditions:** Conversion and allotment processes are governed by regulatory approvals and compliance standards to protect investor interests.

11. European Free Trade Association

Context: Switzerland has completed the ratification process of the trade agreement signed between India and four-nation European Free Trade Association (EFTA) in March last year.

European Free Trade Association (EFTA)

- The **European Free Trade Association (EFTA)** is an intergovernmental organization established

in 1960 to promote free trade and economic integration among its member states, both within Europe and globally. EFTA serves as an alternative trade bloc to the European Union (EU), allowing its members greater independence in setting their trade policies.

Current Member States

Today, EFTA consists of the following four European countries:

- **Iceland**
- **Liechtenstein**
- **Norway**
- **Switzerland**

While these countries cooperate closely with the EU—participating in agreements such as the European Economic Area (EEA) and the Schengen Area—they are not members of the EU Customs Union.

Historical Background

- **Founded:** 1960, by Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom ("Outer Seven").
- Over time, many original members, such as Austria, Denmark, Portugal, Sweden, the UK, and Finland, left EFTA to join the EU.
- Iceland joined in 1970, and Liechtenstein in 1991. Today, only Norway and Switzerland remain from the founding group.

Objectives and Functions

- **Promote Free Trade:** Eliminate tariffs and other trade barriers among member states for goods, and enhance integration in services and investment.
- **Economic Integration:** Foster economic growth and competitiveness while enabling members to retain sovereignty over key policy areas like agriculture and fisheries.
- **International Trade Agreements:** Jointly negotiate and maintain a vast network of free

trade agreements (FTAs) with over 60 non-EU countries and the EU itself.

- **EEA Agreement:** Three members (Iceland, Liechtenstein, Norway) participate in the EEA, which allows for free movement of goods, services, people, and capital with the EU. Switzerland maintains similar access through bilateral agreements.

Governance

- **EFTA Council:** The highest decision-making body, meeting regularly at ambassadorial and ministerial levels.
- **Secretariat:** Headquarters in Geneva (managing EFTA Convention and FTAs), with offices in Brussels (managing EEA agreements) and Luxembourg (statistical cooperation).

EFTA vs. EU

- EFTA enables members to pursue their own bilateral trade deals, unlike the EU, which negotiates trade agreements as a bloc.
- While EFTA promotes economic cooperation, it does not seek the same level of political integration as the EU
- Iceland, Liechtenstein, and Norway (EFTA members) participate in the **EEA Agreement**, enabling them to access the EU's single market without being EU members.
- Switzerland is an EFTA member **but is not part of the EEA Agreement**; it has **separate bilateral agreements** with the EU for limited single market access, not under EEA.
- EFTA agreements **cover both trade in goods and services**, and its modern FTAs with other countries also include investment and intellectual property provisions.

12. Global Capability Centers

Context: India is working on comprehensive policy interventions to accelerate the growth of Global Capability Centers (GCCs).

What are Global Capability Centers (GCCs)?

- These are **offshore units** established by **multinational corporations** to manage a wide range of business functions like software development, data analytics, cybersecurity, cloud computing, and customer experience management.
- These are **wholly owned subsidiaries of global firms**, offering strategic control and alignment with corporate goals.
- GCCs have evolved from **cost-saving BPO units** to strategic innovation hubs driving digital transformation, AI, and R&D.
- They differ from traditional outsourcing by focusing on value creation, innovation, and digital transformation.

Why do GCCs Matter for India?

- **High-Value Services:** GCCs deliver advanced services in AI, cloud computing, and digital transformation.
- **Skill Development:** Government initiatives like the **PM Internship Scheme** and **Mutual Recognition of Skills and Standards** are aligning workforce capabilities with GCC needs.
- **Global Outreach:** India is attracting non-US multinationals from Germany, Japan, and Nordic countries, diversifying its GCC portfolio.
- GCCs (also known as Global In-house Centres, GICs) **provide a range of support services including IT, business process management, engineering services, R&D, analytics, and digital transformation** for parent MNCs, not limited to IT alone.
- India **hosts over 1,500 GCCs** (as of 2024 estimates), making it one of the largest global hubs, with increasing movement towards **higher-value work including product innovation, AI/ML, advanced analytics, and digital transformation**.
- GCC operations contribute to **services exports**, strengthening **India's services trade surplus** by bringing foreign exchange inflows and generating high-value employment.

13. Bond Price and Bond Yield

Context: Indian government bonds little changed on July 23 in the absence of any fresh domestic triggers and shrugging off a decline in U.S. Treasury bonds.

Bond Price and Bond Yield:

- **Bond price** is the current market value of a bond, while **bond yield** refers to the return an investor expects from holding the bond, typically expressed as an annual percentage.

Key Definitions

- **Bond Price:** The price at which a bond is bought or sold in the market, which may differ from its face (par) value.
- **Coupon Rate:** The fixed annual interest paid by the bond issuer, based on the face value.
- **Current Yield:** The annual coupon payment divided by the bond's current market price.
- **Yield to Maturity (YTM):** The total return expected on a bond if held until it matures; it takes into account all coupon payments and the difference between purchase price and face value.

Relationship Between Bond Price and Yield

- Bond prices and yields have an **inverse relationship**:
 - When the **bond price rises**, the yield falls.
 - When the **bond price falls**, the yield rises.
- This happens because the coupon rate is fixed, while the bond's market price changes due to fluctuations in prevailing interest rates or shifts in demand and risk perception.

Example:

- When the market interest rate falls below the bond's coupon rate (the bond pays 9%, but similar new bonds yield only 7%), the bond becomes more attractive to investors. Therefore, its price in the secondary market increases above its face value (₹1,000), so investors pay a premium to receive the higher coupon payments.

14. Foreign Exchange Management Act

Context: The Enforcement Directorate on July 23 said it has registered a FEMA case against Flipkart-backed e-commerce platform Myntra, linked companies and directors for FDI “contravention” of over Rs 1,654 crore.

About Foreign Exchange Management Act (FEMA):

- FEMA is an enactment that deals primarily with the provisions relating to cross-border trade and payments thereof.
- It defines the procedures, formalities, and dealings of all foreign exchange transactions in India.
- It was introduced in 1999 as a replacement for the earlier Foreign Exchange Regulation Act (FERA).
- FEMA’s head office is known as Enforcement Directorate and is situated in Delhi.
- **Primary objective:** To help facilitate external trade and payments in India.
- **Other objectives:**
 - To help orderly development and maintenance of the foreign exchange market in India.
 - To facilitate transactions involving a foreign exchange or foreign security and payments from outside the country to India only through an authorized person.
 - To encourage dealings in foreign exchange under the current account through an authorized person.
 - To authorize the Reserve Bank of India to subject capital account transactions to a number of restrictions.
- **Applicability:**
 - It is applicable to all parts of India.
 - It is also equally applicable to the offices and agencies located outside India but managed or owned by an Indian Citizen.
 - FEMA is applicable to the following entities and transactions
 - Any citizen of India residing in the country or outside (NRI);
 - Any overseas company that is owned 60% or more by an NRI (Non-Resident Indian);
 - Any Associate Branches or subsidiaries, outside India, of companies or bodies corporate, registered or incorporated in India;
 - Exports of any goods and services from India;
 - Imports of goods and services to India;
 - Banking, financial, and insurance services provided outside India;
 - Cross-border sale, purchase, and exchange of any kind (i.e. Transfer).
- Current account transactions are generally free but **subject to reasonable restrictions** by the Central Government in public interest. Hence, they are **not entirely unrestricted**.
- FEMA defines "Person Resident in India" based on **physical presence** (more than 182 days in the preceding financial year), **regardless of nationality**, unless they intend to stay outside India permanently.
- All foreign exchange transactions under FEMA must be conducted through **Authorized Persons** (includes banks, money changers, etc.) approved by the RBI.
- Compounding under FEMA is permitted to avoid litigation. **RBI handles compounding for most cases**, while certain cases (e.g., involving money laundering or serious enforcement) fall under **Enforcement Directorate (ED)**.

15. GST Burden on different classes of citizens

Context: A recent study analysing India’s Goods and Services Tax (GST) regime using the 2022–23 Household Consumption Expenditure Survey (HCES) has revealed that the bottom 50% of consumers bear the same GST burden as the middle 30%, raising important questions about the tax system’s progressivity and equity.

Key Findings from the Study

- The study by Prof. Sacchidananda Mukherjee of the National Institute of Public Finance and Policy (NIPFP) highlights the following:

- **Rural Areas:**
 - Bottom 50% bear **31%** of the GST burden
 - Middle 30% also bear **31%**
 - Top 20% carry **37%**
- **Urban Areas:**
 - Bottom 50% bear **29%**
 - Middle 30% account for **30%**
 - Top 20% shoulder the highest burden at **41%**
- These findings contrast with earlier reports, such as **Oxfam's 2023 Analysis**, which claimed the **poorest 50% contributed nearly two-thirds of total GST** collections, while the richest 10% contributed only 3–4%.

Progressive tax:

- A **progressive tax** is a taxation system in which the tax rate increases as an individual's or entity's income rises, meaning higher earners pay a larger percentage of their income in taxes compared to lower-income individuals. This is usually structured through tax brackets, where different portions of income are taxed at escalating rates.

Key Characteristics

- **Increasing Rates:** As taxable income or wealth grows, so does the percentage taxed.
- **Redistributive Effect:** Designed to reduce income inequality by taxing those who can afford to pay more and facilitating wealth redistribution through public services and welfare.
- **Equity Focus:** Ensures the tax burden is proportionate to the taxpayer's ability to pay.

Common Examples

- **Individual Income Tax:** Most personal income tax systems, including those in India and the U.S., are progressive, with multiple tax brackets.
- **Corporate Tax:** Larger, more profitable companies often face higher tax rates.
- **Capital Gains and Luxury Taxes:** Often structured so that the rate increases with the amount or value involved.

Note: Option d shows a classic case of a **progressive tax**, where the **tax rate increases with income level**.

16. National Financial Reporting Authority

Context: Shri Nitin Gupta (Retd. IRS), former CBDT Chairman, has taken charge as the new Chairperson of the National Financial Reporting Authority (NFRA).

National Financial Reporting Authority (NFRA):

- The **National Financial Reporting Authority (NFRA)** is an independent regulatory body established by the Government of India under Section 132(1) of the Companies Act, 2013. Constituted on 1st October 2018, it serves as India's apex authority for regulating and overseeing the quality of accounting and auditing standards for certain classes of companies and their auditors.

Key Functions and Duties

- **Recommend Accounting & Auditing Standards:** NFRA suggests policies and standards for accounting and auditing, subject to approval by the Central Government.
- **Monitor & Enforce Compliance:** It oversees the enforcement and quality of compliance with these standards by companies and auditing professionals.
- **Oversee Audit Quality:** The authority regulates the professional conduct and service quality of auditors and audit firms, providing measures for improvement where necessary.
- **Investigate and Sanction Misconduct:** NFRA has the power to investigate cases of professional misconduct by chartered accountants or auditing firms. It can impose monetary penalties and debar auditors from practice for up to 10 years if found guilty.
- **Protect Public Interest:** It aims to protect the interests of investors, creditors, and the public by establishing high-quality standards for financial reporting and auditing.

Jurisdiction**NFRA's powers extend primarily to:**

- All listed companies (in India or abroad).
- Unlisted public companies meeting certain thresholds (paid-up capital, turnover, or outstanding loans/debentures).
- Banking, insurance, electricity, and other companies governed by specific acts.
- Any company or body corporate at the direction of the Central Government in public interest.
- Foreign subsidiaries/associates of covered Indian companies if certain financial thresholds are crossed.

Structure

- Headed by a Chairperson (appointed by the Central Government), with three full-time members and a Secretary.
- The Chairperson and members are chosen from professionals with expertise in accountancy, audit, finance, or law.

Background and Rationale

- Originated in response to major financial scandals (e.g., Satyam, Yes Bank) and the recognized need for independent regulatory oversight—distinct from self-regulation by the Institute of Chartered Accountants of India (ICAI).
- NFRA replaced the earlier National Advisory Committee on Accounting Standards (NACAS) to align with international practices and restore trust in financial reporting.

Significance

- NFRA enhances the credibility and transparency of India's financial reporting, aiming to boost investor confidence and attract domestic/foreign investments.
- Its creation aligns India with global standards, similar to the PCAOB in the United States.
- The authority complements but supersedes the investigative powers of the ICAI when it initiates an investigation.

- NFRA was constituted under **Section 132 of the Companies Act, 2013** for matters related to accounting and auditing standards.
- NFRA can investigate professional misconduct and take disciplinary action.
- NFRA's jurisdiction is **not universal**. It primarily covers **listed companies, large unlisted public companies**, and other specified entities, **not all private and unlisted firms**.
- NFRA can impose fines and debar auditors from practicing for up to 10 years.

17. Central Electricity Regulatory Commission

Context: Indian Energy Exchange (IEX) shares hit the lower circuit of Rs 169.10, a 10% decline. IEX's shares tanked after Central Electricity Regulatory Commission (CERC) approved implementation of market coupling in Day-Ahead Market (DAM) in a phased manner. The coupling of DAM is to be implemented by January 2026. The country's power exchanges to act as Market Coupling Operators (MCO) on a round-robin basis, says CERC.

Central Electricity Regulatory Commission (CERC):

- The **Central Electricity Regulatory Commission (CERC)** is a statutory, quasi-judicial body established by the Government of India under the Electricity Regulatory Commissions Act, 1998, and currently governed by Section 76 of the Electricity Act, 2003. Its primary mandate is to regulate and oversee the power sector at the central level, especially concerning interstate matters.

Key Functions and Mandate**Statutory Functions**

- **Regulation of Tariffs:** CERC regulates the tariff of power generating companies owned or controlled by the Central Government, and also of private generators if their operations span more than one state.
- **Interstate Transmission:** It regulates and sets tariffs for the inter-State transmission of electricity.

- **Licensing:** Issues licenses to transmission licensees and electricity traders for inter-State operations.
- **Dispute Adjudication:** Adjudicates disputes involving generating companies or transmission licensees regarding tariff and transmission issues.
- **Grid Standards:** Specifies and enforces the standards for grid operation and quality, continuity, and reliability of service by licensees.
- **Trading Margin:** Can fix trading margins for inter-State trading if considered necessary.
- **Other Functions:** Levies fees, specifies grid codes, and performs other functions as assigned under the Act.

Advisory Functions

- Advises the Central Government on:
 - Formulation of the National Electricity Policy and Tariff Policy.
 - Promotion of competition, efficiency, and investment in the electricity industry.
 - Any matter referred to the Commission by the Central Government.

Structure and Composition

- **Members:** CERC comprises a chairperson and typically four other members, including an ex-officio member from the Central Electricity Authority (CEA).
- **Qualifications:** Members are appointed by the Central Government and must have expertise in sectors like engineering, law, finance, commerce, or management.
- **Tenure:** Members, including the Chairperson, serve for a term of up to five years or till they reach 65 years of age.

Objectives and Impact

- **Market Development:** Promotes competition, efficiency, and transparency in bulk power markets.
- **Consumer Protection:** Works to improve the quality of supply and foster the interests of electricity consumers.

- **Policy Guidance:** Regularly advises the government to reduce institutional barriers, bridge the demand-supply gap, and optimize investments in the sector.
- CERC facilitates **grid integration of renewables** through regulations on **grid connectivity, forecasting & scheduling, deviation settlement mechanisms**, and **market-based economic dispatch** — all crucial for managing variable renewable energy sources like wind and solar.
- **Environmental clearances** for renewable energy projects are handled by the **Ministry of Environment, Forest and Climate Change (MoEFCC)**, not CERC.

18. India and the United Kingdom signed a Comprehensive Economic Trade Agreement (CETA)

Context: India and the United Kingdom signed a Comprehensive Economic Trade Agreement (CETA) during Prime Minister Narendra Modi's visit to the U.K.



- The Prime Meridian (Greenwich Meridian) passes through the Royal Observatory in Greenwich, London, which is in **England**, not Scotland. While Scotland is part of the UK, the Prime Meridian does not extend as far north as Scotland.
- The Cambrian Mountains are a series of mountain ranges located primarily in **mid-Wales**. Wales is to the west of England, and the English Channel is to the south of England. The Cambrian Mountains are inland and are not located near or flanking the English Channel coast.

19. Real Effective Exchange Rate

Context: The Indian Rupee (INR) has entered a phase of recalibrated valuation, as the Reserve Bank of India's (RBI) June 2025 bulletin reports a Real Effective Exchange Rate (REER) of 100.36, huge shift from 105.28 in March and 101.12 in May.

Real Effective Exchange Rate (REER)

- The **Real Effective Exchange Rate (REER)** is an important economic indicator that measures the value of a country's currency relative to a basket of other major currencies, adjusted for inflation. It provides a comprehensive view of a nation's international trade competitiveness over time.

Definition

- **REER** is the weighted average of a country's currency in relation to an index or basket of other major currencies, with each currency's weight determined by the share of trade between the countries.
- Unlike the **Nominal Effective Exchange Rate (NEER)**, the REER adjusts for inflation differences between the home country and its trading partners, making it a better measure of real purchasing power and competitiveness.

Calculation

1. **Basket of Currencies:** Identify major trading partners and compile both their respective

currencies and trade weights (typically by their share in total trade).

2. **Bilateral Exchange Rates:** Gather nominal exchange rates between the home currency and each partner.
3. **Adjustment for Price Levels:** Adjust each bilateral nominal exchange rate for inflation (using Consumer Price Index or Producer Price Index) in both the home country and partner countries.
4. **Weighting and Averaging:** Compute a weighted geometric average of the inflation-adjusted bilateral exchange rates based on each partner's share in total trade.
5. **Formula Example:**

$$REER = \prod_{i=1}^n \left(\frac{E_i \cdot P}{P_i} \right)^{w_i}$$

Where:

- E_i : Nominal exchange rate between home and partner country ii
- P : Domestic price index
- P_i : Price index of partner country ii
- w_i : Trade weight of partner country ii (based on trade volume/importance)
- n : Number of trading partners

Interpretation and Significance

- **Indicator of Competitiveness:** A higher REER indicates that a country's goods are more expensive to foreign buyers, potentially reducing export competitiveness. Conversely, a lower REER implies improved competitiveness for exports.
- **Policy Relevance:** Central banks and policymakers track REER to assess external balance, devise trade policies, and understand shifts in export-import attractiveness.
- **Inflation Adjustment:** Adjusting for relative price levels removes the distortion from

inflation, making year-to-year comparisons more meaningful.

Note: REER Appreciation means the country's currency has strengthened relative to a basket of currencies, adjusted for inflation differentials. This typically leads to higher prices for the country's goods abroad, making exports less competitive.

20. Gini Index ranked India among the world's most equal societies

Context: The Gini Index ranked India among the world's most equal societies, by giving the country a score of 25.5.

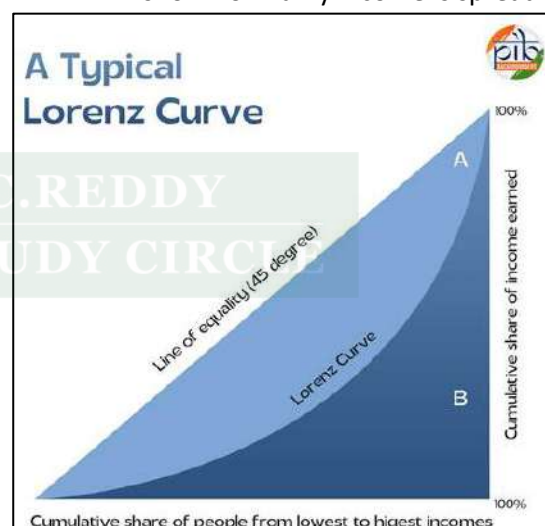
About

- India's score is much **lower than China's 35.7** and far lower than the United States, which stands at 41.8. It is also more equal than every G7 and G20 country, many of which are considered advanced economies.
- India falls into the **"moderately low" inequality category**, which includes Gini scores between 25 and 30, and is only a fraction away from joining the "low inequality" group, which includes countries like the Slovak Republic with a score of 24.1, Slovenia at 24.3, and Belarus at 24.4.
- India's extreme poverty dropped to 2.3% in 2022-23, says the World Bank and 171 million Indians moved out of extreme poverty between 2011-23.

What is a Gini index?

- It measures the extent to which the distribution of income or consumption among individuals or households within an economy deviates from a perfectly equal distribution.
- It ranges in value from **0 to 100**. A score of 0 means perfect equality.
 - A score of 100 means one person has all the income, wealth or consumption and others have none, hence absolute inequality. The higher the Gini Index the more unequal the country.

- Graphically Gini Index can be explained by the Lorenz curve.
 - A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household.
 - A perfectly equal distribution will be shown by a diagonal line, while the actual distribution will be shown by the Lorenz curve.
 - The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, or the gap between the two, expressed as a percentage of the maximum area under the line.
 - The bigger the gap, the more unequal the income. This gives one clear number to show how fairly income is spread.



Note: The Lorenz Curve graphically represents income or wealth distribution. The farther the curve is from the line of equality, the greater the inequality. Hence Country A has higher income inequality compared to Country B.



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8	CA November 2025	14.12.2025
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INTERNATIONAL RELATIONS

1. Kaladan Multimodal Transit Transport Project

Context: The Kaladan Multimodal Transit Transport Project (KMTP) between India and Myanmar would be operational by 2027.

About Kaladan Multimodal Transit Transport Project (KMTP)

- It is a major **infrastructure initiative** jointly developed by India and Myanmar to enhance connectivity between India's eastern seaboard and its landlocked northeastern states, using a combination of sea, river, and road transport.
- The project is entirely funded by India under its Grant in Aid Scheme, with the **Inland Waterways Authority of India** as the project development consultant
- Components:**
 - Sea Route:** Connects Kolkata Port (India) to Sittwe Port (Rakhine State, Myanmar) across the Bay of Bengal, covering about 539 km.
 - River Route:** From Sittwe, cargo is transported via the Kaladan River to Paletwa (158 km).

Significance

- Provides a strategic alternative to the narrow and **vulnerable Siliguri Corridor** (also known as the "Chicken's Neck"), which is currently the only land route connecting Northeast India to the rest of the country.
- Expected to boost trade and economic integration** for India's northeastern states by providing direct access to the sea and Southeast Asian markets.
- Strengthens India's 'Act East' policy**, fostering closer ties with Southeast Asia and reducing dependence on routes vulnerable to geopolitical risks.

- Enhances border trade and offers northeastern states opportunities to access new markets in Myanmar, Thailand, Malaysia, and Singapore.



2. International Seabed Authority

Context: The International Seabed Authority (ISA) is negotiating a global "mining code" to regulate the exploitation of mineral resources (nickel, cobalt, manganese) on the ocean floor in international waters. These minerals are critical for electric vehicles and emerging technologies.

The International Seabed Authority (ISA)

- It is an autonomous international organization established under the 1982 United Nations Convention on the Law of the Sea (UNCLOS).
- Objective:** ISA is the organization through which States Parties to UNCLOS organize and control all mineral-resources-related activities in the Area for the benefit of humankind as a whole.
 - It has the mandate to ensure the effective protection of the marine environment from harmful effects that may arise from deep-seabed-related activities.
- Headquarters:** Kingston, Jamaica.
- Members:** All States Parties to UNCLOS are **ipso facto** members of ISA.
 - As of 2024, ISA has 170 Members, including 169 Member States and the European Union.

3. Geelong Treaty

Context: Australia and the UK signed the bilateral Nuclear-Powered Submarine Partnership and Collaboration Treaty (the Geelong Treaty) in Geelong, Australia, solidifying their commitment to the AUKUS defense pact.

About Geelong Treaty

- The Geelong Treaty is a historic agreement that commits the UK and Australia to **50 years** of bilateral defense cooperation under **AUKUS Pillar I**.
- The Treaty will enable comprehensive cooperation on the design, build, operation, sustainment, and disposal of their **SSN-AUKUS submarines**.
- The signing of the treaty came as the United States wavered on its role in the AUKUS alliance.
 - It has announced a review of the trilateral security partnership to determine whether the agreement aligns with the **America First agenda**.

What is AUKUS?

- AUKUS is a **trilateral defence and security partnership** between **Australia, the United Kingdom and the United States**.

- It was established in **2021** to bolster their allied deterrence and defense capabilities in the **Indo-Pacific**.
- The trilateral partnership has two pillars.
 - **Pillar I** revolves around the acquisition and development of conventionally armed nuclear-powered submarines for the Royal Australian Navy;
 - **Pillar 2** focuses on cooperation in eight advanced military capability areas: artificial intelligence (AI), quantum technologies, innovation, information sharing, and cyber, undersea, hypersonic and counter-hypersonic and electronic warfare domains.



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ENVIRONMENT

1. Corporate Average Fuel Efficiency (CAFE) III Norms in India

Context: At a time when passenger vehicle manufacturers are sharply divided over the corporate average fuel efficiency (CAFE) III norms that kick in from April 2027, a new analysis by Nomura Research Institute (NRI) has come out in support of Maruti Suzuki India, highlighting that the current regulatory framework disproportionately penalises small, lightweight cars.

Corporate Average Fuel Efficiency (CAFE) III Norms in India

- Corporate Average Fuel Efficiency (CAFE) norms are regulatory standards aimed at reducing fuel consumption and carbon dioxide (CO₂) emissions from passenger vehicles. The third phase, CAFE III, represents a significant tightening of these standards in India, with far-reaching implications for automakers, consumers, and the environment.

What Is CAFE III Norms?

- Definition:** CAFE III norms set limits on the average CO₂ emissions of a manufacturer's total fleet of passenger cars, calculated on a sales-weighted basis.
- Implementation Date:** Scheduled to come into effect from **April 1, 2027**.
- Target:** The average fleet emissions must not exceed **91.7 grams of CO₂ per kilometer**, a sharp reduction from the current CAFE II limit of 113 g/km.

Key Features

- Testing Protocols:** India will transition from the Modified Indian Driving Cycle (MIDC) to the more stringent Worldwide Harmonized Light Vehicle Test Procedure (WLTP), aligning domestic standards with global practices.

- Applicability:** Applies to all passenger vehicles with a gross vehicle weight (GVW) under 3,500 kg, including those fueled by petrol, diesel, CNG, LPG, and alternative technologies such as hybrids and electric vehicles.
- Calculation:** The corporate average is based on the **kerb weight** of all vehicles sold and their standard emissions, measured under controlled laboratory conditions.

Super Credits & Incentives

- CAFE III norms offer **super credits** to encourage adoption of cleaner vehicle technologies and reward low-emission vehicles:

Multipliers for Clean Technologies:

- Battery Electric Vehicles (BEVs):** Each unit counts as four vehicles in emissions calculations (up from three in CAFE II).
- Fuel Cell Electric Vehicles (FCEVs):** Count as five vehicles.
- Hybrid Electric Vehicles (HEVs):** Earn lower multipliers but still provide credit boosts.
- Technology Credits:** Additional reductions for vehicles featuring regenerative braking, start-stop systems, advanced transmissions, and those capable of operating on higher ethanol blends.

Impact and Industry Response

- Push for Electrification:** Automakers will need to increase the proportion of hybrids, plug-in hybrids, and electric vehicles in their fleets to remain compliant.
- Affordability Concerns:** Industry leaders, particularly those with a focus on small, fuel-efficient cars, argue that the weight-based formula places a disproportionate burden on light vehicles, potentially making entry-level cars less affordable or pushing their prices up.

- **Market Transition:** The new norms could accelerate the shift toward larger vehicles equipped with advanced technologies or alternative propulsion systems, but may threaten the future of small cars in India.

Comparison with Previous Phases

Phase	CO ₂ Limit (g/km)	Test Cycle	Effective Year
CAFE I	130	MIDC	2017–18
CAFE II	113	MIDC	2022–23
CAFE III	91.7	WLTP	2027–28
CAFE IV*	70	WLTP	2032–33

*CAFE IV is a proposed future phase.

Challenges

- **Infrastructure Needs:** Achieving CAFE III targets will require rapid expansion of EV charging infrastructure and continued technological innovation.
- **Economic Impact:** Higher compliance costs may impact the price of vehicles, particularly in the entry-level segment, unless there is adequate government support.
- **Regulatory Debate:** Ongoing discussions about whether there should be differentiated norms for smaller versus larger vehicles to maintain market balance and affordability.
- CAFE norms were introduced in 2017 under the Energy Conservation Act and apply to petrol, diesel, LPG, CNG, hybrid, and electric passenger vehicles up to 3,500 kg GVW.
- Under CAFE-II (effective 2022–23), manufacturers must ensure their fleet's consumption is ≤ 4.78 L/100 km (≈ 113 g/km CO₂).
- India uses a **linear weight-based method**, not a piecewise-linear footprint model. Lighter cars face stricter targets, unlike the U.S. approach.

2. International Treaty on Plant Genetic Resources

Context: India has raised objections to proposed amendments to the International Treaty on Plant

Genetic Resources for Food and Agriculture (Plant Treaty) at the Peru.

International Treaty on Plant Genetic Resources

- **International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)** was adopted by Food and Agriculture Organization of United Nations in 2001 during the 31st session of FAO.
- Signed in 2001 in Madrid and entered into force in 2004.
- Also known as Seed Treaty, India is a signatory to it.
- **First legally-binding international instrument to formally acknowledge the enormous contribution of indigenous people and small-holder farmers as traditional custodians of the world's food crops.**
- **The treaty was aimed at:**
 - Recognizing the significant contribution of farmers to the diversity of crops that feed the world;
 - Establishing a global system to provide farmers, plant breeders and scientists with access to plant genetic materials; and
 - Ensuring that recipients share benefits they derive from the use of these genetic materials with the countries where they have originated.

Multilateral System of Access and Benefit sharing (MLS)

- The International Treaty created and administered a unique global system that enables countries to exchange much-needed plant genetic material with one another through a Multilateral System of Access and Benefit-sharing.
- Crops grown in different environments develop differently and genetic material from food plants in one country can be essential in another country that is trying to increase food production, fight plants pests, diseases and the

effects of climate change. This is made possible through the MLS of International Treaty.

- To date, its Multilateral System on Access and Benefit-sharing covers 64 of the world's major crops, accounting for about 80% of our food derived from plants.

Benefit-sharing fund

- The International Treaty established and operated a special initiative operated for the benefit of developing countries – the Benefit-sharing Fund (BSF). This Fund supports agricultural projects for farmers, public institutions and others in developing countries to conserve and use PGRFA to improve food crop production, fight plant pests and adapt to the effects of climate change. The high demand for project funding is indicative of the considerable gaps and significant need for support.
- Recipients for material from the Treaty's MLS are to pay a portion of any profits they gain from the use of such material into the BSF. The process of developing and commercialising new varieties takes time, so the amount of user-based payments is still low. Therefore, currently, the BSF rely primarily on voluntary contributions.
- **What is the New Proposal?**
 - The amendments propose **expanding mandatory obligations** under the **Multilateral System (Annex I)**.
 - **All plant germplasm** would have to be shared under **Governing Body-determined SMTA, not India's national laws**.
 - Could dilute India's **sovereign rights** and control over indigenous plant varieties.
 - Might undermine **traditional farming practices** and **seed-saving traditions** of smallholders.

3. Kharai camels

Context: A herd of 33 rare Kharai camels from Gujarat's Singach village was caught in the Arabian Sea tide near Jamnagar while grazing on mangroves.

About Kharai camels:

- **What is the Kharai Camel?**
 - Kharai camel is a rare **swimming camel breed** of Gujarat, uniquely adapted to coastal and marshy ecosystems. It is India's **ninth recognized camel breed**, known for foraging in saline environments.
- **Habitat and Distribution:**
 - Native to **Kutch region** of Gujarat, especially **Bhachau, Abdasa, Lakhpat**, and parts of Devbhoomi Dwarka and Jamnagar.
 - Approximately **4,000 Kharai camels** are found in Gujarat, with 2,000 in coastal Kutch alone.
 - Inhabits **mangrove islands** and swims through shallow sea water to graze.
- **Origin and Cultural Link:**
 - Closely associated with the **Rabari and Fakirani Jat communities**, who manage them through traditional pastoral systems.
- **Maldharis** are a **pastoralist community** of Gujarat, meaning "owner of livestock".
 - They traditionally rear **Kharai camels**, cattle, and goats in **Kutch and Gir** forest regions.
 - The word 'Kharai' comes from Gujarati '**khara**' meaning **salty**, referring to their saline habitat.
- **Key Characteristics:**
 - **Swimming Ability:** Can swim up to **3 km** in the Arabian Sea to access mangrove grazing grounds.
 - **Adapted Physiology:** Can survive on **saline vegetation**, unlike most camel breeds.
 - **Dromedary Type:** Single-humped, muscular, and can weigh up to **500 kg**.
 - **Monsoon Migration:** Moves to **mangrove islands** during the rainy season for weeks.
 - **Diet Specialisation:** Primarily feeds on **mangroves**, a rare trait among camelids.
- Kharai camels are **recognized as climate-resilient livestock** due to their **ability to survive in saline, drought-prone coastal conditions** and are included under **National Livestock Mission for breed conservation**.

- Kharai camels can digest mangrove vegetation (Avicennia, Rhizophora, etc.) despite its high salt content, which is a unique adaptation allowing them to graze in mangrove ecosystems and swim to mangrove islands. Their capacity to thrive on saline vegetation is precisely why they survive in these ecosystems.

4. Island Protection Zone (IPZ) Notification, 2011

Context: The Union environment ministry has issued a new notification extending and amending the rules for infrastructure projects under the Islands Protection Zone (IPZ) Notification 2011.

About

- The Island Protection Zone (IPZ) Notification, 2011 is a **legal framework** issued under the Environment (Protection) Act, 1986 to regulate and protect the coastal and marine ecosystems of India's islands, particularly the Andaman & Nicobar Islands and Lakshadweep.
- As per the notification, the validity of clearances for infrastructure projects under the IPZ 2011 is now 10 years (previously 7 years).
- The notification comes amid a surge in infrastructure and tourism projects in the islands, including the ₹81,800 crore Great Nicobar Holistic Development Project (port, airport, power plant, township, trunk road)

Difference from CRZ

- **CRZ (Coastal Regulation Zone):** Applies to mainland India's coast.
- **IPZ:** Applies only to the islands.
- The **IPZ 2011 uses zoning principles similar to CRZ (like CRZ-I, CRZ-II, CRZ-III) on islands to regulate construction and developmental activities** while ensuring **livelihood security** of island communities in **Andaman & Nicobar and Lakshadweep**.
- The **IPZ does not impose a blanket prohibition within 500 meters of HTL on all islands. The buffer zone varies depending on island size:**

- For **small islands (less than 100 sq km)**, the **No Development Zone (NDZ) is 50 meters from HTL**.
- For **larger islands**, it may extend up to **200 meters**.

5. Pollution & associated technologies

Context: The Union Environment Ministry has exempted the majority of India's thermal power plants from installing flue gas desulphurisation (FGD) systems, which are designed to cut sulphur dioxide (SO₂) emissions. Flue gas, a residue from burning fuels in thermal power plants, emits SO₂, which can mix in the atmosphere and create secondary particulate matter. These are linked to air pollution.

	Devices/technologies	Pollutions
1	Electrostatic Precipitators (ESPs)	Air Pollution
2	Ion Exchange	Water Pollution
3	Stream Stripping	Soil Pollution
4	Double/Triple Glazing	Noise Pollution

6. Tadoba-Andhari Tiger Reserve

Context: The National Board for Wildlife (NBWL) has approved coal mining in Maharashtra's Chandrapur district within a vital tiger corridor connecting three key reserves, sparking ecological concerns. This area lies between Tadoba Andhari Tiger Reserve, Kanhargaoon, and Tipeswar Wildlife Sanctuaries—crucial for tiger movement and gene flow.

About Tadoba-Andhari Tiger Reserve

- **Location:** It is located in the **Chandrapur** district in Maharashtra.
- It is the largest and **oldest Tiger Reserve** of Maharashtra.
- The word 'Tadoba' is derived from the name of God "Tadoba" or "Taru," which is praised by local tribal people of this region and "Andhari" is

derived from the name of Andhari river that flows in this area.

- The reserves includes **Tadoba National Park and Andhari Wildlife Sanctuary**.
- The reserve has corridor linkages with **Nagzira-Navegaon and Pench Tiger Reserves** within the State.
- **Habitat:** Biogeographically, the reserve falls in the Central Plateau province of the Deccan Peninsula. The habitat has undulating topography in the north and is rich in biodiversity.
- **Vegetation:** It consists of **Southern Tropical Dry Deciduous type of vegetation**.
- **Lakes and River:** There are two lakes and one waterway in the reserve, **Tadoba Lake**, Kolsa Lake, and the **Tadoba River**.
- **Flora:** It is blessed with thick forests covered with teak trees and other vegetation such as crocodile bark, salai, tendu, karaya gum, and mahua madhuca.
- **Fauna:** The notable faunal species include the tiger, leopard, sloth bear, wild dog, gaur, chital, and sambar.

7. Lion-Tailed Macaque

Context: The Standing Committee of the National Board for Wildlife (NBWL) has granted in-principle approval for diverting 142.76 hectares of forest land in the Sharavathi Valley Lion-Tailed Macaque Wildlife Sanctuary for the Sharavathi Pumped Storage Project (2,000 MW).

Lion-Tailed Macaque (*Macaca silenus*)

- It is a recognisable monkey with a silver-white mane from the Western Ghats of South India
 - It is endemic to the Western Ghats hill ranges.
- **Population:** According to the IUCN, only around 2,500 individuals remain in the wild and the population continues to decline.
- **Habitat and Distribution:** It is primarily arboreal and it prefers the upper canopy of tropical evergreen rainforests (Sholas) but can also inhabit monsoon forests and disturbed areas.

- It may persist in regions with human-planted fruit trees like jackfruit and guava, though populations vary with fruit availability.
- Lion-Tailed Macaques are **frugivorous and act as key seed dispersers**, maintaining forest regeneration and diversity in the **Western Ghats' evergreen forests**.

- **Threats:** Its population faces threats from habitat loss, fragmentation, and human encroachment.
- **Protection status:** It is listed as **Endangered** species on the International Union for Conservation of Nature Red (IUCN) List.
 - It is protected under Appendix I of CITES. I

8. Water Pollution from Industrial Dyes

Context: Scientists from the Institute of Nano Science and Technology (INST) in Mohali, IIT-Dharwad, and IIT-Kharagpur have designed a cheap, reusable water filter.

Water Pollution from Industrial Dyes

- Industrial plants release **dyes like Congo Red and Methylene Blue** into rivers and groundwater.
- These dyes cause **stomach, skin, and respiratory illnesses** in humans.

Limitations of Existing Treatment Methods

- Methods like **ozone treatment and Fenton chemistry** effectively clean water.
- However, they consume **large amounts of chemicals and electricity**, increasing **costs and carbon footprint**.

The New Solution: Cheap, Reusable Water Filter

- Developed by **INST Mohali, IIT-Dharwad, and IIT-Kharagpur**.
- Designed to **sidestep high cost and carbon footprint issues** of current methods.
- Reported in the **July edition of Nano Energy**.

Technical Design of the Filter

- **3D printing of thin, sponge-like sheets of polylactic acid (PLA)** (biodegradable plastic).
- PLA sheets, naturally water-repelling, treated with **mild sodium hydroxide** to make them water-loving.
- **Nanoparticles of bismuth ferrite (BFO)** prepared and applied on PLA sheets using BFO ink.
- Sheets remained effective over **five reuse cycles with only ~3% loss of cleaning power**.

Working Mechanism

- **Under visible light:** BFO acts as a **solar-powered catalyst**, splitting water molecules to form **reactive radicals** that degrade dyes.
- **Under ultrasound (vibrations):** BFO's **piezoelectric nature** generates an internal electric field, producing radicals even in the **dark**.
- The combined effect is **piezo-photocatalysis**, enabling **day-and-night operation**.

Test Results

- Combined light and vibration led to **removal of ~99% Congo Red and ~74% Methylene Blue within 90 minutes**.
- Successfully **partially cleaned real textile wastewater samples**.

Use of Machine Learning

- Machine-learning regression models (random forests, XGBoost, artificial neural networks) were applied.
- Models used **dye concentration, catalyst amount, light intensity, ultrasound frequency** data.
- Successfully predicted dye degradation rates under various conditions, validating AI forecasting capabilities.

Future Plans

- Plans to **scale up production** and deploy near **treatment plants** where water bodies face regular pollution.

- Potential integration with **Jal Nigam and Namami Gange** projects for **affordable wastewater treatment**.
- The filter removes dyes even at night because the system enables purification in the absence of light.
- The **piezoelectric property of Bismuth Ferrite (BFO)** allows it to **generate an internal electric field when shaken by ultrasound**, leading to the **creation of radicals that degrade dye molecules even in the dark**, enabling the filter to work at night.

9. Climate tipping point

Context: The researchers suggest that extreme marine heatwaves of 2023 were driven by climate change and may signal a climate tipping point.

About climate tipping point:

- These are critical thresholds in a system that, when exceeded, can lead to a significant change in the state of the system, often with an understanding that the change is irreversible (Intergovernmental Panel on Climate Change (IPCC)).
 - For E.g., Global warming triggers a change like a rainforest becoming a dry savannah.
- The IPCC identifies several tipping points: Frequent rainforest in Amazon rainforest, Slowdown of Atlantic circulation, Melting of permafrost, etc.

Note: The core idea of a tipping point: a nonlinear, irreversible change triggered once a critical threshold is crossed (in this case, rapid ice sheet loss).

10. First-ever Grassland Bird Census in Kaziranga National Park

Context: Prime Minister of India highlighted the first-ever Grassland Bird Census in Kaziranga National Park during his Mann ki Baat, praising its innovative use of acoustic technology and its role in biodiversity conservation.

About First-ever Grassland Bird Census in Kaziranga National Park:

- **What is it?**
 - A landmark bird population survey aimed specifically at grassland-dwelling birds in Kaziranga National Park (Assam), covering the period from **March 18 to May 25, 2025**.
- **Who conducted it?**
 - Jointly undertaken by:
 - Forest department officials
 - Researchers including INSPIRE fellow Chiranjib Bora
 - Conservationists and Kaziranga park authorities
- **Objectives of the Census:**
 - Monitor population of grassland bird species
 - Identify rare, endemic, and globally threatened species
 - Map breeding patterns and ecological health of the habitat
- **Methodology and Innovation:**
 - **Passive Acoustic Monitoring:** Recorders placed on tall trees captured birdcalls during the breeding season (March–May).
 - **Audio Identification Tools:**
 - Spectrogram analysis for visualizing sound frequencies
 - AI-based **BirdNET** software to identify bird species by song
 - **Coverage:** Surveyed 29 locations using six recorders over three-day cycles
- **Key Features of the Census:**
 - **First of its kind in India:** Focused exclusively on grassland bird species, often underrepresented in conventional bird surveys.
 - **Data-Driven Approach:** Documented 43 species, including 1 Critically Endangered, 2 Endangered, and 6 Vulnerable birds as per the IUCN Red List.
 - **Conservation Breakthrough:** Discovery of over 85 nests of the endangered Finn's Weaver, endemic to the Brahmaputra floodplains.

- **Ecological Indicator Role:** Presence of grassland birds indicates healthy habitat quality, similar to BMI as a health marker.
- **Highlight on Threats:** Census underlined habitat loss due to ecological succession, overgrazing, cultivation, and climate change impacts.
- The survey was jointly undertaken by: Forest department officials, Researchers including INSPIRE fellow Chiranjib Bora, Conservationists and Kaziranga park authorities.
- Reports confirm that 43 grassland bird species were recorded, with the specified IUCN Red List statuses.
- The discovery of a breeding colony of Finn's Weaver, an endangered species and a key indicator of healthy grasslands, was indeed a significant outcome of the census.
- While advanced techniques like passive acoustic monitoring (PAM) might be used in some modern censuses, the first-ever grassland bird census in Kaziranga primarily employed **transect-based visual surveys and point counts**, which are traditional manual observation methods.

11. Golden Jackal (*Canis aureus*)

Context: Research undertaken by NGO Aranyakam Nature Foundation estimates that Kerala is home to 20,000–30,000 golden jackals.

About Golden Jackal (*Canis aureus*)

- **Appearance:** Also known as the common jackal, it is smaller than a wolf but larger than a fox. It has a golden to pale gold or brown-tipped coat, which can vary seasonally and regionally.
- **Behaviour:** Primarily nocturnal, active mostly at night.
- **Habitat and Distribution :** Found across Europe, Southwest, Central, South, and Southeast Asia.
 - In India, golden jackals are found in states like Kerala, Maharashtra, Rajasthan, and Haryana.

- **Diet: Omnivores** in nature, they feed on small mammals, insects, hares, fish, birds and fruits and often venture into human habitats in search of the same.
- **Legal protection:**
 - **IUCN Red List: Least Concern.**
 - **CITES: Appendix III**

12. Small Cats & IUCN Status

Context: Report compiled by Wildlife Institute of India (WII) and National Tiger Conservation Authority (NTCA) provides comprehensive assessment of small cats' occupancy status and dynamics.

Key Findings:

- Jungle Cat is most widespread small cat species in India, followed by Rusty-Spotted Cat (World's smallest wildcat).
- 10 small cat species found in India include Pallas's cat, Eurasian lynx, Jungle cat, Fishing cat, leopard cat, rusty-spotted cat, marbled cat, Asiatic golden cat, Desert cat, and Caracal.

	Small Cats	IUCN status
1	Asiatic golden cat	Near Threatened
2	Caracal	Least Concern
3	Fishing cat	Vulnerable
4	Eurasian lynx	Least Concern

13. Great Barrier Reef

Context: The Australian government announced YouTube will be among the social media platforms that must ensure account holders are at least 16-years-old from December, reversing a position taken months ago on the popular video-sharing service.

- The Great Barrier Reef, the world's largest coral reef system, stretches for over 2,300 kilometers

along the coast of Queensland, which is indeed in the north-eastern part of Australia.

- The Great Australian Bight is a large oceanic bight (bay) located off the **southern coast** of mainland Australia, spanning parts of South Australia and Western Australia. It is not on the eastern coast.



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SCIENCE AND TECHNOLOGY

1. Altermagnetism

Context: Scientists at the S.N. Bose National Centre for Basic Sciences have discovered a rare direction-dependent conduction polarity (DDCP) in Chromium Antimonide (CrSb), a newly discovered altermagnet. This is the first known altermagnet to show both p-type and n-type conduction within a single crystal based on direction.

- **What is altermagnetism?**
 - Altermagnetism combines antiferro - magnetic-like zero net magnetization with ferromagnetic-like spin splitting of electronic bands, breaking time-reversal symmetry while preserving zero macroscopic magnetization.
 - It differs from ferromagnetism (net magnetization) and antiferromagnetism (zero net magnetization without band spin splitting).
 - It is emerging in advanced condensed matter physics and spintronics research.
- **What are Altermagnets?**
 - **Altermagnets** are a novel class of magnetic materials that combine the internal spin ordering of antiferromagnets with the functional advantages of ferromagnets, yet exhibit zero net magnetization externally.
 - Their **hidden magnetic symmetry** enables unique control over electron spin and transport without external magnetic signatures.
- **Discovered By:** This specific behaviour in **CrSb** was discovered by **N. Bose National Centre for Basic Sciences**, under the Department of Science and Technology, Government of India.

- **Key Characteristics:**

- **Zero Net Magnetism:** Despite magnetic ordering, they show no external magnetic field like regular magnets.
- **High Spin Splitting:** Internal electron spin energy levels differ greatly—30× room temperature in CrSb.
- **High Thermal Stability:** CrSb remains magnetic at temperatures twice that of room temperature, making it viable for industrial electronics.
- **DDCP (Direction-Dependent Conduction Polarity):** CrSb shows n-type behaviour along layers and p-type behaviour across layers, a first among known magnetic materials.
- **Single-Crystalline Purity:** High-quality crystals allow precise measurement of anisotropic conduction.

- **How it Happens?**

- In **CrSb**, when electric current flows within the crystal layers, electrons carry charge (n-type).
- When current flows across the layers, holes (absence of electrons) take over (p-type).
- This unusual conduction behaviour arises from asymmetric spin and charge distribution in the crystal structure.

- **Applications:**

- **Spintronics:** Enables manipulation of electron spin rather than charge, paving the way for ultra-fast, low-energy memory devices.
- **Compact Electronics:** Acts as both **p-type and n-type**, removing the need for separate materials or doping.
- **Thermoelectric:** Enhances energy efficiency in power conversion systems.
- **Simplified Manufacturing:** Obviates heterostructures or junctions, reducing cost and complexity.

- **Sustainable Tech:** CrSb is **non-toxic and earth-abundant**, aligning with green electronics initiatives.

2. Kombucha

Context: A new study in *The Journal of Nutrition* has revealed that kombucha, a fermented tea drink, can positively modulate gut microbiota in individuals with obesity.

What is Kombucha?

- Kombucha is a **fermented, fizzy drink** made from sweetened tea (typically black or green tea) and a living culture known as a **SCOBY** (Symbiotic Culture of Bacteria and Yeast). The SCOBY is a thick, jelly-like disk that transforms the sweet tea into a tangy, effervescent beverage through fermentation.

Kombucha is produced by symbiotic fermentation of sugared tea using a symbiotic culture of bacteria and yeast (SCOBY) commonly called a "mother" or "mushroom".

How is Kombucha Made?

- **Ingredients:** Tea, sugar, water, and a SCOBY.
- **Process:** The sweetened tea is cooled and combined with a SCOBY and a bit of starter tea (from a previous batch). It is then left to ferment at room temperature for 7–30 days.
- **Fermentation:** During fermentation, the yeast in the SCOBY breaks down the sugar, producing alcohol, which is then converted by bacteria into organic acids. This process creates **probiotics, B vitamins, acetic acid, and a small amount of alcohol** (generally less than 0.5%).
- **Flavor:** The resulting drink is slightly sweet, tangy, and fizzy. It can be consumed plain or flavored with fruits, spices, or herbs.

History and Popularity

- Kombucha originated in China over 2,000 years ago, later spreading to Russia, Eastern Europe, and eventually the rest of the world. It has seen a surge in popularity as a health beverage, with a global market valued at over \$1.7 billion as of 2019 and expected to grow further.

Health Claims and Evidence

- Kombucha is often promoted for its **probiotic content**, which may support gut health, similar to other fermented foods.
- Other claimed benefits include improved digestion, immune support, and detoxification.
- However, **scientific evidence supporting these health claims is limited**. Most benefits are attributed to the probiotics found in kombucha, but direct studies on kombucha itself are lacking.
- It is generally considered safe for most people, but rare adverse effects have been reported, especially from contaminated home-brewed kombucha.

Risks and Considerations

- **Home brewing** poses a risk of contamination if not done in a sterile environment.
- People with compromised immune systems, pregnant women, or those sensitive to alcohol or caffeine should consult a healthcare provider before consuming kombucha.
- Kombucha **qualifies as a functional food** due to its **probiotic, polyphenol, and antioxidant composition** supporting gut, metabolic, and immune health.
- Its **gut microbiome rebalancing, reduction of harmful microbes, and potential anti-inflammatory effects** are the reason it is classified as functional and marketed as a **health-oriented beverage**, directly explaining its classification and marketing approach.

3. Glutathione

Context: Actor Shefali Jariwala's death has put glutathione injections in the spotlight. While the exact cause is still under investigation, reports say she took them as part of an anti-ageing treatment.

What is glutathione?

- Glutathione is a powerful **antioxidant** naturally produced by our liver. It repairs skin, boosts immunity, slows ageing, neutralises free radicals, and even helps fight cancer cells.

Because of this, it's often called the '**mother of all antioxidants.**'

- It is a **tripeptide containing glutamate, cysteine, and glycine**, acting as a major intracellular antioxidant involved in detoxification by reducing reactive oxygen species.
- But as we age, our bodies produce **less glutathione** — so many people turn to oral supplements or intravenous injections to boost levels.

Its impact and regulation

- High doses, especially through injections, can cause serious side effects like allergic reactions, low blood pressure, kidney damage, and may disrupt the body's natural antioxidant balance.
- Notably, the **Central Drugs Standard Control Organisation (CDSCO)**, India's national regulator for cosmetics, pharmaceuticals, and medical devices, **has not approved glutathione** for skin lightening — though it's widely used off-label for this purpose.

4. Genome

Context: Researchers have sequenced the first whole ancient Egyptian genome from an individual who lived 4,500-4,800 years ago — the oldest DNA sample from Egypt to date.

About

- DNA was successfully extracted from the **individual's teeth**.
- The genome of the ancient Egyptian is said to be the **most complete and oldest from Ancient Egypt**.

Genome

- The genome of an organism is made up of a unique DNA or RNA sequence.
- The human genome is the **complete set of genetic information for Homo sapiens**.
- It consists of **about 3 billion base pairs of DNA**, organized into **23 pairs of chromosomes**.

- Each chromosome carries a **unique set of genes**, which are sequences of DNA that **encode instructions for building proteins** and other molecules **essential for life**.

Genome Sequencing

- Each sequence is composed of chemical building blocks known as **nucleotide bases**.
- **Determining the order of bases** is called "**genomic sequencing**" or, simply, "**sequencing**."
- The information encoded in the genomes provide **researchers with unique genetic "fingerprints."**
- The sequence tells scientists the **kind of genetic information** that is carried in a particular DNA segment.
- In modern forensic cases with fresh biological samples, other sources like blood, saliva, hair follicles, or skin cells are generally chosen first because they are less invasive to collect, easier to process, and yield sufficient quantities of DNA more readily. Teeth are typically reserved for cases where other tissues are unavailable or degraded (e.g., mass disasters, ancient remains).

5. Defence Acquisition Council

Context: The Defence Acquisition Council (DAC) approved capital acquisition proposals worth ₹1.05 lakh crore, aimed at enhancing India's defence capabilities through 100% indigenous sourcing.

About Defence Acquisition Council (DAC):

- It is the **highest decision-making body** in the Ministry of Defence for procurement matters.
- **Established:** Formed in 2001, following the **Group of Ministers Report on National Security reforms post Kargil War (1999)**.
- **Ministry:** Under the **Ministry of Defence**, Government of India.
- **Composition:**
 - **Chaired by the defence minister.**

- Includes **Chief of Defence Staff**, and the **Chiefs of Army, Navy, and Air Force**.
- **Aim:** To ensure time-bound, cost-effective, and capability-driven procurement using allocated budget optimally.
- **Key Functions:**
 - **DAC accords Acceptance of Necessity (AoN) for capital acquisition proposals (the financial threshold may vary with time, but DAC typically handles higher-value proposals).**
 - Gives in-principle nod to the Long-Term Integrated Perspective Plan (LTIPP) spanning 15 years.
 - Categorises acquisitions under Buy (Indian), Buy & Make, and Make categories.
 - Decides on Transfer of Technology (ToT) and offsets for deals over ₹300 crore.
 - Resolves single vendor procurement issues.
 - Oversees field trial evaluations and performance assessments.

6. “3 by 35” Initiative

Context: The World Health Organization (WHO) has launched the “3 by 35” Initiative, calling on countries globally to increase taxes on tobacco, alcohol, and sugary drinks. The initiative urges a minimum 50% real price increase on the three targeted products by 2035, achieved through higher excise or health taxes.

About

- The world faces an urgent challenge of **non-communicable diseases (NCDs)** such as heart disease, cancer, and diabetes now account for **over 75% of global deaths**.
- Simultaneously, shrinking development aid and rising public debt have strained health systems, especially in low- and middle-income countries.
- Studies suggest a **one-time 50% price hike could prevent up to 50 million premature deaths** over the next 50 years and raise USD 1 trillion in public revenue over the next decade.

- From 2012 to 2022, nearly **140 countries raised tobacco taxes**, with real prices rising over 50% on average, demonstrating that large-scale change is possible.

Objectives and Expected Impacts

- **Reduce NCD Burden:** Lower consumption of unhealthy products to prevent millions of premature deaths.
 - In Columbia, cigarette tax hike led to a **34% drop in consumption**.
- **Mobilize Revenue:** Generate an additional US\$ 1 trillion globally over the next decade.
- **Strengthen Health Systems:** Fund universal health coverage, prevention, and health infrastructure.
- **SDG 3:** Ensure healthy lives and promote well-being for all ages, with targets to reduce NCD mortality by one-third by 2030.

7. Ham Radio

Context: Indian astronaut Shubhanshu Shukla interacted with the students using a ham radio from the International Space Station (ISS).

Ham Radio

- Ham Radio is popularly known as Amateur radio.
- It is a licensed radio service that relies on **radio waves for establishing communication**.
- It is largely deployed for **educational and knowledge purposes, for emergency or SOS communication**.
 - Using a dedicated frequency, a transceiver and an antenna, communication can be set up between two licensed hams by trained ham operators.
- The communication can be **hyper-local, global, and in space**.
- In India, any individual above the age of 12 is permitted to operate a ham radio.
 - The **Ministry of Electronics and Information Technology** issues these licences.

Uses in Space

- **Amateur radio** was first used on a space shuttle in **1983** for communication between space and Earth.
- The ISS also hosts an **Amateur Radio on the International Space Station (ARISS)** system, which facilitates astronaut-student interactions to inspire the younger generation.
 - ARISS project is supported by amateur radio organizations and space agencies from the U.S., Russia, Canada, Japan, and Europe
 - It provides equipment and operational support.
 - Radio outages are scheduled during critical activities like docking to avoid interference.

How will the Axiom-4 crew use ham radio?

- During the Axiom-4 mission, astronauts from India, Poland, and Hungary will use ham radio to communicate with their home countries twice during their 14-day stay at the ISS.
 - The communication will occur when the ISS passes over the horizon for brief windows of 5-8 minutes.

Significance

- Ham radio remains a reliable and stable mode of communication, especially during emergencies.
- It has been crucial when traditional communication systems fail due to **conflicts or natural disasters**.
- In India, ham radio has been used during major events like the 2001 Bhuj earthquake, the 2004 Indian Ocean tsunami, and the 2013 Uttarakhand floods, providing vital emergency contact when needed most.
- HAM radio licenses in India are issued under the **Indian Wireless Telegraphs (Amateur Service) Rules, 1978**, framed under the **Indian Telegraph Act, 1885**, by the WPC Wing of the Ministry of Communications.
- HAM operators can use **designated frequency bands in HF, VHF, and UHF ranges** (e.g., 144–

146 MHz in VHF) for **non-commercial, personal, and emergency communication**.

- During **natural disasters**, HAM radio operators **can provide emergency communications but must still operate under licensing requirements**; there is **no blanket exemption** from licensing even during emergencies, though temporary permission for extended operations may be granted.

8. Equine Disease

Context: India has set up its first Equine Disease-Free Compartment (EDFC) at the Remount Veterinary Corps (RVC) Centre & College in Meerut Cantonment, Uttar Pradesh. The facility was officially recognised by the World Organisation for Animal Health (WOAH).

About Equine Disease

- These are a wide **range of illnesses** that affect horses, ponies, donkeys, and their hybrids. These diseases can be caused by viruses, bacteria, parasites, or other factors, and may be either **contagious or non-contagious**.
- **Notable examples** include Equine Infectious Anemia, Influenza, Piroplasmosis, Glanders, and Surra.
- Additionally, India has remained free of **African Horse Sickness since 2014**.

World Organisation for Animal Health (WOAH)

- The **World Organisation for Animal Health (WOAH)**—formerly known as the Office International des Epizooties (OIE)—is an intergovernmental body dedicated to improving global animal health and welfare. Headquartered in Paris, WOAH is recognized as the worldwide authority on animal health and plays a crucial role in safeguarding both the livestock industry and public health through science-based standards, information sharing, and capacity building

Historical Background

- **Founded:** 1924, in response to the devastating rinderpest outbreak that affected livestock and economies worldwide.
- **Founding Members:** 28 countries joined forces to address the challenge of infectious animal diseases and facilitate safe international trade.
- **Evolution:** Started as a body focused on epizootic disease control among land animals, later expanding to cover aquatic animals, animal welfare, and wildlife disease management.
- **Name Change:** In 2023, the organization officially aligned its acronym with its English name, becoming WOAAH.
- **Membership:** Now boasts 183 member countries, collaborating to manage transboundary animal diseases and foster global solidarity.

Structure and Governance

- **Headquarters:** Paris, France.
- **Leadership:** Directed by a General Assembly of national delegates and overseen by an elected Director General (current term: 2024–2029).
- **Regional Presence:** Maintains regional and sub-regional offices worldwide, ensuring close collaboration with members and partners across all continents.
- **Partnerships:** Collaborates with over 70 international organizations, including the Food and Agriculture Organization (FAO), World Health Organization (WHO), and United Nations Environment Programme (UNEP).
- The **World Organisation for Animal Health (WOAH)** was previously known as the **Office International des Epizooties (OIE)**, established in 1924.
- WOAAH is not a specialized agency of the United Nations; it is an intergovernmental organization independent of the UN, though it collaborates with FAO, WHO, and WTO.
- India is a member of WOAAH and regularly reports animal disease outbreaks and status, including for diseases like avian influenza, foot-and-mouth disease, and African swine fever, to

maintain transparency in global trade and disease control.

9. Pressurised Heavy Water Reactors

Context: The Atomic Energy Regulatory Board (AERB) has granted operational licences to NPCIL for two indigenous 700 MWe Pressurised Heavy Water Reactors (PHWRs) at Kakrapar Atomic Power Station (Units 3 & 4) in Gujarat.

About Pressurised Heavy Water Reactors:

What is a PHWR?

- A nuclear fission reactor that uses natural uranium as fuel and heavy water (D₂O) as both coolant and neutron moderator.
- Designed to operate with online refuelling, allowing continuous energy production.

Developed By:

- Initially with Canadian support (Rajasthan-1), later fully indigenised by BARC (Bhabha Atomic Research Centre) and NPCIL (Nuclear Power Corporation of India Ltd) under the Department of Atomic Energy.

Historical Evolution:

- RAPS-1 (1973): With Canadian collaboration.
- RAPS-2 onwards: Entirely developed by Indian scientists post-AECL withdrawal.
- Progression from 220 MWe → 540 MWe → 700 MWe with full domestic R&D and manufacturing.

How Does It Work?

- Uses heavy water as moderator to slow down neutrons and maintain a sustained chain reaction.
- Fuel rods (natural uranium) are inserted into pressure tubes within a calandria vessel.
- Hot pressurised heavy water carries heat to steam generators → drives turbines → generates electricity.
- Control rods and ECCS systems regulate power output and enhance safety.

Key Features of 700 MWe PHWRs:

- Fully indigenous design and operation, including construction, fuel fabrication, and control systems.
- Online refuelling system improves efficiency and reduces downtime.
- Equipped with twin fast-acting shutdown systems, double containment, and passive heat removal.
- Digital Instrumentation and Control Systems enhance real-time safety and automation.
- On-site heavy water moderation and cooling reduces external dependency and enriches neutron economy.
- PHWRs can indeed use **natural uranium as fuel without enrichment**, which is a key economic and strategic advantage for India.
- Heavy water has a **low neutron absorption cross-section**, not high, which allows **efficient moderation without capturing neutrons excessively**, enabling the use of natural uranium fuel. The high absorption cross-section would hinder, not aid, a sustained chain reaction with natural uranium.

10. Japonica Rice

Context: Scientists at the National Institute of Plant Genome Research (NIPGR) have used CRISPR-Cas9 gene-editing to enhance phosphate uptake in japonica rice, leading to a 20–40% increase in yield under controlled phosphate use.

Japonica Rice:

- **Japonica rice** (*Oryza sativa* subsp. *japonica*), sometimes called sinica rice, is one of the two main types of Asian rice, alongside Indica rice. It is renowned for its short, round to medium grains, sticky texture, and versatility in cuisine—especially in East Asian countries like Japan, Korea, and parts of China.

Key Characteristics

- **Grain Shape:** Short to medium, round, plump, and thicker than Indica rice.

- **Texture:** Sticky, chewy, and soft when cooked. This makes it ideal for eating with chopsticks and for dishes like sushi.
- **Color and Aroma:** Typically white, with a delicate, mildly sweet flavor and a slight natural shine.
- **Amylose Content:** Low (0-20%), causing its high stickiness after cooking.
- **Nutritional Profile:** About 80% carbohydrates, 10% protein, and 10% fats. Also offers fiber, vitamins, and minerals for digestive wellness and energy.

Types and Varieties

Japonica rice has several subgroups and notable cultivars:

- **Uruchimai (Ordinary):** Standard rice used for everyday meals and sushi in Japan.
- **Mochigome (Glutinous):** Used for making mochi and sweets; very sticky and opaque.
- **Aromatic, Black, and Green Varieties:** Specialty types for specific culinary uses.
- **Popular Cultivars:** Koshihikari (Japan's premium rice), Arborio, Calrose, Carnaroli, Yamada Nishiki (for sake).

Cultivation Regions

- **Primary Producers:** Japan, Korea, and China's northern and eastern regions.
- Also cultivated in Vietnam, Indonesia, Italy (for risotto), parts of the Americas, and, increasingly, other regions due to adaptability advancements.
- **Climate Preference:** Prefers temperate and subtropical climates, with ideal growing temperatures between 28°C and 31°C. Usually grown in irrigated, well-managed fields.

Growth and Farming

- **Sowing and Harvesting:** In Japan and Korea, planting starts in spring (May/June), with harvesting by September/October.
- **Modern Practices:** High mechanization, strict quality controls, and sometimes organic or low-chemical farming methods for health and sustainability.

Nutritional & Culinary Benefits

- **Digestibility:** Gentle on the stomach and gluten-free, making it suitable for gluten-sensitive individuals.
- **Culinary Uses:** Sushi, rice bowls, rice soups, mochi, risotto, sake, and desserts.
- **Taste:** Delicate, lightly sweet, and slightly nutty in some varieties.
- Japonica rice is **grown in temperate climates (China, Japan, Korea, California) and in high-altitude tropical areas (parts of Nepal, Bhutan) where cooler climates prevail.**
- Japonica rice actually **requires a shorter growing season and has lower heat tolerance** compared to Indica rice, which is suited for hot tropical lowland areas. Japonica varieties are more cold-tolerant, not heat-tolerant.

11. Polycyclic aromatic hydrocarbons

Context: Researchers studied the indenyl cation, $C_9H_7^+$ to study the PHA molecules survival in Taurus Molecular Cloud 1 (TMC1).

What is PAH?

- Polycyclic aromatic hydrocarbons (PAHs) are **flat, ring-shaped molecules of carbon and hydrogen.**
- Astronomers think they make up a **fifth of all carbon in interstellar space.**
- There is a hypothesis that **meteors brought PAHs from space** to young earth and created the **first building blocks of life**, attaching important value to their ability to survive in space.
- **On Earth, PAHs** are also known to form during incomplete combustion of organic matter, like burning fossil fuels.

Taurus Molecular Cloud 1 (TMC1)

- **Taurus Molecular Cloud 1 (TMC1)** is a cold, dark cloud of gas, dust, and plasma in the Taurus constellation.
- It is located about **430 light-years from Earth.**

- In TMC1, **small PAHs** (with paired electrons or “closed-shell”) are found in large amounts, even though starlight should destroy them.
- This raised a major question: **How do these molecules survive in such harsh space conditions?**
- Scientists studied a **PAH fragment called $C_9H_7^+$ (indenyl cation).**
 - They found it has a **fast cooling method**, which helps it survive instead of breaking apart.
- PAHs are persistent organic pollutants (POPs) formed during incomplete combustion of organic matter (vehicular emissions, industrial burning, biomass burning). They persist in the environment, bioaccumulate, and are carcinogenic, making them significant in urban air quality and public health management.
- PAHs are hydrophobic (not water-soluble) and have low vapor pressure, leading to persistence in air, soil, and sediments. They do not degrade rapidly in the atmosphere; their degradation is slow, occurring via photolysis and reactions with atmospheric oxidants.

12. RhoDIS India programme

Context: The Assam Forest Department has initiated **DNA profiling of rhino horns, integrating the genetic data into the RhoDIS India DNA database to bolster efforts against wildlife crime.**

About RhoDIS India programme

- It was started in **2016** as a collaboration among the Environment Ministry, the rhino-bearing States of India, the WII, and the World Wide Fund for Nature-India.
- The programme seeks to **improve the crime investigations** scientifically and provide technical support for the scientific management of India’s rhino population.

Great One-horned Rhinoceros

- The great one-horned rhino (or “Indian rhino”) is the **largest of the rhino species.**

- **Appearance:** Indian Rhinos are brownish-grey in colour and are hairless.
- **Habitat:** Grasslands and shrublands on the southern base of the Himalayas.
- **Distribution:** India, Pakistan, Bangladesh, Bhutan and Myanmar.
 - In India, they are found in **Assam, West Bengal and Uttar Pradesh.**
- **Conservation Status:**
 - **IUCN Status:** vulnerable.
 - **CITES:** Appendix I (includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances).

13. Astra Missile

Context: DRDO and the Indian Air Force have successfully conducted a flight-test of the indigenous Astra missile from a Sukhoi-30 MKI, engaging high-speed aerial targets off the coast of Odisha.

About the Astra Missile

- **Developed by:** Defence Research and Development Organisation (DRDO).
- **Type:** Advanced Beyond-Visual-Range Air-to-Air Missile (**BVRAAM**).
- **Range:** Capable of engaging aerial targets over **100 km** away.
- **Features:**
 - Advanced guidance and navigation systems for high precision.
 - All-weather, day-and-night operational capability.
 - Maximum speed: **exceeds Mach 4.**
 - Operational ceiling: up to **20 km** altitude.
- **Significance:** Enhances India's indigenous air combat capabilities and aligns with Aatmanirbhar Bharat in defence production.

Beyond-Visual-Range (BVRAAMs):

Air-to-Air

Missiles

- Astra is India's indigenous BVRAAM under DRDO development and being mass-produced, notable for its 80–160 km range in latest variants
- Arrow (e.g., Arrow-3) is an Israeli-designed BVRAAM used for air defence and intercept roles
- Derby (I-Derby ER) is Israel's active-radar BVRAAM, integrated into platforms like India's Su-30MKI
- Meteor is a European ramjet-powered BVRAAM, now integrated on Typhoon, Rafale, Gripen—and even test-fired on the F-35

14. Temporary slowdown of protein production to repair DNA damage

Context: Using baker's yeast and human skin cells, a new study has shown that cells temporarily slow the step in which protein-building machines read messenger RNA, or mRNA, for specific repair genes. In this process, two guardian proteins act like traffic lights that turn those messages from green to red until the emergency has passed.

How Cells Temporarily Slow Protein Production to Repair DNA Damage

- **DNA damage triggers urgent repair:** Ultraviolet light, certain chemicals, or normal copying errors damage DNA, prompting cells to repair while ensuring they do not overproduce repair proteins.
- **Temporary slowdown of protein production:** Using baker's yeast and human skin cells, a study showed cells temporarily slow the translation step where ribosomes read mRNA for specific repair genes.
- **Guardian proteins act as traffic lights:** Two proteins act like traffic signals, turning mRNA translation from green to red until the emergency passes.
- **Hidden layer of DNA damage response:** This mechanism prevents under-repair and over-repair, supporting cell survival as an evolutionarily conserved strategy.

- **Visualization using fluorescent tags:** Researchers attached green fluorescent tags to two proteins:
 - **Scd6** (yeast)
 - **LSM14A** (humans)
 and filmed living cells during DNA damage using hydroxyurea.
- **Formation of reversible RNA granules:**
 - DNA damage caused tagged proteins to condense into bright dots called RNA granules.
 - Removing stress dissolved these clumps, indicating they are reversible holding areas, not trash bins.
- **Mechanism in yeast cells:**
 - Inside granules, Scd6 captured mRNA for the enzyme **Srs2**, reducing its production.
 - Mutating Scd6's RNA-gripping regions prevented it from capturing Srs2 mRNA.
 - Yeast lacking Scd6 grew poorly when extra Srs2 was present during DNA damage, proving reduced Srs2 production protects cells.
- **Mechanism in human cells:**
 - LSM14A formed granules after hydroxyurea treatment.
 - Knocking down LSM14A led to overproduction of enzymes that repair DNA in an error-prone way.
- **Potential implications:**
 - Interfering with RNA granule dynamics could disrupt stress adaptation in **cancer cells**, making them more vulnerable to chemotherapy.
 - The team is also studying these mechanisms in the context of **neurodegeneration**.
- Cells temporarily slow the step in which protein-building machines read messenger RNA, or mRNA, for specific repair genes
- Using baker's yeast and human skin cells, a study showed cells temporarily slow the translation step where ribosomes read mRNA for specific repair genes. Two proteins act like traffic signals, turning mRNA translation from green to red until the emergency passes. This mechanism prevents

under-repair and over-repair, supporting cell survival as an evolutionarily conserved strategy. Thus, **slowing translation directly contributes to balanced DNA repair and cell survival.**

15. 3I/Atlas – Third-Ever Interstellar Object

Context: The object 3I/Atlas, discovered by the ATLAS telescope in Chile, has been confirmed as the third-ever interstellar object, potentially older than our Solar System.

About 3I/Atlas – Third-Ever Interstellar Object:

- **What is 3I/Atlas?**
 - **Interstellar Origin:** 3I/Atlas is a **hyperbolically orbiting interstellar object**, meaning it came from outside our solar system and is not gravitationally bound to the Sun.
 - **Discovery:** It was spotted by the **Asteroid Terrestrial-impact Last Alert System (ATLAS)** in Río Hurtado, Chile, when it was around **670 million km from the Sun**.
- **Key Features of 3I/Atlas:**
 - **High Speed:** It moves at **~60 km/s** — too fast to be held by the Sun's gravity — confirming its **interstellar nature**.
 - **Current Distance:** The object is now near Jupiter's orbit, about 917 million km from Earth.
 - **Oldest Known Comet:** Scientists estimate its age to be 7 billion years, which is older than the 4.6-billion-year-old Solar System.
- **Significance of 3I/Atlas:**
 - **Clues to Alien Worlds:** Studying it may reveal the chemical and physical makeup of distant planetary systems.
 - **Rare Interstellar Sample:** It gives humanity a direct connection to exoplanetary material, much before space travel allows such exploration.
 - **Builds on Past Discoveries:** It follows **1I/'Oumuamua (2017)** and **2I/Borisov (2019)** as the only known interstellar visitors so far.

16. Quantum Noise

Context: Indian scientists from Raman Research Institute (RRI) have discovered that quantum noise, previously seen as destructive, can generate and revive entanglement in certain quantum systems.

About Quantum Noise:

- **What is Quantum Noise?**
 - Quantum noise refers to **random disturbances** that affect quantum systems due to unavoidable interaction with the environment. It leads to **decoherence**, making entangled states unstable—posing a challenge for quantum computing.
- **Origin and Nature of Quantum Noise:**
 - **Quantum origin:** Arises from **Heisenberg's Uncertainty Principle** and quantum interactions with thermal or electromagnetic environments.
 - **Environment-induced:** Happens when quantum systems are not perfectly isolated—causing errors or collapse of quantum states.
 - **Unavoidable:** Even the most controlled quantum labs cannot eliminate all noise due to environmental interaction.
- **Features of Quantum Noise:**
 - **Decoherence-inducing:** Breaks the link between entangled particles, damaging quantum information.
 - **Random yet measurable:** Often modelled through channels like amplitude damping, phase damping, and depolarizing noise.
 - **System-dependent behaviour:** Different for intraparticle vs interparticle entanglement.
 - **Non-deterministic impact:** May reduce, alter, or—surprisingly—**generate** entanglement under certain conditions.
- **Significance of This Discovery:**
 - **Paradigm Shift:** Redefines the role of noise from being a threat to becoming a constructive force in quantum systems.
 - **Improved Quantum Stability:** Intraparticle entanglement shows greater resistance to

decoherence—key for real-world quantum devices.

- **Foundation for Quantum Tech:** Enables progress in quantum communication, quantum cryptography, and quantum error correction.
- **Cross-platform applications:** Findings apply to photons, neutrons, trapped ions—not limited to a single quantum setup.

	Quantum phenomena	Applications
1	Quantum superposition	Quantum computing using qubits
2	Heisenberg Uncertainty	Spectral line broadening
3	Band Gap	Semiconductor devices like LEDs and lasers
4	Quantum Entanglement	Quantum cryptography

17. Magnetic levitation

Context: China unveiled a new high-speed Maglev train that can cover 1,200 km (Beijing–Shanghai) in just 2.5 hours, outperforming even airplanes.

Magnetic levitation:

- Maglev, short for **magnetic levitation**, is a revolutionary transportation technology that allows vehicles, most notably trains, to float above a guideway using the fundamental principles of magnetism. This eliminates friction between the vehicle and the track, enabling incredibly high speeds, smooth rides, and reduced maintenance.

Application of Maglev principle:

- **High-speed trains** (core application of Maglev)
- **Frictionless bearings** (magnetic bearings)
- **Magnetic levitation globes** (decorative use of Maglev)
- **Superconducting magnetic energy storage (SMES)** (uses superconducting levitation to reduce mechanical friction)

No directly application of Maglev principle:

- **Magnetic stirrers** use rotating magnetic fields, not levitation.
- **Wireless power transfer** uses magnetic induction, not levitation.
- **MRI machines** use strong magnetic fields but not for levitation.

18. Silicon-Perovskite Tandem Solar Cells

Context: The Union Minister for MNRE, lauded NCPRE's breakthrough in Silicon-Perovskite Tandem Solar Cells with a record 29.8% efficiency, calling it a game-changer for India's solar future.

About Silicon-Perovskite Tandem Solar Cells:

- **What It Is?**
 - A **tandem solar cell** combines two types of solar materials—**silicon** and **perovskite**—stacked to absorb different parts of the sunlight spectrum.
 - This structure boosts energy conversion efficiency far beyond conventional silicon panels.
- **Developed By:** Developed by **ART-PV India**, a startup incubated at **IIT Bombay**
- **Key Features:**
 - **29.8% efficiency** in a **4-terminal Silicon/CdTe-Perovskite** configuration
 - Potential to exceed **30% efficiency**, among highest in India
 - Lower production cost and superior energy yield per unit area
- **Applications:**
 - Rooftop solar systems for urban and rural homes
 - Utility-scale solar parks to power smart grids
 - EV charging infrastructure powered by high-efficiency solar units
- In single-junction silicon cells, photons with energy much higher than the silicon bandgap lose excess energy as heat (thermalization losses). Tandem structures reduce these losses.
- The perovskite top cell (high bandgap) absorbs high-energy photons, while the silicon bottom

cell (low bandgap) absorbs lower-energy photons, allowing better spectrum splitting, thus reducing thermalization losses.

19. Aspergillosis

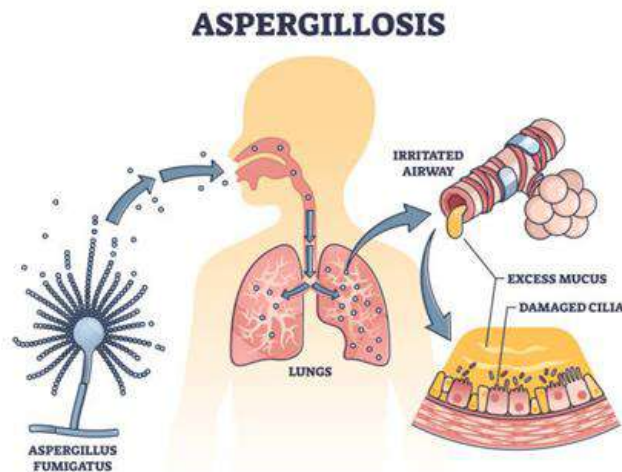
Context: Pigeons in Indian cities, especially the Blue Rock Pigeon (*Columba livia*), are being wrongly blamed for rising cases of Aspergillosis, a fungal respiratory infection.

About Aspergillosis:

- **What is Aspergillosis?**
 - A **respiratory infection** caused by inhaling spores from *Aspergillus*, a genus of mold.
 - Most commonly caused by *Aspergillus fumigatus*, which releases airborne spores.
- **Source and Transmission:**
 - **Not contagious** from person to person.
 - Spread occurs through inhalation of spores found in:
 - Soil, compost, dust, rotting vegetation
 - Air ducts, damp walls, bird droppings, old grains
 - Pigeons may contribute indirectly but are not the primary source.
- **Key Features of the Fungus:**
 - Ubiquitous and naturally present in urban and rural environments.
 - Grows best in moist, poorly ventilated, or decaying areas.
 - Spores are microscopic and easily inhaled in large quantities.
- **Symptoms of Aspergillosis:**
 - Persistent cough, chest pain, wheezing.
 - Fever, shortness of breath.
 - Coughing blood in advanced cases (chronic pulmonary aspergillosis).
- **Treatment Options:** Antifungal medications like voriconazole or itraconazole.
 - Surgery in severe or invasive cases.
- Aspergillosis (including invasive aspergillosis) predominantly affects **immunocompromised individuals** (e.g., neutropenia, post-transplant,

corticosteroid therapy) as their immune system cannot clear inhaled *Aspergillus* conidia.

- ***Aspergillus* species are not part of the normal human respiratory flora.** They are ubiquitous environmental molds, and infection typically occurs through inhalation of airborne conidia, not from endogenous flora.



20. Gravitational waves

Context: Scientists have detected signals from the largest black hole merger ever observed, marking a breakthrough in the study of the universe's most powerful cosmic collisions.

About

- The event, named **GW231123**, was detected on November 23, 2023, by the global network of **gravitational wave detectors**, including **LIGO**, **Virgo**, and **KAGRA**.
- The merger involved two black holes with masses of 100 and 140 times the mass of our Sun, creating a final black hole of **225 solar masses** — making it one of the heaviest black hole mergers ever detected.

What Are Gravitational Waves (GW), and How Are They Detected?

- **Gravitational waves (GW)** are ripples in the fabric of space-time, predicted by Albert Einstein in 1916 as part of his General Theory of Relativity.

- These waves are generated by some of the universe's most violent and energetic processes—like the collision and merger of black holes.
- When massive objects **accelerate (especially in mergers)**, they produce these waves, which travel outward at the speed of light, causing tiny distortions that can be measured by highly sensitive instruments.

Black Holes

- A black hole is a region in space where gravity is so strong that nothing—not even light—can escape.
- Black holes may be:
 - **Stellar-mass:** Formed from dying massive stars (typically a few to tens of solar masses),
 - **Intermediate-mass:** Ranging from hundreds to thousands of solar masses (like the GW231123 remnant),
 - **Supermassive:** Millions to billions of solar masses, found at galactic centers.

What is LVK Collaboration?

- The **LVK Collaboration** refers to the **LIGO-Virgo-KAGRA Collaboration**, a large international scientific partnership focused on the detection and study of **gravitational waves**. It combines three major interferometric gravitational-wave observatories:
 - **LIGO** (Laser Interferometer Gravitational-wave Observatory) in the United States
 - **Virgo** in Italy
 - **KAGRA** in Japan
- Together, the LVK Collaboration operates these observatories as a single global network, enabling triangulation and improved sensitivity for gravitational-wave detections.
- The collaboration involves over 2,000 scientists from more than 300 institutions worldwide.
- Recent LVK discoveries include some of the most massive black hole mergers ever observed, detected using gravitational waves—ripples in spacetime caused by cosmic events like black hole or neutron star mergers.

- The joint operation allows precise localization of cosmic events and has contributed fundamentally to the new field of gravitational-wave astronomy.

21. Prime Minister Professorships

Context: The Anusandhan National Research Foundation (ANRF) has announced the Prime Minister Professorships.

About Prime Minister Professorships:

- The scheme facilitates structured mentorship engagements, wherein superannuated/retired, active experts will provide sustained academic and research support to faculty and students in institutions with emerging research capacity.
- **Duration:** Up to 5 years, based on performance evaluated by the expert committee constituted for the purpose.
- **Eligibility:** Open to overseas scientists, including Non-Resident Indians, Persons of Indian Origin, and Overseas Citizens of India.
 - Professionals from industry and experienced Professors of Practice with a “distinguished record” of research and innovation are eligible to apply.
- **Funding Support:** The PM Professor will receive a fellowship of Rs. 30 lakh plus Research Grant of Rs.24 Lakh per annum. Additionally, Rs. 1.00 Lakh (fixed) is provided as overhead to the host institute per year.
- **Eligible host institutions** are the state universities which have been qualified/listed as spoke institutions, in Category A of recently awarded PAIR program of ANRF.

22. CP Violation in Baryons

Context: For the first time, scientists have observed that the laws of physics are different for the particles that make up visible matter and their antiparticles. The finding is key to understanding why matter dominates the universe even though it once had equal quantities of matter and antimatter.

Observation of CP Violation in Baryons

- **Background:**
 - The universe contains **mostly matter, not antimatter**, though **both should have existed equally after the Big Bang**.
 - **CP violation (Charge-Parity violation)** is key to explaining the matter-antimatter asymmetry.
 - Previously, **CP violation was only observed in mesons (quark-antiquark pairs), not baryons (three-quark particles like protons and neutrons)**.

What has been discovered?

- The **LHCb collaboration at CERN** has reported the **first-ever observation of CP violation in baryon decays**, specifically in the **Λ_b^0 (lambda b-zero) baryon**.
- Published in **Nature on July 16**, this is seen as a **key step toward understanding matter dominance in the universe**.

What is CP violation?

- **Charge conjugation (C):** swapping particles with antiparticles.
- **Parity (P):** flipping spatial coordinates (mirror image).
- **CP symmetry:** Laws of physics should remain unchanged under C and P together.
- **CP violation:** This symmetry is broken; laws differ for matter and antimatter.

About the experiment:

- **Λ_b^0 baryon (up, down, bottom quarks)** decays studied:
 - Decay: $\Lambda_b^0 \rightarrow p K^- \pi^+ \pi^-$
 - Compared with the **antiparticle $\Lambda_b^0\text{-bar}$** decaying with charges reversed.
- Data from **LHCb (2011–2018)** using **machine learning and particle identification** to isolate real signals.
- **CP asymmetry measured:** Found a **2.45% difference in decay rates** between Λ_b^0 and $\Lambda_b^0\text{-bar}$.
- The result is **5.2 sigma** from zero, confirming discovery-level significance.

Significance:

- Confirms **CP violation in baryons** (previously seen only in mesons).
- Matches **Standard Model predictions**, but:
 - The **amount of CP violation predicted by the Standard Model is insufficient** to explain the universe's matter-antimatter imbalance.
 - The **complex phase (from CKM matrix) related to CP violation in baryons has not yet been measured**, which is crucial to test Standard Model limits.

Connection with Sakharov Conditions:

To explain the universe's matter dominance:

1. **Baryon number violation** (needed to imbalance matter and antimatter).
2. **CP violation in baryons** (observed here).
3. **Departure from thermal equilibrium** (to prevent rebalancing).

This discovery **addresses the second condition**, but **full understanding requires further measurements of the complex phase** and deeper theoretical work.

Way Forward:

- **Experimental:** Need **precise and comprehensive measurements** of CP violation across particles, including baryons.
- **Theoretical:** Better calculations to align experimental data with fundamental physics.
- If future measurements **match Standard Model predictions**, the mystery remains unresolved.
- If they **deviate**, it could indicate '**new physics**' **beyond the Standard Model**.

Terms associated with CP violation:

- **Charge conjugation (C):** Swapping particles with their antiparticles.
- **Parity transformation (P):** Flipping spatial coordinates (mirror reflection).
- **CP symmetry:** Laws of physics should remain identical under simultaneous application of C and P.
- **CP violation:** This **symmetry is broken**, meaning the laws of physics are different for matter and

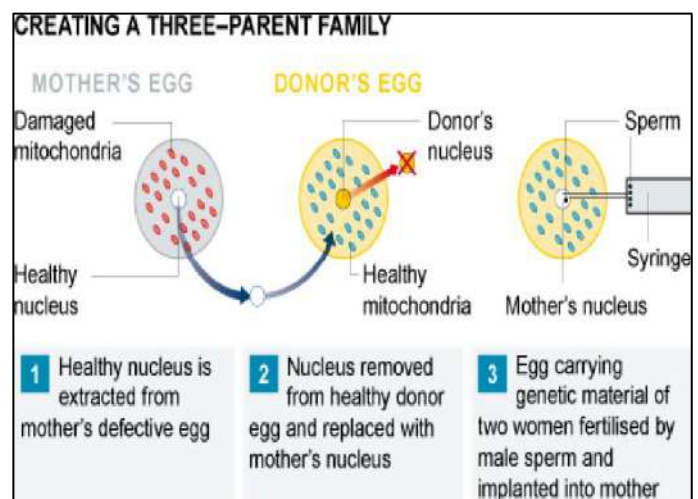
antimatter, which is crucial in explaining why **matter dominates over antimatter in the universe**.

23. Mitochondrial Donation Treatment

Context: Eight healthy babies were born in Britain with the help of an experimental technique called **Mitochondrial Replacement Therapy (MRT)**.

Mitochondrial Donation Treatment (MDT)

- A **three-parent baby** is produced from the genetic material of one man and two women through **mitochondrial replacement therapy (MRT)** and **three-person in vitro fertilization (IVF)**.
- **Aim:** To prevent children from inheriting **mutated mitochondria**.
- **Procedure:** It involves **fertilising the mother's egg with the father's sperm** and then **transferring the genetic material** from the nucleus into a fertilised healthy donor egg that has had its own nucleus removed.
 - This creates a **fertilised egg with a full set of chromosomes** from the parents, but healthy mitochondria from the donor.
 - The egg is then implanted into the womb to establish a pregnancy.
- These babies carry **nuclear DNA from their biological mother and father**, and a **small portion of mitochondrial DNA** from a female donor.



- In MDT, the child inherits:
 - **Nuclear DNA from the biological mother and father (~99.8% of DNA)**
 - **Mitochondrial DNA (mtDNA) from the donor woman (~0.2% of DNA)**
- This is why MDT is often referred to as **“three-parent baby.”**
- MDT does not replace nuclear DNA with donor nuclear DNA. Instead, it retains the intended parents’ nuclear DNA and replaces the faulty mitochondrial DNA with healthy donor mitochondrial DNA.

24. Isotopes & their applications

Context: Nuclear medicine using radioactive iodine (¹³¹I) is gaining prominence in India as a non-invasive, effective treatment for thyroid disorders and differentiated thyroid cancers.

	Isotopes	Applications
1	Sodium-24 (Na-24)	Leak Detection
2	Fluorine-18 (F-18)	PET Scans (Positron Emission Tomography)
3	Carbon-14 (C-14)	Radiocarbon Dating
4	Cobalt-60 (Co-60)	Radiotherapy

25. Golden Handshake in Space

Context: The handshake, which occurred 50 years ago this July 17, defined the Apollo-Soyuz Test Project, the first international human spaceflight. That simple symbol of partnership between bitter competitors remains an enduring legacy of the mission.

Golden Handshake in Space

- The phrase **"Golden Handshake in Space"** commonly refers not to a financial severance package, but to a moment of profound diplomatic and technological significance: the first handshake between American and Soviet astronauts in orbit during the **Apollo-Soyuz Test Project (ASTP)** of 1975.

Historical Context

Apollo-Soyuz Test Project mission patch showing the Apollo and Soyuz spacecraft docking over Earth, featuring the title "APOLLO/COY3" and crew names Stafford, Brand, Slayton, Leonov, and Kubasov

- **Date:** July 17, 1975
- **Event:** The American Apollo spacecraft and the Soviet Soyuz capsule docked in orbit.
- **Participants:** NASA's Thomas Stafford, Vance Brand, and Deke Slayton; Soviet cosmonauts Alexey Leonov and Valery Kubasov.

During this landmark mission, the hatch between the two spacecraft was opened, and **Commander Thomas Stafford (USA) and Commander Alexey Leonov (USSR) shook hands in space**—an act broadcast worldwide and widely described as the **"handshake in space"** or a "golden handshake" because of its symbolism for peace and cooperation between former Cold War rivals.

Significance

- **Diplomatic Breakthrough:** The mission marked the first international human spaceflight and became a symbol of détente between the United States and the Soviet Union, who had been adversaries throughout the space race.
- **Legacy:** This act of cooperation laid the groundwork for future collaboration, leading to joint missions on Russia's Mir space station and, ultimately, the ongoing multinational partnership that created and sustains the **International Space Station (ISS)**.
- **Symbolism:** The handshake was more than a greeting—it was a "golden handshake" between two superpowers, signaling a new era of peaceful collaboration in space despite continued tensions on Earth.

Lasting Impact

- The spirit of the 1975 “golden handshake in space” continues to influence international space efforts, demonstrating that collaboration above the Earth can transcend geopolitical conflict below.

The “**Golden Handshake in Space**” involves **space-faring nations (India, China, Russia, USA)** offering **satellite launches, navigation services, and technology transfer to emerging space nations** at concessional rates to:

- Secure diplomatic support in **ITU frequency allocations**.
- Influence positions in **UN COPUOS** and other global space governance bodies.

It is not exclusive to the USA:

- **China** practises it under its **Space Silk Road (Belt and Road Initiative in space)**, offering BeiDou and launch services.
- **Russia** provides **GLONASS** and launch cooperation.
- **India** extends launch services under Antrix and ISRO, supporting friendly nations.

The **USA’s Artemis Accords** are an example of space diplomacy, but not the only practice of Golden Handshake in space.

- Golden Handshake in space can **counter technology denial regimes** (like MTCR restrictions) by:
 - Providing **satellite navigation alternatives (BeiDou, GLONASS)**.
 - Offering **remote sensing data** to countries denied high-resolution imagery by Western providers.

26. BioEmu

Context: The new deep learning system developed by Microsoft, Rice University and Freie Universität allows **high-resolution protein flexibility modelling at scale, unlike slower, more classical approaches**.

What is BioEmu?

- **BioEmu** is a **deep learning system** developed by Microsoft, Rice University (US), and Freie Universität (Germany).

- Predicts the **full range of shapes (equilibrium ensemble)** a protein explores under biological conditions.
- Allows **high-resolution, scalable modelling of protein flexibility**, unlike slow classical methods.

Why Protein Flexibility Matters?

- Proteins are **dynamic**, not rigid, and change shapes to:
 - **Bind molecules (enzymes)**
 - **Control signalling processes**
 - **Reveal hidden drug-binding sites**
- Understanding flexibility is crucial for **drug discovery and protein function analysis**.

Limitations of Classical Methods

- **Molecular Dynamics (MD):**
 - Tracks atomic movements with high accuracy but is **slow and costly**.
 - Requires **tens of thousands of GPU-hours** even on supercomputers for microsecond simulations.

How BioEmu Works

- Uses an **AI diffusion model** to predict protein conformations.
- Trained on:
 - Millions of AlphaFold-predicted structures.
 - MD simulation data across thousands of proteins.
 - Experimental stability measurements of mutants.
- Can **generate thousands of protein shapes in minutes to hours on a single GPU**.

Performance Highlights

- Accurately predicts:
 - Large conformational changes in enzymes.
 - Local unfolding that activates proteins.
 - Hidden “cryptic pockets” for drug binding.
- Achieved **83% accuracy for large shifts** and **70-81% for small changes**.
- Cannot show **step-by-step pathways** like MD but provides **snapshot ensembles**.

Limitations of BioEmu

- Cannot:
 - Model **temperature shifts, membranes, pH changes, or cell walls.**
 - Show **drug-pathway unfolding.**
 - Predict reliability like AlphaFold.
 - Handle **multi-chain protein interactions.**
- Best used as a **hypothesis-generating tool** needing experimental validation.

Future Potential

- Could **significantly reduce drug discovery timelines** (weeks to hours).
- Complements MD simulations for **hybrid modelling approaches.**
- Indicates the need for **interdisciplinary training** in physics, chemistry, and machine learning for future researchers.

27. Terahertz Radiation

Context: In a new study, researchers demonstrated **long-term, non-invasive monitoring of blood sodium levels** using a system that combines **optoacoustic detection with terahertz spectroscopy**. **Accurate measurement of blood sodium is essential for diagnosing and managing conditions such as dehydration, kidney disease and certain neurological and endocrine disorders.**

What is Terahertz Radiation?

- Falls **between microwaves and mid-infrared** in the electromagnetic spectrum.
- **Low-energy, non-harmful,** and **scatters less** than near-infrared and visible light.
- Sensitive to **structural and functional biological changes**, making it ideal for biomedical applications.

Challenges in Terahertz Spectroscopy:

1. Difficulty in detecting **molecules other than water** in complex samples.
2. Limited **penetration through thick tissues** for in-body detection.

The Solution: Terahertz Optoacoustic Detection

- Developed by **Tianjin University, China.**
- Combines **terahertz irradiation** with **optoacoustic detection**, converting absorbed terahertz energy into **sound waves** for measurement.
- Enables **first in vivo ion detection** using terahertz waves in live mice.
- Overcomes **water interference**, a major limitation of terahertz in biomedical use.

How It Works:

- Terahertz waves **vibrate sodium ions bound to water molecules**, generating **ultrasound waves** detected by transducers.
- Allows **non-invasive, label-free, real-time monitoring** of **blood sodium levels.**

Key Findings:

Live Mice:

- Successfully tracked **blood sodium levels under the skin** on millisecond timescales for over 30 minutes.
- Measurements taken from the ear with skin cooled to 8°C to reduce water background signals.

Human Tests:

- Distinguished **high vs. low sodium levels in blood samples.**
- Measured **non-invasively in blood vessels of healthy volunteers** without skin cooling.
- Signal correlated with **blood flow under the skin**, suggesting clinical potential.

Future Potential:

- Could replace **needle-based blood draws** for **sodium monitoring**, especially in **critically ill patients**, avoiding neurological complications from rapid sodium changes.
- Potential to identify **other biomolecules (sugars, proteins, enzymes)** using unique terahertz absorption signatures.
- Researchers are exploring:

- **Detection sites like inside the mouth** for better signals.
- **Alternative signal processing** to reduce water interference without cooling for **practical clinical use**.
- Terahertz optoacoustics enables **real-time, non-invasive sodium monitoring**, aiding **dysnatremia management with high specificity despite other blood components**.
- Terahertz optoacoustics does not use fluorescence signals. Instead, high-frequency terahertz light causes sodium ions to produce distinguishable acoustic (sound) waves detected by optoacoustic sensors. The system uses sound wave generation, not fluorescence, for detection.

28. AdFalcivax

Context: The Indian Council of Medical Research (ICMR) is developing AdFalcivax, India's first indigenous two-stage malaria vaccine, to combat Plasmodium falciparum using a novel multistage antigen design.

About AdFalcivax – First Indigenous Two-Stage Malaria Vaccine:

- **What it is?**
 - AdFalcivax is a recombinant, chimeric malaria vaccine candidate targeting Plasmodium falciparum.
 - It combines antigens from two lifecycle stages to provide dual protection.
- **Developed by:**
 - Jointly developed by ICMR, RMRC-Bhubaneswar, NIMR, and DBT-NII.
 - Production uses Lactococcus lactis, a safe food-grade bacterium platform.
- **Objective:**
 - To prevent malaria infection at the individual level and break the transmission chain within communities.
 - It aims to provide immunity against both liver-stage infection and mosquito-stage transmission of Plasmodium falciparum.

• Key Features:

- **Dual-stage immunity:** Targets both pre-erythrocytic and sexual stages, blocking infection and halting spread.
- **Extended stability:** Remains functional at room temperature for over 9 months, aiding storage in tropical regions.
- **Broader immune response:** Combines multiple antigens to reduce immune evasion and improve long-term protection.
- **Scalable production:** Uses Lactococcus lactis, a food-grade bacterium, making it safe and cost-efficient to manufacture.
- **Licensable model:** ICMR will allow non-exclusive licensing, encouraging domestic and global production partnerships.

• Significance:

- Positions India as a leader in indigenous vaccine innovation for tropical diseases.
- Supports India's Malaria Elimination Roadmap (by 2030) and Make in India drive.
- Potentially reduces malaria-related deaths, especially in endemic tribal belts.

- AdFalcivax supports **India's Malaria Elimination Roadmap (by 2030)** and **Make in India drive**, making it significant for malaria elimination.
- By **targeting both liver and mosquito-stage transmission**, it **breaks the infection and transmission chain**, critical for elimination.
- **Room temperature stability for 9+ months** aids **deployment in endemic tribal belts and tropical regions**, essential for wide-scale vaccination.

29. Biostimulants

Context: Union Agriculture Minister has directed states to halt forced sales of biostimulants, amid rising complaints over efficacy and regulatory violations. The Centre is tightening oversight on biostimulants through revised specifications and regulatory checks under the Fertiliser Control Order (FCO), 1985.

Biostimulants:

- A **biostimulant** is any substance or microorganism, or a mixture thereof, applied to plants, seeds, soil, or the rhizosphere, which stimulates natural processes in plants to improve nutrient uptake, nutrient efficiency, tolerance to abiotic stress (such as drought or salinity), crop quality, or yield. Unlike fertilizers, which provide nutrients, biostimulants enhance the plant's own physiological capacities without necessarily supplying traditional nutrients or acting as pesticides.

Key Features and Mechanism

- **Improves Nutrient Use Efficiency:** Enhances plant uptake and assimilation of nutrients already present in the soil.
- **Increases Stress Tolerance:** Helps plants better withstand and recover from environmental stresses like drought, temperature extremes, or high salinity.
- **Enhances Crop Quality and Yield:** Promotes stronger growth, improved flowering or fruit-setting, and higher crop quality.
- **Acts Via Natural Plant Processes:** Stimulates physiological pathways or beneficial microbial activity, rather than acting directly as a nutrient or protective chemical.

Common Types of Biostimulants

- **Humic and Fulvic Acids:** Organic substances that improve soil structure and nutrient uptake.
- **Seaweed Extracts:** Provide bioactive compounds and hormones promoting plant vigor.
- **Amino Acids and Protein Hydrolysates:** Enhance nutrient absorption and stress resilience.
- **Beneficial Microorganisms:** Including plant growth-promoting bacteria (PGPB), rhizobacteria, and mycorrhizal fungi that improve root function and soil health.
- **Chitosan and Derivatives:** Naturally occurring compounds that help plants strengthen defense responses.

- **Other Organic Materials:** Extracts or complexes that stimulate plant development via less direct mechanisms.

Distinct from Fertilizers and Pesticides

- Fertilizers **supply nutrients** directly required for plant growth.
- Pesticides **protect plants** from pests and diseases.
- Biostimulants **trigger or enhance natural processes** that help the plant grow better without necessarily providing essential nutrients or acting as a direct defense.

Applications and Benefits

- Used across conventional, organic, and regenerative agriculture to sustainably increase productivity.
- Help growers reduce dependence on chemical fertilizers, leading to better soil health and environmental outcomes.
- Support sustainable agriculture by improving water use efficiency, soil health, and long-term crop resilience.

Regulatory Framework:

- **Legal Backing:**
 - Included under **Fertiliser Control Order (FCO), 1985** through an amendment in February 2021.
 - Must comply with toxicity tests, eco-safety trials, and bio-efficacy studies.
- **Mandatory Testing:**
 - Five **acute toxicity tests** (oral, dermal, inhalation, eye, skin).
 - Four **eco-toxicity tests** (on fish, birds, honeybees, and earthworms).
 - Trials at **3 agro-ecological zones** over a season, with **3 different doses**.
- **Central Biostimulant Committee:**
 - Constituted in 2021 for 5 years under the **Agriculture Ministry**.
 - Advises on product approvals, testing methods, and lab standards.

- Biostimulants include seaweed extracts, humic substances, amino acids, beneficial microbes. They enhance nutrient uptake and abiotic stress tolerance.
- In India, biostimulants are regulated under FCO 1985. Manufacturers must submit bio-efficacy, toxicity, and heavy metal data for registration to ensure safety and efficacy.
- Biostimulants do not replace fertilizers. They do not provide essential nutrients in sufficient quantities but stimulate natural plant processes for better utilization of existing nutrients.

30. In Vitro Biotransformation (ivBT) System

Context: Chinese researchers have developed a method to convert methanol into white sugar, bypassing the need to grow sugar cane or sugar beets.

More on the news:

- The team has developed an **in vitro biotransformation (ivBT) system** that **synthesises sucrose from methanol**, a low-carbon chemical that is derived from industrial waste or carbon dioxide.
 - By utilising enzymes to convert methanol, researchers have presented a **sustainable alternative to traditional agriculture**.

In Vitro Biotransformation (ivBT) System:

- **In Vitro Biotransformation (ivBT)** systems represent a new and rapidly advancing platform for sustainable biomanufacturing and biosynthesis. Unlike traditional metabolic engineering (which relies on living cells like bacteria or yeast), ivBT uses artificial biological environments with purified enzymes to facilitate complex biochemical conversions in a single "one-pot" reaction outside of living organisms.

Definition

- **ivBT systems** are artificial biological reaction setups, built using purified enzymes or multiple

engineered enzymes, to convert low-cost substrates—such as methanol, starch derivatives, or even CO₂-derived molecules—into valuable biochemicals (e.g., sucrose, ethanol, amino acids, polyhydroxybutyrate) without the limitations of cell viability or metabolism.

Key Features and Advantages

- **Cell-Free:** No living cells involved, eliminating bottlenecks such as growth inhibition, metabolic side-reactions, and cell toxicity.
- **Highly Flexible:** Enzyme selection and pathway design can be flexibly engineered for specific biomanufacturing needs.
- **Fast Reaction Rates & High Yields:** Purified enzyme systems allow rapid reactions, higher yields, and easier scalability.
- **Product Range:** Can produce a variety of biocommodities, including food ingredients (e.g., sucrose), organic acids, amino acids, and bioplastics.
- **Sustainability:** Enables direct conversion of industrial feedstocks like methanol or waste CO₂ into food and chemicals, addressing sustainability and climate concerns.

Recent Breakthroughs

- **Sucrose from Methanol:** Chinese researchers created an ivBT system that synthesizes sucrose from methanol (which itself can be derived from industrial waste or CO₂), offering potential solutions to food shortages and greenhouse gas reduction.
- **Starch-to-Chemicals:** ivBT systems have been engineered to convert starch derivatives (such as maltodextrin) into high-value products like polyhydroxybutyrate (a bioplastic), with record-setting production rates and yields.
- **Versatility:** Newer ivBT systems have been adapted for multiple substrates and products, including fructose, amylose, amylopectin, and various oligosaccharides.

Applications

- **Food Manufacturing:** Synthesis of sugars like sucrose, even directly from CO₂.
- **Biorefinery:** Production of organic acids, amino acids, and other commodity chemicals.
- **Green Chemistry:** Enabling efficient utilization of greenhouse gases and industrial by-products.
- **Bioplastics:** Scalable, high-yield systems for producing biodegradable plastics like PHB.

Challenges

- **Enzyme Cost and Preparation:** Bulk production of customized, robust enzymes at low cost remains a technical hurdle.
- **Pathway Complexity:** Designing highly integrated, balanced pathways for multi-step synthesis is challenging.
- **System Stability:** Ensuring long-term enzyme activity and efficient cofactor recycling at industrial scale.

Note: ivBT systems simulate metabolic processes in vitro using enzymes (like cytochrome P450), liver S9 fractions, or microsomes, and are widely used in drug development for evaluating metabolism, toxicity, and pharmacokinetics.

31. HOPS-315

Context: Astronomers have, for the first time, directly observed the earliest physical conditions in which rocky planets begin to form around a distant, young star.

What is HOPS-315?

- HOPS-315 is a newborn protostar located about 1,300 light-years away in the Orion molecular cloud. It is surrounded by a dense, flat, rotating protoplanetary disc made of gas and dust, which is uniquely inclined so that Earth-based telescopes can peer deep into its interior—a rare vantage point for studying early planet formation.

Significance of the Discovery

- **Planet Formation Genesis:** This breakthrough offers direct insight into the fundamental process of how rocky planets, like Earth, initially form from vaporized rock in protoplanetary discs.
- **Solar System Parallel:** The observed processes and the types of minerals found around HOPS-315 remarkably mimic the early stages of our own Solar System's formation.
- **Interstellar Mineral Match:** The mineral types detected, such as forsterite and enstatite, mirror those found as inclusions in chondritic meteorites on Earth.

32. Cyber Espionage

Context: Microsoft has revealed that hackers exploiting unpatched vulnerabilities in its SharePoint server software—previously used for cyber-espionage—have escalated their attacks to include ransomware deployment.

About Microsoft SharePoint – Cyber Espionage:

- **What is Cyber Espionage?**
 - Cyber espionage refers to the unauthorized and covert digital infiltration of systems, networks, or devices to steal sensitive information, often by state or non-state actors for political, strategic, or economic advantage.
- **Recent Attack: Microsoft SharePoint Exploit**
 - Exploited a vulnerability in Microsoft's SharePoint server software.
 - Conducted by a group dubbed **Storm-2603**, reportedly linked to **Chinese state-backed actors** (though denied by China).
 - Initially used for espionage, it now includes **ransomware**, freezing systems until payment is made.
 - **400+ entities** impacted, according to Eye Security (Netherlands), with many more suspected.
 - Marks a shift from passive data theft to **active disruption and financial extortion**.

- **Implications:**

- Risks to **national security**, healthcare, and critical infrastructure.
- Signals growing **convergence of espionage and cybercrime tactics**.
- Exposes gaps in **patch management and incident response** by organizations.
- Calls for **international cooperation** on cybersecurity norms and digital sovereignty.

33. Corals

Context: A study revealed that corals in the Lakshadweep archipelago have declined to half of what they were in 1998. Over 24 years, coral cover declined from 37.24% to 19.6%, reflecting a roughly 50% reduction from the 1998 baseline.

What are Corals?

- Corals are **invertebrates** that belong to a large group of animals called **Cnidaria**.
 - Corals are formed by **multiple small, soft organisms known as polyps**.
 - They secrete a **rocky chalk-like (calcium carbonate) exoskeleton** around themselves for protection.
 - **Coral reefs** are therefore created by **millions of tiny polyps forming large carbonate structures**.
- **Appearance:** Corals range in colour from **red to purple and even blue**, but are most commonly shades of **brown and green**.
 - Corals are bright and colorful because of microscopic algae called **zooxanthellae**.
- **There are three types of coral reefs** – fringing reefs, barrier reefs and atolls.
 - Fringing reefs **form along shorelines**, **barrier reefs form in open water** and **atolls are circular reefs** that have formed around **sunken volcanoes**.
- **Coral reefs in India:** Gulf of Kutch, Gulf of Mannar, Andaman & Nicobar, Lakshadweep Island and Malvan.
- **Significance:** They provide food, shelter, resting and breeding grounds to a quarter of all marine

life, acting as nurseries and refuges to protect critical biodiversity.

- They also support more than 1 billion people living in coastal regions around the world by providing food, livelihoods and recreation.

Reasons for degradation of coral ecosystem:

- **Nutrient runoff → Algal blooms:** Excess nitrogen & phosphorus from agriculture leads to eutrophication, smothering corals.
- **High CO₂:** Increases **Ocean acidification**, reducing coral calcification rates.
- **Cyanide/blast fishing:** Destroys reef structure and kills non-target marine life.
- **Invasive species:** Crown-of-thorns starfish consume coral polyps and have caused widespread destruction.
- **Underwater volcanic activity (Rare but Real):** Can cause localized destruction via heat, sedimentation, and acidic emissions.

While,

- **Offshore wind farms:** Generally, do not contribute to degradation; if well-placed, they can avoid reef zones. Hence they are not the factors in the degradation of coral ecosystem.

34. Compulsory licensing in context of Patents

Context: India has lowered the guard against the threat of pharmaceutical patent rights undermining public health concerns by treating “voluntary licensing” route as the preferable route in the recently signed Comprehensive Economic and Trade Agreement (CETA) with the United Kingdom (UK).

compulsory licensing provision:

- The **compulsory licensing provision** under Indian patent law enables a person other than the patent holder to produce, use, or sell a patented invention without the patentee’s consent, in specific circumstances, to balance public interest and patent rights.

Legal Basis

- **Governing Law:** Section 84 to 94 of the Indian Patents Act, 1970
- **Aligned with International Treaties:** The provision is consistent with Article 31 of the TRIPS Agreement.

Key Provisions**Grounds for Granting a Compulsory License**

A compulsory license can be requested **after 3 years** from the date the patent is granted. Any interested person may apply to the Controller General of Patents on the following main grounds:

- **Reasonable requirements of the public are not satisfied** regarding the patented invention.
- **The patented invention is not available at a reasonable/affordable price** to the public.
- **The invention is not worked in the territory of India** (i.e., not manufactured/imported in sufficient quantity).

Additional Considerations

While granting a compulsory license, the Controller must consider:

- The **nature of the invention** and the time since the patent was granted.
- **Efforts made by the applicant** to obtain a voluntary license from the patentee.
- **Ability of the applicant** to work the invention to public advantage.
- **Capacity and willingness of the applicant** to undertake the risk of working the invention.
- **Measures taken by the patentee/licensee** to make full use of the invention.
- Any voluntary license request by the applicant that was **unsuccessful within a period not exceeding six months**.

Scope and Impact

- **Any person** (including existing licensees) can apply for a compulsory license; prior voluntary efforts to negotiate are generally required.
- The Controller can **set terms and conditions** to ensure the license primarily satisfies domestic demand.

- The provision especially benefits public health, notably for **pharmaceuticals**, allowing for wider access to essential medicines.

Export Provisions

- **Section 92A:** Special provision allows manufacture and export of patented pharmaceutical products to countries with insufficient or no manufacturing capacity to address public health crises.

Purpose and Rationale

- **Prevents abuse of patent monopoly.**
- Ensures inventions are **commercially exploited** and benefit the public.
- Addresses **public health and nutrition** concerns.
- Encourages local working and manufacturing of patented inventions, aligning with India's developmental needs.
- The **compulsory licensing (CL)** provision under **Section 84 of the Indian Patent Act, 1970** is designed to **protect public health** by allowing others to manufacture and sell a patented product **without the consent of the patent holder** under specific conditions, such as high prices or lack of availability.
- The law **does not require a complete refusal to sell**. A CL may be granted if:
 - The **reasonable requirements of the public** are not being satisfied,
 - The **product is not available at a reasonably affordable price**, or
 - The **patented invention is not worked (manufactured) in the territory of India**.

35. Global SPECS Network

Context: The World Health Organisation (WHO) has launched a global initiative — ‘Global Specs 2030’ — to ensure that everyone has access to affordable eyecare services by 2030.

The Global SPECS Network

- It is a **network of stakeholders** whose mission is to support the WHO SPECS 2030 initiative

through coordinated advocacy and united action across all sectors.

- The Global SPECS Network membership application process is open, and eligible organizations can apply throughout the year.

Objectives

- It aims to unite stakeholders around a shared vision to achieve the 2030 global target for refractive error.
- It promotes evidence-based advocacy to support WHO's public health goals and raise awareness of refractive error.
- It encourages discussion, knowledge sharing, and collaboration among network members.

36. Altermagnets

Context: A study by researchers at the S.N. Bose National Centre for Basic Sciences and the Indian Association for the Cultivation of Science, both in Kolkata, has reported that the inexpensive and stable magnetic compound chromium-antimony (CrSb) also belongs to this elite group.

Altermagnets:

- **Altermagnets** are a newly discovered class of magnetic materials that combine the most important features of both ferromagnets and antiferromagnets, but represent a distinct, third fundamental magnetic phase.

Key Characteristics

- **Internal Magnetism, No External Field:** Altermagnets do not generate net external magnetism—unlike ferromagnets (e.g., fridge magnets), they do not attract metal objects, yet they possess highly active internal magnetic properties.
- **Spin Structure and Symmetry:** Their spins alternate as in antiferromagnets, resulting in zero net magnetization. However, the arrangement and crystal symmetries ensure that the electronic bands display strong spin polarization, much like ferromagnets, but with a

unique alternation as energy states change across the material.

- **Non-Relativistic Spin Splitting:** Altermagnets exhibit a special kind of spin splitting—non-relativistic and determined by crystal symmetry, not by relativistic effects like spin-orbit coupling as in traditional magnets.
- **Stability and Speed:** They are stable under high magnetic fields (similar to antiferromagnets) and allow manipulation of spin information at speeds up to a thousand times faster than in ferromagnets, all with very low energy loss.

Scientific Importance

- **Spintronics:** Altermagnets are ideal for spintronic technologies, which utilize electron spin (instead of just charge) for data storage and processing, promising faster, energy-efficient, and more compact devices.
- **No Magnetic Interference:** Because they produce no stray external magnetic fields, altermagnets are safer for use around sensitive electronics, overcoming a key limitation of ferromagnetic data storage.
- **Quantum Devices and Memory:** Their unique internal spin properties enable information to be written and read rapidly, without risk from external magnetic fields—vital for next-gen memory chips and quantum computing components.
- Altermagnets exhibit unique spin-split band structures **without net magnetization**, meaning they do not produce disruptive stray magnetic fields like ferromagnets do. This makes them **ideal for high-density spintronic circuits**.
- The **spin-polarized bands** in altermagnets allow spin currents to be generated/manipulated—**even in the absence of overall magnetization**—a major advantage for minimizing crosstalk in nanoscale devices.

37. Deep-brain stimulation

Context: Over 1.6 lakh people worldwide have received deep-brain stimulation (DBS), a cutting-

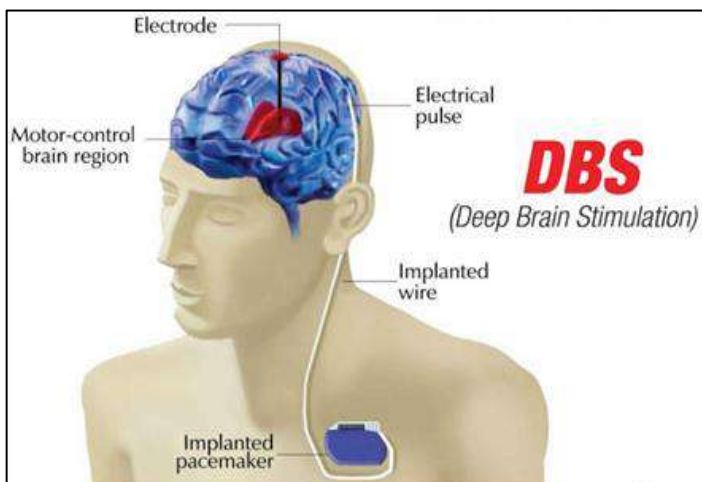
edge neurotechnology increasingly used in treating complex brain disorders.

About

- **Deep-brain stimulation (DBS)** is a medical technique where doctors implant **electrodes** deep inside specific areas of the brain to treat certain disorders.
- These electrodes are connected by wires to a small device, similar to a heart's pacemaker, which is usually placed under the skin in the upper chest.
- The device sends controlled, mild electrical impulses to targeted brain regions, helping adjust abnormal brain activity or chemical imbalances.

How Does It Work?

- Technically, DBS works by modifying how groups of neurons talk to each other. Many of these disorders involve faulty electrical signals in the brain.
- Delivering electrical pulses through DBS can interrupt these erratic signals, helping reduce symptoms such as tremors or muscle stiffness.
- The amount and pattern of stimulation can be precisely adjusted by doctors or, to some extent, by patients themselves using external programmers.
- One advantage of DBS is that, unlike brain surgery that destroys tissue, **its effects are reversible**: if you turn off the device, the stimulation stops.



Applications

- DBS is primarily used to treat movement disorders such as: **Parkinson's Disease, Essential Tremor and Dystonia**.
- It has also been approved for some psychiatric conditions like obsessive-compulsive disorder, and is being studied for severe depression and **epilepsy**.

38. CRIB Blood Group

Context: A South Indian woman was found to have a "new" blood group with a rare antigen named CRIB Blood Group.

What is CRIB Blood Group?

- The CRIB blood group is a newly discovered blood group antigen that is part of the **Cromer (CR) blood group system**. "CR" refers to the Cromer system; "IB" refers to "**India, Bengaluru**," recognizing the place of discovery.
- The Cromer system is a rare blood group classification. It involves antigens located on the **Decay-Accelerating Factor (DAF)** protein found on red blood cells.
- These antigens play a significant role in immune reactions that can occur during blood transfusions.

Scientific Significance

- CRIB is a new entry in global transfusion medicine.
- Its discovery highlights India's contribution to rare blood immunogenetics.
- It emphasizes the critical need for rare donor registries and global collaboration in blood typing.

Blood Group Basics

- Blood groups are determined by specific molecules (antigens) on the surface of red blood cells.
- The ABO and H blood groups are the oldest and most important blood group system in

transfusion medicine due to their high immunogenicity.

- There are over 30 blood group systems (e.g., Bombay, Kell, Kidd, Duffy, MNS, etc.).
- The ABO system was originally discovered in 1900 by Austrian scientist, Karl Landsteiner, for which he later received the Nobel prize in 1930.

Note: Bombay blood group (hh phenotype) is a rare blood group lacking A, B, and H antigens. Kell, Kidd, Duffy, MNS are all minor blood group systems beyond the main ABO and Rh systems. These antigen systems are clinically significant in blood transfusion medicine and immunohematology.



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GEOGRAPHY AND MAPPING

1. Location of Sudan

Context: Millions of people displaced by the war in Sudan are at risk of falling deeper into crisis as funding for food aid dwindles, the UN's World Food Programme warned on June 30.

- The Blue Nile, originating from Lake Tana in Ethiopia, and the White Nile, originating from the Great Lakes region in Central Africa, converge in Khartoum, the capital city of Sudan, to form the main Nile River.
- The Nuba Mountains are located within South Kordofan, a state in central-southern Sudan. They do not form a boundary between Sudan and Libya. The border between Sudan and Libya is a long, largely desert boundary far to the northwest of the Nuba Mountains. The Nuba Mountains are sometimes referred to in relation to the border between Sudan and South Sudan, but not Libya.



2. Location of Algeria

Context: An Algerian court upheld a five-year jail term against dual-national author Boualem Sansal, whose case has strained ties with France. Sansal, 80,

was first sentenced to five years behind bars on March 27 on charges related to undermining Algeria's territorial integrity over comments made to a French media outlet.

- The Atlas Mountains are a major mountain range in North Africa that stretches across Morocco, **Algeria**, and Tunisia. Specifically, the Tell Atlas and Saharan Atlas ranges are prominent parts of the Atlas Mountains located within Algeria.
- Algeria has longest border with Morocco (1,559 km), and not with Mauritania (463 km).



3. Location of Trinidad & Tobago

Context: Indian Prime Minister has scheduled a historic diplomatic visit to Trinidad and Tobago, marking the first-ever bilateral PM-level visit, intensifying India's engagement with the Global South.

- Trinidad and Tobago is part of the Lesser Antilles (specifically, the southernmost islands of the Lesser Antilles), not the Greater Antilles. The Greater Antilles include Cuba, Hispaniola (Haiti and Dominican Republic), Jamaica, and Puerto Rico. While some Caribbean islands are known for volcanic mountains, Trinidad and Tobago is not primarily known for active volcanoes. Its geology is more related to its position on the South American continental shelf.

- The Gulf of Paria is a shallow inland sea located between the island of Trinidad and the northeastern coast of Venezuela. It serves as a natural maritime boundary between the two nations.



4. Location of Switzerland

Context: The threat from espionage is high in Switzerland as global insecurity increases, with the main threats emanating from Russia and China, the country's Federal Intelligence Service warned on July 2.

- The Matterhorn is a prominent mountain in the Alps, straddling the border between **Switzerland and Italy**, not Switzerland and France.
- Lake Zurich is entirely within **Switzerland**, primarily bordered by the cantons of Zurich, St. Gallen, and Schwyz. The border between Switzerland and Liechtenstein is formed by the Rhine River in parts and also extends through the Rätikon range of the Alps. Lake Zurich does not form a boundary with Liechtenstein.



5. Roll Cloud

Context: A rare roll cloud was spotted over Portugal's coastline as a cool Atlantic air mass collided with hot, dry air during an intense European heatwave, captivating beachgoers and meteorologists alike.

About Roll Cloud:

- A **roll cloud** is a rare, low-level, horizontal, tube-shaped cloud that appears to roll as it moves.
- Unlike funnel clouds, it is **not attached to any thunderstorm base** or rotating vortex.
- Commonly Seen In:**
 - Coastal regions where **oceanic and continental air masses** interact
 - Frequently observed over Plains in the U.S., Gulf of Carpentaria in Australia, and Atlantic coasts of Europe.
- How Roll Clouds Form?**
 - Contrasting Air Masses:** Formed due to the interaction of cool, moist maritime air and hot, dry continental air at coastal boundaries.
 - Thermal Inversion:** A temperature inversion layer develops, with cool air trapped below

warm air, restricting vertical convection in the troposphere.

- **Atmospheric Gravity Waves:** As the dense cool air undercuts warm air, it triggers gravity waves—oscillations in the lower atmosphere.
- **Adiabatic Cooling & Condensation:** The rising limb of the wave cools adiabatically, causing condensation and cloud formation and the sinking limb remains dry.
- **Cloud Structure:** Forms a horizontal, cylindrical cloud detached from main cloud systems—indicating meso-scale dynamics.
- **Geographic Zones:** Common in coastal transition zones where marine-continental boundaries are sharply defined.
- **Alignment & Wind Influence:** Typically aligns parallel to low-level wind flow, often shaped by sea breeze fronts or nocturnal land breezes.
- **Characteristics of Roll Clouds:**
 - **Long, tube-shaped, and low-lying** and can stretch hundreds of kilometers.
 - Detached from the parent cloud system.
 - Often forms in the **morning hours** (also called “**morning glory**” clouds).
 - Appears to **roll horizontally**, like a giant rolling pin in the sky.
- Roll clouds **are not stationary**; they **move along with the wind direction and speed**, appearing to roll about their horizontal axis.
- Roll clouds can form when a downdraft from a thunderstorm lifts warm, moist air, which cools and condenses into a tube-shaped rotating cloud, typically detached from the storm.

6. Location of Ethiopia

Context: Ethiopia’s Prime Minister Abiy Ahmed on July 3 said a multi-billion-dollar mega-dam on the Blue Nile that has long worried neighbouring countries is complete and will be officially inaugurated in September. The Grand Ethiopian Renaissance Dam is considered Africa’s largest hydroelectric project.

- The White Nile River's primary source is generally considered to be Lake Victoria, which is located in East Africa, shared by Uganda, Kenya, and Tanzania. While the White Nile does flow through parts of the East African Rift System, and the Nile basin includes parts of Ethiopia, the Blue Nile (a major tributary of the Nile) originates from Lake Tana in the Ethiopian Highlands.
- The Danakil Desert (also known as the Afar Desert) is primarily located in northeast Ethiopia, southern Eritrea, and northwestern Djibouti. While Ethiopia shares a border with Somalia, the Danakil Desert is not the geographical feature that separates Ethiopia from Somalia. It is located to the northeast of Ethiopia, whereas Somalia is to the southeast.



7. Location of Germany

Context: Faced with an ageing population and growing labour shortage, Germany — Europe’s largest economy — is turning towards other countries, including India which German officials call “the world’s largest labour pool”, for skilled workers.

- Both East and North Frisian Islands lie in North Sea off coasts of Germany.
- Oder River, which makes the natural boundary between Germany and Poland empty up in Baltic Sea.



8. Location of Myanmar

Context: Myanmar's ruling junta made a rare call for the armed groups it is fighting to cooperate with it ahead of a slated election, an invitation anti-coup forces swiftly rejected. The unexpected appeal comes as the junta continues to suffer major battlefield reverses to ethnic minority armed groups and pro-democracy forces.

- The Tropic of Cancer is approximately at 23.5° North latitude. Sittwe Port is located in Rakhine State, Myanmar, at approximately 20.14° North latitude. While the Tropic of Cancer does pass through the northern part of Myanmar, it passes significantly north of Sittwe.
- The Irrawaddy River is the longest river in Myanmar and its most important commercial waterway. It forms a large delta and empties into the Andaman Sea (part of the Indian Ocean), not

the Gulf of Thailand. The Gulf of Thailand is much further east.



9. Slow Quakes

Context: For the first time, scientists have directly observed a slow slip earthquake in the midst of relieving tectonic stress along a major underwater fault zone.

Slow Quakes:

What Are Slow Quakes?

- Slow quakes, also known as **slow earthquakes** or **slow slip events (SSEs)**, are a distinctive type of seismic phenomenon where tectonic energy is released gradually along fault lines, over periods ranging from hours to months or even years. Unlike regular earthquakes, which unleash energy suddenly and cause noticeable ground shaking, slow quakes happen so gradually that their movement typically goes undetected by people and traditional seismometers.

Key Characteristics

- **Duration:** Slow quakes can last from several hours to weeks, months, or, in rare cases, years.

- **Slip Rate:** The relative movement along the fault during a slow quake is much slower compared to a typical earthquake.
- **Seismic Radiation:** They generate little to no high-frequency seismic waves, producing minimal or no perceptible ground shaking. Detection often requires sensitive instruments and filtering for low-frequency tremors.
- **Depth:** Slow quakes commonly occur at intermediate depths (10–40 km), especially along tectonic plate boundaries and subduction zones.

Types and Classification

- Slow earthquakes are classified based on their **duration, frequency content, and location** relative to the main locked (seismogenic) zone of a fault:
 - **Short-term SSEs:** Last for days to weeks.
 - **Long-term SSEs:** Extend over months to several years.
 - **Low-frequency tremor:** Seismic signals with frequencies of a few hertz, typically deeper in subduction zones.
 - **Very-low-frequency (VLF) events:** With longer periods (tens of seconds), often accompanying slow slip.

How Are Slow Quakes Detected?

- Owing to the lack of strong shaking, **slow quakes are primarily detected by:**
 - **Geodetic instruments** (like GPS and strainmeters) monitoring subtle changes in the Earth's surface.
 - **Seismic analysis** filtering for low-frequency tremors and very-low-frequency events.

Why Are Slow Quakes Important?

- **Seismic Hazard Assessment:** Slow quakes may precede or influence larger, potentially damaging earthquakes, making their study essential for hazard forecasting.
- **Earth Dynamics:** They provide insight into processes along fault interfaces, especially in

subduction zones, helping explain the mechanics of earthquake cycles and stress buildup.

- **Earthquake Prediction:** Monitoring slow quake activity could improve understanding of when and where larger earthquakes might be triggered, although this remains an area of active research.
- Emerging research strongly suggests that slow slip events (a type of slow earthquake) can indeed transfer stress to locked segments of subduction zones, thereby increasing the likelihood or even directly triggering larger, fast-moving megathrust earthquakes.
- Slow quakes, particularly slow slip events, occur on the downdip extensions of the seismogenic zone (where megathrust earthquakes occur) or even within the shallower parts of the megathrust interface itself. Their slow movement, without immediate seismic rupture, nonetheless changes the stress distribution on adjacent, locked portions of the fault.

10. Location of Suriname

Context: Suriname's parliament backed Jennifer Simons as the South American country's first woman president on July 6, setting the doctor and former parliamentary speaker on course to helm a nation on the cusp of a predicted oil boom.



- Historically, Suriname was a Dutch colony and was known as **Dutch Guiana**.
- Suriname shares borders with French Guiana to the east, Brazil to the south, and Guyana to the west. Suriname and Venezuela do not share a direct border. Venezuela shares a highly contested border with Guyana (the Essequibo region).

11. River Seine

Context: For the first time since 1923, France has reopened the River Seine for public swimming, following extensive clean-up efforts ahead of the Paris Olympics.

- The Bay of Biscay is located in the Atlantic Ocean, to the west of France and north of Spain. It does not separate France from Italy. France and Italy are separated by the Alps mountain range and are bordered by the Mediterranean Sea to their south. The water body separating them in the Mediterranean is the Ligurian Sea, an arm of the Mediterranean.
- The Seine River originates in the Langres plateau in Burgundy, France, not the Jura Mountains. It does indeed flow through Paris and ends up in the English Channel at Le Havre.



12. Location of Uzbekistan

Context: Colombia and Uzbekistan have officially joined the New Development Bank (NDB), expanding the multilateral lender's membership to 11 countries.

- Amu Darya is a major river of Central Asia forms part of Uzbekistan's southern border and flows through its western regions. Syr Darya is the other major river of Central Asia, and it flows through the eastern and northern parts of Uzbekistan.
- Uzbekistan shares borders with Kazakhstan, Kyrgyzstan, Tajikistan, Afghanistan, and Turkmenistan.



13. Neighbours of Bulgaria

Context: EU finance ministers have officially approved Bulgaria's entry into the eurozone from January 1, 2026, making it the 21st member of the single currency area.

Neighbours of Bulgaria:

- Romania:** To the north, separated mostly by the Danube River.
- Serbia:** To the west.
- North Macedonia:** To the southwest.
- Greece:** To the south.
- Turkey:** To the southeast.



14. Tokara Islands

Context: More than 1,000 earthquakes have rattled the Tokara Islands in southern Japan over the past two weeks.

About

- The **Tokara Islands** are an archipelago consisting of **seven inhabited islands** and **five uninhabited islands**.
- The chain stretches about **150 km (93 miles)** and lies between **Yakushima** and **Amami-Oshima**.
- Japan is among the most seismically active nations on Earth, located at the intersection of **four major tectonic plates** along the western edge of the **Pacific “Ring of Fire”**.



15. Location of Spain

Context: A massive wildfire in Tarragona province, Catalonia (Spain) has forced over 18,000 people into lockdown, burning nearly 3,000 hectares of forested land.

- The Ebro River originates in the Cantabrian Mountains, not the Cordillera Central. The Ebro River flows into the Mediterranean Sea, not the Atlantic Ocean.
- The Balearic Islands (Mallorca, Menorca, Ibiza, Formentera, etc.) are indeed located in the Mediterranean Sea and belongs to Spain.



16. Location of Namibia

Context: The President of Namibia conferred on Prime Minister Modi the highest civilian award of Namibia – Order of the Most Ancient Welwitschia Mirabilis. He is the first Indian leader to be given this award.

Namibia shares land boundaries with:

- Angola (north)
- Zambia (northeast, at the Caprivi Strip)
- Botswana (east)
- South Africa (south)



17. Turkana Basin

Context: Recent studies extracted 18–20-million-year-old enamel proteins from extinct mammal fossils in the Turkana Basin, Kenya.

Turkana Basin:

- Located in **northern Kenya and southern Ethiopia** within the **East African Rift System**.
- Contains **Lake Turkana** (world's largest permanent desert lake, saline and alkaline).
- Rivers **Omo and Turkwel** feed the lake.
- Known for **hominid fossils** (e.g., Turkana Boy).
- Semi-arid climate, savannah, and bushland vegetation, Grevy's zebras, crocodiles, endemic tilapia species.
- Livelihood: **pastoralism by local communities** (Turkana, Dassanech, etc.).



18. Carpathian Mountains

Context: Slovakia's President on July 10 swapped his suit for a uniform as he entered a two-week Army reserve training course in a bid to boost the force's ranks.

Carpathian Mountains:

- The Carpathian Mountains are a major mountain range in Central and Eastern Europe.
- A significant portion of their main range, particularly the High Tatras (Vysoké Tatry), forms a prominent and well-defined natural border directly between **Poland** to the north and **Slovakia** to the south.
- This mountain range has historically served as a natural barrier and a geographical separator for these two nations.



19. Location of Lithuania

Context: The seals at the top of the food chain in the Baltic Sea absorbed the pollution, leaving the females infertile and the entire population with a weak immune system. After a ban on toxic pesticide use, the population survived, with the current estimates putting the number of grey seals in the Baltic Sea at 50,000 to 60,000.

Lithuania, located in the Baltic region of Europe, shares land borders with four countries:

1. **Latvia** (to the North)
2. **Belarus** (to the East and Southeast)

3. **Poland** (to the Southwest)
4. **Russia** (specifically, its exclave of Kaliningrad Oblast, to the Southwest)



20. Florida Strait

Context: The U.S. is sanctioning Cuban President Miguel Díaz-Canel and others for human rights violations and restricting access to visas on the anniversary of the 2021 protests. The protests, which were not led by an opposition group, developed on July 11 and 12, 2021, drawing attention to the depths of Cuba's economic crisis.

- The Florida Straits (Straits of Florida), about 150 km wide, separate Cuba from the USA (Florida).
- The Tropic of Cancer passes through the middle of Cuba, so it does not lie entirely north of it.



21. Gulf of California

Context: President Donald Trump on July 12 announced he's levying tariffs of 30% against the European Union and Mexico starting August 1, a move that could cause massive upheaval between

the United States and two of its biggest trade partners.

- The Gulf of California (also known as the Sea of Cortez) separates the Baja California Peninsula (which is part of Mexico) from the mainland of Mexico. The border between Mexico and the USA is primarily defined by the Rio Grande River in the east and a land border that extends westward to the Pacific Ocean, crossing states like Texas, New Mexico, Arizona, and California.
- The Baja California Peninsula is located in northwestern Mexico, extending south from the U.S. border. Central American nations like Guatemala and Belize are located far to the southeast of mainland Mexico, connected by Mexico's narrow Isthmus of Tehuantepec.



22. City & Latitude

Context: Russia's foreign minister warned the U.S., South Korea and Japan against forming a security partnership targeting North Korea as he visited his country's ally for talks on further solidifying their booming military and other cooperation.

Arrangement:

City	Latitude
Pyongyang	39.019444°N
Osaka	34.672314°N
Shanghai	31.224361°N
Hong Kong	22.302711°N

Thus, **North to South: Pyongyang → Osaka → Shanghai → Hong Kong.**



23. Sierra Leone

Context: Sierra Leone's Tiwai island — a lush forest home to one of the world's highest concentrations of primates — landed a spot July 13 on the UN cultural agency's World Heritage list.

Sierra Leone shares land borders with:

- Guinea (north and northeast)
- Liberia (southeast)



24. Location of Malaysia

Context: Malaysia clamped down on July 14 on the export, transshipment and transit of all U.S.-made artificial intelligence chips, seeking to stop illegal trade to countries including China.

- Peninsular Malaysia shares a land border with Thailand to the north and is connected by

causeways/bridges to Singapore (though often considered a maritime border). East Malaysia (on the island of Borneo) shares land borders with Indonesia (Kalimantan) and Brunei.

- The Strait of Malacca is a narrow stretch of water that separates the Malay Peninsula (which is part of Malaysia) from the island of Sumatra (which is part of Indonesia).



25. Location of Saudi Arabia

Context: The Union Minister for Health and Family Welfare and Chemicals and Fertilizers concluded his three-day visit to Saudi Arabia.



- Saudi Arabia and Egypt are separated by the Red Sea, specifically the Gulf of Aqaba. While they are geographically close in that region, they do **not** share a direct land border. The Sinai Peninsula is part of Egypt and borders Israel and the Gaza Strip to its east, but not Saudi Arabia by

land. There has been a proposal for a causeway/bridge connecting them, but it doesn't currently exist as a land border.

- The Tropic of Cancer is approximately at 23.5° N latitude. Riyadh's approximate latitude is 24° 38' N. While Riyadh is very close to the Tropic of Cancer, it is located just north of it, not directly on it. The Tropic of Cancer does pass through other parts of Saudi Arabia.

26. South China Sea

Context: The United States Navy will construct two military boat repair facilities in Palawan, Philippines, facing the South China Sea, to strengthen maritime security amid rising tensions with China in the contested region.

About South China Sea:

- **What It Is?**
 - The South China Sea is the largest marginal sea of the western Pacific Ocean, known for its strategic and economic importance due to rich marine biodiversity, oil reserves, and critical shipping lanes.
- **Location:**
 - Located between **Southeast Asia and China**, it connects to the Pacific via the Luzon Strait and to the Indian Ocean through the Strait of Malacca.
 - Major geographic features include:
 - **China Sea Basin:** Deepest point (~5,000 m).
 - **Palawan Trough and Sunda Shelf:** Vital undersea features.

Sequence of islands:

1. **Pratas Islands:** Located in the northernmost part of the South China Sea, southeast of Hong Kong.
2. **Paracel Islands:** South of Pratas, closer to Vietnam and China's Hainan Island.
3. **Scarborough Shoal:** West of the Philippines, and southwest of the Paracels.

4. **Spratly Islands:** The southernmost and largest contested archipelago, located much further south than the others.

So the North to South sequence is: **Pratas Islands - Paracel Islands - Scarborough Shoal - Spratly Islands.**



27. Eswatini (formerly Swaziland)

Context: The U.S. has deported five migrants convicted of crimes to the small African kingdom of Eswatini, ruled by an absolute monarch accused of human rights abuses. The deportation of migrants to countries which are not their own is part of Donald Trump's poll promise to expel millions of undocumented migrants from the U.S.

- Eswatini (formerly Swaziland) is indeed a landlocked country. However, it is not completely surrounded by South Africa. Eswatini is bordered by **South Africa to its north, west, and south**, but it is also bordered by **Mozambique to its east**.
- The Lebombo Mountains form a natural boundary primarily between **Eswatini and Mozambique** (along Eswatini's eastern border). They do not primarily form a boundary between Eswatini and South Africa. While parts of the range might extend near the South Africa

border, its main role as a boundary is with Mozambique.



28. Bolivia

Context: India dispatched 3 lakh doses of Measles-Rubella vaccine to Bolivia amid a disease outbreak, reaffirming its commitment to Global South health diplomacy.

Bolivia shares land boundaries with:

- Brazil (Northeast and East)
- Peru (Northwest)
- Chile (Southwest)
- Argentina (South)
- Paraguay (Southeast)



29. Slovenia

Context: Slovenia declared two far-right Israeli Cabinet Ministers, Itamar Ben-Gvir and Bezalel Smotrich, persona non grata on July 17, the first European Union country to do so, Foreign Minister Tanja Fajon said.

- The Alps Mountain range indeed extends into Slovenia. The most prominent and well-known part of the Alps in Slovenia is the **Julian Alps**, which includes Slovenia's highest peak, Mount Triglav. Another significant part of the Alps in Slovenia is the **Kamnik–Savinja Alps** (often referred to simply as Savinja Alps, though Kamnik–Savinja Alps is the full and more precise name). These ranges form a substantial part of Slovenia's landscape.
- Slovenia is one of the few Central European countries that has access to the sea. It has a short but beautiful coastline along the **Adriatic Sea**, specifically the Gulf of Trieste, which is part of the larger Adriatic Sea. The main Slovenian coastal towns include Koper, Piran, and Portorož.



30. Location of Senegal

Context: France on July 17 formally handed its last two military bases to Senegal, ending a 65-year troop presence and leaving no permanent French camps in west or central Africa. This move echoes continent-wide demands for sovereignty as France consolidates its military presence only in Djibouti.

Senegal shares its land boundaries with:

- Mauritania (North)
- Mali (East)
- Guinea (Southeast)
- Guinea-Bissau (Southwest)
- The Gambia (enclave inside Senegal)



31. Socotra Island

Context: Field teams from the United Arab Emirates and the World Health Organization have successfully completed the first phase of a comprehensive health assessment on Socotra Island in Yemen.

About the Socotra Island

- Socotra Island is a remote **Yemeni archipelago** located in the **Indian Ocean** approximately 380 kilometers south of the Arabian Peninsula.
 - It lies in the northwest Indian Ocean near the Gulf of Aden, stretching 250 km, and consists of four islands and two rocky islets that appear as an extension of the Horn of Africa.
- The largest island covers about 3,600 square kilometers and is home to approximately 60,000 inhabitants.

- Socotra is renowned for its extraordinary biodiversity, with up to a third of its plant species being endemic and found nowhere else on the planet.
 - Despite its natural significance, Socotra faces ongoing challenges from Yemen's civil war.
- The island was recognized as a **UNESCO World Heritage Site** in 2008.



32. SWIFT ISO 2022 Norms

Context: Indian Banks' Association (IBA) has asked all banks to fast-track the implementation of the SWIFT ISO 2022 norms, failing which they may face difficulties in cross-border payments.

SWIFT ISO 2022 Norms

- **ISO 2022** is a global, open standard for financial messaging, developed by the International Organization for Standardization (ISO) and adopted by SWIFT (Society for Worldwide Interbank Financial Telecommunication) as the new framework for exchanging electronic data between financial institutions.
- It is gradually replacing older, fragmented messaging schemes such as SWIFT MT (Message Type) and proprietary formats used in payment, securities, card, and trade finance domains.

Key Features

- **Rich, Structured Data:** ISO 2022 enables use of more detailed, standardized, and structured

data fields in payments and other financial messages—primarily using XML syntax.

- **Semantic Consistency:** Unlike legacy formats that used different jargon across countries or banks, ISO 20022 provides a central dictionary of business terms to achieve global uniformity and interoperability.
- **Extensive Applicability:** Supports a broad range of activities, including payments (domestic and cross-border), securities clearing and settlement, FX transactions, card operations, and more.

Migration & Adoption

- **Global Adoption:** Over 70 countries and most major central banks are implementing or have already implemented ISO 20022 for their high-value and real-time payment systems.
- **SWIFT Migration Timeline:** SWIFT started the global migration in March 2023, with full transition from old message formats to ISO 20022 standards expected by November 2025. During this period, banks and financial institutions must support both legacy MT and ISO 20022 (MX) message formats.
- **Why Transition?** The shift is driven by the need for better data, automation, improved compliance (e.g., anti-money laundering), advanced fraud prevention, and to support new digital financial services.

Benefits

- **Enhanced Data Quality:** Enables richer and more accurate transaction details, facilitating improved analytics, compliance controls, and customer service.
- **Automation & Efficiency:** Reduces manual intervention, promotes straight-through processing and reconciliation, and lowers overall transaction costs.
- **Better Regulatory Compliance:** Improved information granularity helps institutions with more effective AML and fraud screening.
- **Interoperability:** Facilitates consistent communication throughout the global financial

ecosystem, enabling faster, more reliable cross-border payments.

Technical Aspects

- **Message Structure:** ISO 20022 messages are defined in a centralized repository and expressed in XML or ASN.1 formats, and built around a global set of business concepts and terms.
- **Toolkit for Implementation:** Provides guidelines for modeling, dictionary maintenance, message definition, and syntax generation.

Challenges

- **System Upgrades:** Migration requires significant upgrades to IT systems and processes to handle the richer data and new messaging formats; older systems may struggle with the transition, potentially causing delays or truncation of data.
- **Operational Impact:** Higher manual effort may be needed temporarily until full automation and interoperability are achieved across all institutions.

33. Bitra Island

Context: Lakshadweep administration is considering acquisition of Bitra for defence purposes.

About Bitra Island

- It is the smallest inhabited island in the territory of Lakshadweep having a land area of 0.105 sq km.
- **Location:** Near the Agatti Island, Arabian Sea.
- **Climate:** Categorised as 'Aw' i.e., tropical savannah according to the Köppen-Geiger system of climate classification.
- The average rainfall received is ~1600 mm a year.



34. Pay Commission of India

Context: The government has begun early discussions to set up the 8th Central Pay Commission (CPC), which is expected to revise salaries, allowances, and pensions for central government employees and pensioners. The commission is scheduled to be implemented from January 1, 2026.

Pay Commission of India:

- The **Pay Commission** is a specialized committee set up periodically by the Government of India to review and recommend changes in the salary structure, allowances, and pension schemes for Central Government employees, including both civil and military personnel. Its recommendations have a direct impact on the financial well-being of millions of employees, as well as the overall fiscal situation of the country.

Purpose and Mandate

- **Objective:** To review and revise pay scales, allowances, and pensions, considering inflation, changes in the cost of living, and the nation's financial standing.
- **Constitution:** Usually constituted every 10 years under the authority of the President of India.
- **Scope:** Applies to Central Government employees, personnel of All India Services, Union Territories, the Defence Forces, and various public regulatory bodies and courts.
- **Mandate:** Each commission is given a timeframe (often 18 months) to submit its recommendations, after wide-ranging consultations and analysis of the country's economic situation.

Process and Impact

- **Study and Analysis:** Each commission comprehensively analyzes pay-related data, economic conditions, and fiscal implications before submitting its report.
- **Recommendations:** Not binding—the government may accept, modify, or reject recommendations.

- **Implementation:** Involves revising pay, Dearness Allowance (DA), House Rent Allowance (HRA), Travel Allowance (TA), etc., impacting not just pay but also pensions and overall quality of life for public servants.

Current and Upcoming Developments

- **7th Pay Commission:** Implemented from January 1, 2016; minimum salary set at ₹18,000; overall increase in pay, allowance, and pension by 23.55% for nearly 48.62 lakh employees and 67.85 lakh pensioners.
- **8th Pay Commission:** Approved for implementation from January 1, 2026; expected minimum wage to rise to ₹41,000; fitment factor proposed at 2.28; DA expected to reach 70% and be merged into base salary.

Importance of the Pay Commission

- **Employee Welfare:** Ensures public servants' remuneration keeps pace with economic changes.
- **Fiscal Impact:** Recommendations can significantly affect the national exchequer and fiscal deficit.
- **Economic Adaptation:** The pay structure evolves in response to changing economic scenarios, improving fairness and efficiency within the public sector workforce.
- Pay Commissions have influenced India's fiscal discipline, bureaucratic efficiency, and socio-economic structures.
- Pay Commissions recommend for **central government employees** only; states may or may not adopt their recommendations and often have separate pay revision commissions.
- Implementing Pay Commission recommendations has **major fiscal impacts**, influencing **inflation**, **public expenditure**, and **government borrowing**.

35. Location of Belgium

Context: Belgian officials said they held and questioned two Israeli citizens who attended an

electronic music festival, after pro-Palestinian groups accused them of war crimes in Gaza. Prosecutors said they received complaints alleging that two Israeli soldiers were spotted at the Tomorrowland festival near Antwerp last week.

Belgium shares land borders with the following four countries:

1. **France** (to the south and southwest)
2. **Germany** (to the east)
3. **Luxembourg** (to the southeast)
4. **Netherlands** (to the north)



36. Financial Inclusion Index

Context: The Financial Inclusion Index (FI-Index), which captures the extent of financial inclusion across the country, improved to 67 in March 2025 from 64.2 in March 2024, the Reserve Bank of India (RBI) said on July 22.

Financial Inclusion Index (FII):

- The **Financial Inclusion Index (FII)** is a composite, multidimensional metric designed to measure the level of financial inclusion within a country or region. It captures the extent to which individuals and businesses have access to, and

effectively use, formal financial services. The index is widely used for both cross-country comparisons and micro-level policy planning, especially in countries like India.

Definition and Purpose

- **FII quantifies:** The degree of access, usage, and quality of key financial services such as banking, savings, credit, insurance, investments, postal services, and pensions.
- **Purpose:** To provide policymakers and researchers with a comprehensive measure of financial system inclusivity, to help guide interventions aimed at broadening financial access.

Key Dimensions

Most methodologies, including the one used by the Indian government, measure FII across three core dimensions:

- **Access:** Availability and reach of financial services (number of branches, ATMs, business correspondents, etc.)
- **Usage:** Frequency and volume of financial product use (accounts operated, loan disbursement, insurance penetration, etc.)
- **Quality:** Assessment of service adequacy, customer satisfaction, and the range of formal product choices.

Methodology and Calculation

- **Single Value Index:** The FII is represented on a scale of 0 to 100, where higher values indicate greater financial inclusion.
- **Normalized Scores:** For each dimension (access, usage, quality), normalized scores are calculated using empirical minimum and maximum values for chosen indicators. The dimension index for an indicator d_i is typically computed as:

$$d_i = w_i \times \frac{A_i - m_i}{M_i - m_i}$$

where A_i is the actual value, m_i and M_i are minimum and maximum values, and w_i is the assigned weight (often equal across indicators).

- **Composite Index:** The scores of all dimensions are then aggregated—often using an average or principal component analysis—to give the final FII value.
- **Interpretation:** An FII score between 0.6 and 1 implies high financial inclusion; 0.4–0.6 medium; and below 0.4 low.

Main Indicators

Typical indicators include:

- Number of bank accounts per thousand adults (banking penetration)
- Number of ATMs and bank branches per capita (service availability)
- Volume and frequency of credit and insurance service use
- Pension and investment product coverage

Applications

- **Policy Guidance:** Used by governments to evaluate and benchmark financial inclusion initiatives.
- **Comparative Research:** Facilitates cross-country and inter-state comparisons on financial access and usage.
- The index **ranges from 0 to 100**, where higher scores represent greater financial inclusion.
- It indeed covers **Access, Usage, and Quality** as the three core dimensions.
- The index is **broad-based** and includes information from **NBFCs, cooperative banks, and payment banks**—not just traditional banks.
- It is **published annually**, not monthly.

37. Location of Tanzania

Context: Tanzania's Vision 2050 aims to tackle the climate crisis threatening the Great Ruaha River, a vital resource for agriculture and biodiversity.

Tanzania, located in East Africa, shares land borders with eight countries:

1. **Kenya** (to the north)
2. **Uganda** (to the north)
3. **Rwanda** (to the west)
4. **Burundi** (to the west)
5. **Democratic Republic of the Congo** (to the west, largely along Lake Tanganyika)
6. **Zambia** (to the southwest)
7. **Malawi** (to the south, largely along Lake Nyasa/Malawi)
8. **Mozambique** (to the south)



38. Vanuatu

Context: On July 23, Vanuatu will get its day in the world's highest court. The International Court of Justice will issue an advisory opinion on what legal obligations nations have to address climate change and what consequences they may face if they don't. The case, led by Vanuatu and backed by more than 130 countries, is seen as a potential turning point in international climate law.

- While Vanuatu is located northeast of Australia, it is part of the **Melanesia** group of islands, not Micronesia. Micronesia includes islands like Guam, Kiribati, and the Federated States of

Micronesia, while Melanesia includes Papua New Guinea, Solomon Islands, Fiji, and Vanuatu.

- Vanuatu is indeed an archipelago of volcanic origin, and it is well-known for its active volcanoes, with Mount Yasur on Tanna Island being one of the most famous and accessible.



39. Orange river

Context: India and South Africa signed two agreements on submarine cooperation during the 9th Joint Defence Committee meeting in Johannesburg.



- The Orange River forms the boundary between **South Africa and Namibia**, not Botswana. The primary rivers that define the South Africa–Botswana border are the Nossob, Molopo, Marico, and Limpopo rivers. While the Orange River's catchment includes parts of

Botswana, it does not act as the boundary between Botswana and South Africa.

- The **Cape of Good Hope** is often mistakenly believed to be the southernmost point, but the true southernmost point of Africa is **Cape Agulhas**, which lies southeast of the Cape of Good Hope.

40. Red Sea Hills

Context: The Islamist movement toppled in Sudan's uprising in 2019 could support an extended period of army rule as it eyes a political comeback after deploying fighters in the country's war, according to some of its leading members.

- The Red Sea Hills are a mountain range that runs parallel to the Red Sea coast in northeastern Sudan and extends into Egypt and Eritrea. They are indeed located at the coast of Sudan, overlooking the Red Sea.
- Sudan does share a land border with the Central African Republic (CAR). The border runs from their tripoint with Chad in the north to their tripoint with South Sudan in the south.



41. Malaysia

Context: Tens of thousands of Malaysians protested at Merdeka (Independence) Square in Kuala Lumpur against rising living costs and unfulfilled reform promises by Prime Minister Anwar Ibrahim's government. Organised by Opposition parties, the rally demanded his resignation despite his recent populist economic measures.

- East Malaysia (Sabah and Sarawak on the island of Borneo) and West Malaysia (Peninsular Malaysia) are separated by the **South China Sea**, not the Celebes Sea. The Celebes Sea is located to the east of Borneo, primarily bordering Indonesian and Philippine territories, though it does touch the eastern coast of Sabah (part of East Malaysia).
- he Natuna Islands are **Indonesian territory**, and the dispute over the waters around them in the South China Sea is primarily between **Indonesia and China**. China's "nine-dash line" claim in the South China Sea overlaps with Indonesia's exclusive economic zone (EEZ) around the Natuna Islands, leading to frequent tensions and incidents.



42. Location of Niger

Context: The European Union on July 25 urged Niger's ruling junta to release Mohamed Bazoum, the President the military authorities overturned and detained on July 26, 2023.

Countries sharing a land border with Niger:

1. **Algeria** (to the northwest)

2. **Libya** (to the northeast)
3. **Chad** (to the east)
4. **Nigeria** (to the south)
5. **Benin** (to the southwest)
6. **Burkina Faso** (to the southwest)
7. **Mali** (to the west)



43. Waterfalls & rivers

Context: A glass bridge built over the Napne waterfall was recently inaugurated by the Maharashtra Minister.

About:

- The glass bridge is part of the **Sindhuratna tourism scheme**, aimed at promoting lesser-known destinations across the state.
- Napne waterfall** originates near Nadvade village, it is located in the **Konkan region** and is a **perennial waterfall** in Maharashtra.
- It is home to **hornbills, butterflies, and an abundance of endemic flora** offering both aesthetic and ecological appeal.
- The place is also home to some **exotic bird life** attracting birdwatchers from all over.

	Waterfalls	Rivers	States/UTs
1	Jog Falls	Sharavathi River	Karnataka
2	Hogenakkal Falls	Kaveri River	Tamil Nadu
3	Chitrakote Falls	Indravati River	Chhattisgarh
4	Kapildhara Falls	Narmada River	Madhya Pradesh

44. Majuli Island

Context: Locals of Pathorichuk village of Majuli, Assam are combating riverbank erosion by planting Kanchan trees along the Brahmaputra's banks.

About the Majuli Island

- Majuli is the **world's largest river island**.
- It lies in the **Brahmaputra River** in Assam and became **India's first river island district in 2016**.
- The island is bounded by:
 - **Northwest:** River Subansiri and its tributaries Ranganadi, Dikrong, Dubla, Chici, and Tuni etc.
 - **Northeast:** Kherkatia Suli (a spill channel of the Brahmaputra)
 - **South and Southwest:** Main Brahmaputra River
- Majuli is home to indigenous tribes such as the **Mising, Deori, and Sonowal Kachari**, and it is a centre for **Assamese neo-Vaishnavite culture**.

Some popular river islands:

- **Chongming Island** (China): Located in the Yangtze River delta; it is the second-largest alluvial island in the world, ecologically rich and densely inhabited.
- **Srirangam Island** (India): Situated between the Kaveri and Kollidam rivers in Tamil Nadu, known for the Ranganathaswamy Temple and large population.
- **Belene Island** (Bulgaria): Formed by the Danube River; it has ecological significance and also historical importance (Belene labor camp).
- **Mosqueiro Island** (Brazil): In the Pará River, known for its freshwater beaches and tourism.

45. Kamchatka Peninsula

Context: An earthquake of magnitude 8.8 struck Russia's Kamchatka Peninsula triggering tsunami waves near Kuril Islands in the Pacific Ocean.

Kamchatka Peninsula:

- The **Kamchatka Peninsula** is a vast, mountainous region in Russia's Far East, renowned for its dramatic volcanic scenery, rich wildlife, and sparse population.

Geography and Location

- **Location:** Stretches about 1,250km (777mi) from north to south in the Russian Far East, between the Sea of Okhotsk (west) and the Pacific Ocean/Bering Sea (east).
- **Area:** Roughly 270,000km²—comparable in size to New Zealand and larger than the UK.
- **Key Features:**
 - Lies on the Pacific "Ring of Fire," making it one of the world's most volcanically active regions.
 - The peninsula is dominated by two parallel mountain ranges: the Central (Sredinny) Range and the Eastern (Vostochny) Range, separated by the Kamchatka River valley.
 - **Highest Point:** Klyuchevskaya Sopka volcano (4,750m), the tallest active volcano in Eurasia and the Northern Hemisphere.

Natural Features

- **Volcanoes:**
 - Over 150 volcanoes, with 29 currently active—creating the UNESCO-listed Volcanoes of Kamchatka World Heritage Site.
 - Notable volcanoes: Klyuchevskaya, Kronotsky, Avachinsky, Karymsky, and Shiveluch.
- **Geysers and Hot Springs:**
 - The Valley of Geysers is the world's second-largest concentration of geysers and unique within Eurasia.
 - Rich in hot springs and mineral water sources, supporting ecotourism and recreation.
- **Wildlife:**
 - Home to some of the world's densest populations of brown bears, Steller's sea eagles, sea otters, and salmon runs.

- Ecosystems range from tundra and grassland to dense forests; supports over 750 plant species.



46. Location of Columbia

Context: A Colombian court on Monday found Alvaro Uribe guilty of witness tampering, making him the South American country's first ex-president to be convicted of a crime. The 73-year-old — who led Colombia from 2002 to 2010 — was found guilty of asking right-wing paramilitaries to lie about their alleged links to him.

- Colombia shares a land border with **5 countries**:
- **Panama** (to the northwest)
- **Venezuela** (to the east)
- **Brazil** (to the southeast)
- **Peru** (to the south)
- **Ecuador** (to the southwest)



47. Zagros Mountains

Context: The Prime Minister of Iraq has kept his country on the sidelines as military conflicts raged nearby for almost two years. This required balancing Iraq's relations with two countries vital to his power and enemies with each other: the United States and Iran.

- The Zagros Mountains form a natural boundary between **Iraq and Iran**, running along Iraq's eastern border. Jordan is located to the west of Iraq, and there are no Zagros Mountains forming a boundary between Iraq and Jordan. The border between Iraq and Jordan is primarily desert terrain.
- Iraq is **not a landlocked country**. It has a short but strategically important coastline along the **Persian Gulf** in its southeastern part, bordering Kuwait and Iran. Its main port city is Umm Qasr.



48. Gulf of Venice

Context: Italy on July 30 summoned Russia's Ambassador after Moscow included Italian President Sergio Mattarella on a list of Western officials critical of the Kremlin. Mr. Mattarella was included on Foreign Ministry's 'Russophobe' list of

Western officials whom it accuses of using “the language of hatred” against Russia.



The north-to-south arrangement of the given water bodies is:

1. **Gulf of Venice** (approx. $45^{\circ}19'N$) – At the very northern end of the Adriatic Sea, bordered by northeastern Italy, Slovenia, and Croatia.
2. **Strait of Bonifacio** (approx. $41^{\circ}19'N$) – Separates the islands of Corsica (France) and Sardinia (Italy) in the Mediterranean.

3. **Strait of Sicily** (approx. $37^{\circ}12'N$) – Lies between Sicily (Italy) and Tunisia in the central Mediterranean.
4. **Malta Channel** (approx. $36^{\circ}20'N$) – Separates the island of Malta from the southern tip of Sicily, further south than the Strait of Sicily.

Order from North to South:

- Gulf of Venice
- Strait of Bonifacio
- Strait of Sicily
- Malta Channel



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ART AND CULTURE

1. Kolhapuri chappals

Context: Luxury brand Prada showcased Kolhapuri chappal-inspired footwear in Milan (June 2025), triggering a debate on cultural misappropriation of India's GI-tagged heritage products.

What had Prada done?

- Italian luxury brand Prada recently unveiled its Men's Spring/Summer 2026 collection.
- The collection showcased "leather flat sandals" which drew attention due to their resemblance to **Kolhapuri chappals**, traditional handcrafted leather footwear from India.
- Prada also distributed leather "ring" tokens at the event, featuring the toe-loop design characteristic of Kolhapuri chappals.

Do Kolhapuri chappals have the GI tag?

- **Yes, Kolhapuri chappals were granted the Geographical Indication (GI) tag in 2018.**
- Eight districts are designated as places of origin:
 - **Maharashtra:** Kolhapur, Sangli, Solapur, and Satara.
 - **Karnataka:** Belgaum, Dharwad, Bagalkot, and Bijapur.
- The registered proprietors are Sant Rohidas Leather Industries and Charmakar Development Corporation (LIDCOM), Mumbai, and Dr. Babu Jagjivan Ram Leather Industries Development Corporation Ltd (LIDKAR), Bengaluru.
- There are 93 authorized users, including artisans and producers in the specified districts.
- These chappals are typically priced between Rs 1,000-4,000, though artisans may only receive around Rs 400 per pair.
- Artisans often work with rural cooperatives and face challenges from shrinking markets and competition from factory-made imitations.

What is a Geographical Indication?

- A GI is a form of **intellectual property right**.
- It is a distinctive sign applied to a product that possesses a specific quality, characteristic, or reputation primarily attributable to its place of origin or production.
- Its purpose is to identify and protect products with a unique link to their place of production.
- **The sign can be any name, logo, or combination indicating the geographical source, not necessarily a geographical name.**
- Examples include natural items (Makrana Marble), agricultural products (Darjeeling tea, Coorg coffee), handicrafts (Chanderi Sarees), or manufactured goods (Mysore Sandal Soap).
- The GI tag assures consumers of a product's **authenticity, quality, and distinctiveness linked to its origin**, while protecting producers from competitors exploiting the product's reputation.

GI vs Trademark

- **Geographical Indication (GI):**
 - Identifies a product as originating from a specific location, with qualities or reputation linked to that place.
 - Indicates the geographical source of a product.
 - Often features collective ownership.
 - Has links to a product's reputation and specific place of origin.
- **Trademark (TM):**
 - A name, term, design, or symbol that identifies a product or service and distinguishes it from others.
 - Identifies the commercial source.
 - Usually held by a single legal entity (unless it's a collective or certification mark).
 - A brand can be manufactured anywhere.
- **Both GI and TM can coexist for a product.**
- India enacted the Geographical Indications of Goods (Registration and Protection) Act in 1999

(effective September 15, 2003) to fulfill its obligations under the TRIPS Agreement.

- This Act allows for the registration of products, proprietors, and authorized users, granting an exclusive right to use the GI.
- Proprietors can take legal action against unauthorized users of the GI.

Is global protection available to GI items?

- **GI rights are territorial, meaning they are primarily protected within the country of origin.**
- However, the Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement (1994) mandates that member countries protect GIs of other countries.
- There's **no common global practice** for protection; some countries use trademark law, while others have specific GI laws (e.g., the EU has extensive regulations).
- Protection can be secured through national registration laws or bilateral/regional agreements between countries.
- In cases of GI infringement in a foreign country, the affected party can pursue legal action according to that country's laws.
- It is alleged that Prada copied the design without authorization, which means the proprietors of the Kolhapuri chappals GI can potentially take legal action under Italian law.

2. Santhal Rebellion

Context: June 30 is observed as Hul Diwas, marking the anniversary of the 1855 Santhal rebellion/Santhal Hul, one of the earliest peasant uprisings against the British.

Santhal Rebellion

- Santhals from **Cuttack, Dhalbhum, Manbhum, Hazaribagh**, and Midnapore migrated into the **Rajmahal area** in the late 1770s and early 1780s.

- They demonstrated a readiness to abandon their wandering lifestyle in favor of a more established one.
- They were prepared to remove woods, till land, and plant crops. This suited British interests since the **Company** needed more land revenue and more products to sell.
- As a result, the British convinced the Santhals to reside in the **Rajmahal foothills**.
- However, there was a long-running conflict between the Santhals and the Paharias.
- In 1832-33, the British formed the **Damin i-koh**, which was a compromise between the two parties.
- The **Santhals** were given a piece of **land in the foothills** to live on and practice agriculture with the plough; they were to become established peasants in this region.
- The **Pahariyas** were compelled to flee to the upper reaches of the hills.
- Over time, the **Santhals discovered** that they were losing control of the land they had worked so hard to cultivate.
- The agriculturists were devastated by the **Permanent Settlement Act in 1793**.
- The Company administration imposed high taxes on their land, and money had to be borrowed to pay off obligations.
- The moneylenders, on the other hand, demanded exorbitant interest rates and eventually claimed control of the land if debts were not paid.
- The Damin tracts were gradually taken up by zamindars.
- The **Santhals** were compelled to revolt against the zamindars and moneylenders by the 1850s.
- The uprising quickly morphed into a movement against the British colonial government. The insurrection was dubbed "**hul**" by the Santhals, which means "**liberation movement**."
- The Santhals declared an end to Company control and declared the territory between Bhagalpur and **Rajmahal independent** under the leadership of two brothers, **Sidhu and Kanhu Murmu**.

- The Murmu brothers are claimed to have dispatched ambassadors to Santhal regions to collect support using sal branches as a method of covert communication.
- **Sidhu and Kanhu's sisters, Phulo and Jhano Murmu**, took part in the revolt and are claimed to have penetrated the opposing camp under cover and slain numerous soldiers before dying.
- By 1856, the British had put down the revolt with a harsh force, burning towns down or wrecking them with elephants, and murdering hundreds of Santhals. Sidhu and Kanhu were both assassinated.
- The **Santhal Pargana** was formed from the districts of Bhagalpur and Birbhum after the **Santhal Revolt of 1855-56**. The pargana was supposed to have its own set of laws.
- **Guerrilla warfare** was used by the Santhals. This was a first in Bihar's history.
- The Santhals raised their own army made up of peasants to fight their oppressors.
- The railway and postal lines were demolished by the Santhal army.
- The **Santhal insurrection** was indeed effective for a time, but it was crushed when it came up against the government's full authority.

3. Penico: Peru's Newly Unearthed Ancient City

Context: Archaeologists have discovered a 3,500-year-old ancient city named Penico in northern Peru. It likely served as a major trade centre linking Pacific, Andean, and Amazonian cultures after the decline of the Caral civilization.

About Penico: Peru's Newly Unearthed Ancient City:

- Located in: Barranca Province, northern Peru, ~200 km north of Lima.
- Altitude: Situated on a hillside terrace ~600 meters above sea level.
- Time Period: Founded between 1800–1500 BCE, contemporary to early civilizations of Egypt, Sumeria, and India.

Key Features of the Site:

- **Urban Center Layout:** A central circular structure surrounded by 18 identified buildings made of stone and mud.
- **Structures Found:**
 - Ceremonial temples
 - Residential complexes
 - Central plaza with sculpted reliefs
- **Artifacts Discovered:**
 - Clay figures (humans and animals)
 - Conch shell trumpets (pututus)
 - Beaded necklaces and ceremonial objects

Significance of Penico:

- **Trade Hub:** Strategically located for exchange between coastal, highland, and Amazonian societies.
- **Post-Caral Evolution:** Considered a cultural continuation of the Caral civilization, which declined due to climatic disruptions.
- **Cultural Insights:** Sheds light on urban development, trade, and ceremonial life in pre-Inca Peru.
- **Civilizational Comparison:** Emerged independently during the same epoch as the Bronze Age civilizations but in geographic isolation.

4. Paika Rebellion

Context: NCERT's latest Class 8 history textbook has omitted the Paika Rebellion of 1817, triggering political backlash in Odisha.

Paika Rebellion:

- The **Paika Rebellion** (also known as the Paika Bidroha or Paik Rebellion) was a major armed uprising against the British East India Company in Odisha in 1817, led primarily by the Paikas—traditional warrior-militia of the region's Gajapati rulers.

Background and Causes

- The Paikas were hereditary military retainers who, in return for their martial services, held rent-free lands (nish-kar jagirs) under the Gajapati kings.
- After the British annexed Odisha in 1803, they deprived the Paikas of their privileges, confiscated their lands, and imposed new revenue settlements. The introduction of taxes, economic hardships, and monopolization of salt—an important local industry—further fueled resentment among local communities and elites.
- The revolt was further prompted by the loss of political authority by local rulers and rising oppression by British officials.

Course of the Rebellion

- The uprising began in March 1817 when a force of 400 Kondh tribals and a large number of Paikas, under the leadership of **Bakshi Jagabandhu**, launched attacks on police stations, burned British buildings, looted government treasuries, and killed officials.
- The movement quickly spread across large parts of Odisha, gaining support from local rajas, zamindars, peasants, and even priests.
- The Paikas used both direct assaults and guerrilla tactics, taking the Company forces by surprise and briefly achieving major gains.
- Despite initial successes, by mid-1817 the British brought reinforcements and harshly repressed the revolt, proclaiming martial law in affected areas.

Outcome and Legacy

- The rebellion was effectively suppressed by 1819, though clandestine resistance continued for several years. Bakshi Jagabandhu went into hiding and was eventually captured in 1825; he died in prison in 1829.
- The Paika Rebellion is recognized as one of the earliest organized uprisings against British rule, preceding the more widely known Revolt of 1857 by four decades.

- The movement remains a symbol of Odia pride and early Indian resistance to colonialism; its omission from national textbooks in recent years has been controversial, with calls for its rightful place in the narrative of India's independence movement.

5. Sohrai Art

Context: Sohrai Art from Jharkhand was spotlighted at Kala Utsav 2025 held at Rashtrapati Bhavan, where President of India hailed it as reflecting “the soul of India.”

Sohrai Art:

- **Sohrai Art** is a vibrant and culturally rich tribal mural tradition originating in Jharkhand, especially prevalent among the indigenous communities of Hazaribagh, Santhal Pargana, and surrounding regions. Deeply rooted in ritual and agricultural life, Sohrai art is intrinsically linked with the annual Sohrai festival, marking the winter harvest and the domestication of cattle.

Key Features

- **Creators:** Primarily practiced by tribal women, with knowledge and styles passed down matrilineally from mother to daughter. This tradition reinforces the matriarchal aspects of the art and preserves socio-cultural identity.
- **Medium:** Walls of mud houses serve as the canvas, making the murals both a protective and decorative layer after annual repairs post-monsoon.
- **Materials:** All pigments are derived from locally sourced natural materials:
 - Black: Manganese-rich clay or charcoal
 - Red: Red ochre (gerua) or haematite
 - Yellow: Yellow earth ochre (nagri/pila maati)
 - White: Kaolin (charak maati) or cream clay (dhudhi maati)

- Tools include cloth, neem twigs, broken combs, or finger tips, creating intricate and textured designs.
- **Technique:** Walls are first coated with soil and dung, followed by white or coloured clays. Patterns and motifs are created either by painting directly or by etching designs into the partially dried surface.
- **Motifs & Themes:** Sohrai paintings are characterized by:
 - Geometric patterns: Red and black lines for fertility, ancestry, and eternity
 - Nature and daily life: Forests, rivers, flowers, trees, domestic and wild animals (elephants, horses, birds, buffalo, peacocks, hens with chicks)
 - Spirituality: Depictions of Pashupati (Shiva as lord of animals) and symbols of creation and prosperity.
- **Symbolic Value:** The art represents harmony with nature, fertility, creation, and prosperity. It also functions as a spiritual and social ritual to ensure good fortune and reinforce bonds between generations.

Cultural Significance

- **Festival Association:** Centered on the Sohrai festival, which celebrates the harvest and honours cattle, integral to tribal agrarian life.
- **Historical Roots:** The practice is ancient, believed to date back to the Meso-chalcolithic period (~9000–5000 BC), with motifs akin to prehistoric rock art from the region.
- **Contemporary Adaptation:** While traditionally mural-based, Sohrai art is now found on paper, cloth, and used in public art projects. It was granted a Geographical Indication (GI) tag in 2020 in recognition of its unique cultural value.
- **Preservation Efforts:** Governments and NGOs have promoted and recognized the tradition at art festivals and as part of regional identity.

6. Ratadiya Ri Dheri

Context: A Harappan site has surfaced at Ratadiya Ri Dheri, marking the first known Indus Valley settlement in Rajasthan's arid region.

Ratadiya Ri Dheri:

- **Ratadiya Ri Dheri** is a significant archaeological discovery in Rajasthan's Jaisalmer district, marking the first known Harappan (Indus Valley Civilization) site in the Thar desert. The find fundamentally shifts our understanding of the geographic reach and adaptability of the Indus Valley Civilization (IVC), suggesting its urban elements extended deep into Rajasthan's arid expanse.

Location and Discovery

- **Geographical Setting:** Located about 60km from Ramgarh tehsil (Jaisalmer) and just 17km northwest of Sadewala (Pakistan), where Harappan traces were also previously found.
- **Discovery Team:** The site was identified by Dilip Kumar Saini (history lecturer) and Parth Jagani (local history enthusiast), later validated by experts from the University of Rajasthan and Rajasthan Vidyapeeth, Udaipur.

Archaeological Significance

- **Chronology:** Dated to the mature urban phase of the Indus Valley Civilization, approximately 2600 to 1900 BCE.
- **Context:** Ratadiya Ri Dheri fills a crucial archaeological gap between established Harappan sites in northern Rajasthan (like Pilibanga) and Gujarat, confirming that Harappan settlement reached far into the Thar, bridging key trade and cultural corridors.

Key Findings

- **Pottery and Artifacts:**
 - Abundance of red pottery fragments: bowls, pots, jars, including perforated vessels.
 - Terracotta cakes, clay and shell bangles, and various stone tools.

- **Architectural Features:**

- A unique kiln structure with a central column, comparable to those found in Kanmer (Gujarat) and Mohenjo-daro (Pakistan), suggesting sophistication in ceramic production and perhaps organized urban planning.

- Wedge-shaped bricks, possibly used for constructing circular walls and kilns, typical of urban Harappan construction methods.

- **Trade and Material Culture:**

- Chert blade fragments indicate the existence of long-distance trade. Some chert sources match those from the Rohri region in Pakistan, signifying extensive resource exchange typical of the Harappan network.

- **Settlement Character:**

- Rural Harappan settlement with adaptation to desert living, innovative construction suitable for extreme environments, and evidence of water management and survival strategies.

Importance and Impact

- **First-in-Region:** Ratadiya Ri Dheri is the first-ever confirmed Harappan site in Rajasthan's desert

zone, dramatically extending the known boundary of Indus civilizations into the heart of the Thar.

- **Bridging Civilizations:** The discovery supports theories that the IVC adapted flexibly to new terrains and that river and water-source changes shaped ancient settlement patterns, with the site helping to connect archaeological narratives between Kalibangan in the north and Gujarat sites in the south.
- **Redefining the Map:** With this extension, history must now consider the Thar desert as part of Harappan cultural and trade spheres, not just as a geographical barrier.



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MISCELLANEOUS

1. States and their local Toys

Context: Commerce and Industry Minister Piyush Goyal on July 4 said a scheme to boost toy production in the country will be finalised soon after consultation with the industry.

	Toys	States/UTs
1	Channapatna Toys	Karnataka
2	Etikoppaka Toys	Andhra Pradesh
3	Asharikandi Terracotta Toys	Assam
4	Nirmal Toys	Telangana

2. AMS Dating

Context: The Tamil Nadu State Department of Archaeology (TNSDA) has sent 23 charcoal samples from 7 excavation sites for Accelerator Mass Spectrometry (AMS) Dating to the Beta Analytic Laboratory in the U.S.

What is AMS Dating?

- **Accelerator Mass Spectrometry (AMS) dating** is a highly advanced method for determining the age of archaeological, geological, and environmental samples by measuring the concentrations of rare isotopes—most commonly radiocarbon (^{14}C). Unlike traditional radiocarbon dating methods, AMS can analyze very small samples with exceptional precision and speed, making it a preferred technique for analyzing precious or minute archaeological materials.

How Does AMS Dating Work?

1. **Sample Preparation:** Organic materials (bone, charcoal, seeds, wood, etc.) are cleaned and chemically treated to remove contaminants.
2. **Ionization and Acceleration:** The sample's carbon atoms are converted into negative ions and accelerated to extremely high kinetic

energies using a tandem accelerator. This improves sensitivity and is critical for separating rare isotopes from background contaminants.

3. **Mass Analysis:** High-energy ions are separated according to their mass and charge through a series of magnetic and electric fields. Molecular isobars and interfering particles are efficiently removed at this stage.
4. **Detection:** The desired ions, such as ^{14}C , are counted individually using sensitive detectors. The ratio of ^{14}C to stable carbon isotopes (^{12}C and ^{13}C) enables precise age determination.
5. **Data Calibration:** The raw results are calibrated with established atmospheric data to correct for changes in ^{14}C concentrations over time.

Advantages of AMS Dating

- **Small Sample Size:** AMS requires as little as a few milligrams of sample material, compared to grams required for conventional methods.
- **High Precision:** Detects and counts individual isotopic atoms, offering more accurate and reliable dating.
- **Speed:** Results can be produced in hours, compared to days for traditional radiometric methods.
- **Versatility:** Can date a wide range of materials, including fragile or valuable artifacts.
- **Lower Background Noise:** Better separation and suppression of interfering molecules and isotopes improve sensitivity for rare isotopes like ^{14}C .

Applications

- **Archaeology:** Dating ancient artifacts, bones, and charcoal to reconstruct human history and site chronology.
- **Geology and Climate Science:** Studying soil, sediments, and environmental samples to understand Earth's history.
- **Biomedicine and Forensics:** Tracing isotopes in biological tissues and studying biogeochemical cycles.

- **Other Sciences:** Used in analyzing tree rings, marine shells, speleothems, and more.

Limitations

- **Cost:** Setting up and maintaining an AMS facility is expensive and requires highly specialized equipment and expertise.
- **Sample Handling:** Though small sample size is an advantage, it also means contamination must be meticulously controlled to ensure reliable results.

3. “Battery Passport” regime.

Context: India will soon have its own “Battery Passport” regime.

About

- Under the system, the **specifications of every battery**, including its origin, performance, composition, end of life and the entire supply cycle will be captured digitally and embedded in a **QR code**.
- NITI Ayog has started deliberations with ministries and government departments on the proposed framework.
- Battery passport serves as an **Aadhaar identity of sorts**, with every battery having a unique ID that provides all information on the product.
- The initiative will not only improve safety and quality standards but also accelerate export of EVs from India.

4. 134th IMO Session

Context: India has reiterated its commitment to maritime safety and gender equality during the 134th session of the International Maritime Organization (IMO) Council, held in London.

India’s Key Interventions at the 134th IMO Session

- **Call for IMO-Led Investigation into Maritime Incidents:** India highlighted recent accidents, which caused container losses, and release of hazardous cargo such as;

- Sinking of **MSC ELSA 3**, a container ship carrying hazardous cargo, off the coast of Kochi, Kerala (in May 2025),
- Fire and explosion on **WAN HAI 503** (in June 2025) off the Kerala coast.

India urged the IMO to:

- **Conduct comprehensive investigations** into such incidents.
- **Review global standards** governing the transport of hazardous goods, especially lithium-ion batteries and other items listed under the International Maritime Dangerous Goods (IMDG) Code.
- **Improve international protocols** on packaging, declaration, stowage, and monitoring of dangerous cargo.

About the IMO

- The International Maritime Organization (IMO) is a specialised UN agency responsible for regulating shipping.
- The IMO was established following agreement at a UN conference held in Geneva in 1948 and the IMO came into existence ten years later, meeting for the first time in 1958.
- **MARPOL is a key IMO convention covering pollution by oil, noxious liquid substances, harmful substances in packaged form, sewage, garbage, and air pollution from ships.**
- **Headquarters: London, United Kingdom.**
- IMO currently has 176 Member States and three Associate Members.
- **India is a member of the IMO since 1959 and actively participates in its conventions.**

5. Tribes & Countries

Context: Over 4,000 refugees from Myanmar’s Chin State entered Mizoram’s Champhai district in July 2025 after violent clashes between Chin rebel groups.

	Tribes	Countries
1	Awá	Brazil
2	Toto	India
3	Chin	Myanmar, India
4	Ayoreo	Paraguay

6. Pradhan Mantri Divyasha Kendra

Context: The Union Ministry of Social Justice & Empowerment, Government of India, is set to inaugurate the 75th Pradhan Mantri Divyasha Kendra (PMDK) at Uttar Pradesh.

About

- PMDK is a **unique initiative** aimed at providing **integrated services under one roof**—including assessment, evaluation, counselling, distribution, and post-distribution care—for eligible Divyangjan and elderly beneficiaries.
- With the launch of this centre, the total number of operational PMDKs across India **reaches 75**.

Pradhan Mantri Divyasha Kendra

- It is a government-run initiative established to provide **comprehensive rehabilitation and assistive services to**:
 - Persons with disabilities (Divyangjan), and
 - Senior citizens in need of mobility or sensory support.
- The centres function under the **Ministry of Social Justice & Empowerment**, and are implemented by **ALIMCO** (Artificial Limbs Manufacturing Corporation of India), a central public sector enterprise.
- **Target Groups:** Persons with disabilities (PwDs), identified under the Rights of Persons with Disabilities Act, 2016.
 - **Senior citizens:** Particularly those belonging to economically weaker sections (EWS).

7. Druze Community

Context: Israel launched multiple airstrikes on Damascus and Suwayda in Syria, citing the protection of the Druze minority, triggering condemnation from Syria over what it called a “flagrant assault” on its sovereignty.

Druze Community:

- The **Druze** are an **ethnoreligious group** who follow a **distinct monotheistic religion** that

emerged in the 11th century as an offshoot of **Ismaili Shia Islam** but has developed into a separate, closed faith system.

- **Geographical presence:**
 - **Lebanon** (notably in Mount Lebanon)
 - **Syria** (southern regions, e.g., Jabal al-Druze)
 - **Israel** (especially in the Galilee and Carmel regions)
- They do **not accept new converts** and have a strong community identity.
- The Druze have played significant roles in **Lebanese politics** and in **Syria’s minority dynamics**.

8. Group of Friends (GoF) for Accountability of Crimes against Peacekeepers

Context: India reiterated its strong commitment to ensuring justice for crimes against UN peacekeepers at a high-level meeting of the Group of Friends (GoF) at the UN Headquarters, calling accountability a strategic necessity.

About Group of Friends (GoF) for Accountability of Crimes against Peacekeepers:

- **What it is?**
 - An informal platform of UN member states committed to advancing justice for crimes against UN peacekeepers and strengthening global peacekeeping norms.
- **Launched In:** December 2022, during India’s Presidency of the UN Security Council.
- **Membership:** Includes around 40 UN member states, co-chaired by India and like-minded countries from Asia, Africa, and Latin America.
- **Objectives:**
 - Promote legal and policy frameworks to prosecute crimes against peacekeepers.
 - Ensure deterrence by addressing impunity.
 - Uphold credibility and integrity of UN Peacekeeping Operations.
- **Key Functions:**
 - Facilitate dialogue among states, UN bodies, and experts.

- Support investigation mechanisms and legal reforms.
- Track implementation of **UNSC Resolution 2589 (2021)** which mandates accountability for attacks on peacekeepers.
- Advocate for reports from the UN Secretary-General on progress made.
- **Significance:**
 - Vital for the safety of UN peacekeepers in high-risk missions.
 - Reinforces trust in multilateralism and India's leadership in peacekeeping.
 - Aligns with India's legacy of contributing over **300,000 peacekeepers**, the highest by any country.
 - Safeguards operational morale and legal protections for personnel from Global South countries.

9. Navy Projects

Context: The Indian Navy commissioned INS Nistar, the first indigenously designed and constructed diving support vessel, on July 18, 2025, in Visakhapatnam, in the presence of Minister of State for Defence Sanjay Seth.

	Projects	Types of Vessels	Class of Vessels
1	Project 15B	Destroyers	Visakhapatnam-class
2	Project 17A	Frigates	Nilgiri-class
3	Project 28	Corvettes	Kamorta-class

10. World's largest hydropower dam

Context: Chinese authorities have begun constructing what will be the world's largest hydropower dam in Tibetan territory, in a project that has sparked concerns from India and Bangladesh.

More on the news:

- Once completed, it can surpass the scale of China's Three Gorges Dam on the Yangtze River.
- Brahmaputra flows across the Tibetan Plateau, carving out the deepest canyon on Earth.
- **Key Concerns associated with the Dam**
 - **Disaster Risk:** This increases the threats related to earthquakes. Tibetan plateau frequently experiences earthquakes as it is located over the tectonic plates.
 - E.g., 1950 Assam-Tibet Earthquake
 - **Environmental Challenges:** It may cause disruption to local ecology and downstream water flow. It will affect biodiversity and agriculture.
 - **Geopolitical challenges:** China can potentially weaponize (as a 'water bomb') dam during conflicts by causing floods.
 - **Cultural challenges:** E.g., Project threatens tribes like the Adi Tribe in Siang valley in Arunachal Pradesh.
- China and India have established Expert Level Mechanism (ELM) in 2006 to address trans-border river issues by sharing hydrological data on Brahmaputra and Sutlej rivers during flood seasons. India is also building its hydropower dam on the Brahmaputra in Arunachal Pradesh.
- Both countries are not signatories to the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, 1997.



- The U-Bend's location near the border, its hydrological significance, and the ongoing water disputes make it a highly strategic area for both nations.
- The U-bend is indeed located near the Namcha Barwa massif, which is a geologically active

region. Intense tectonic uplift and seismic activity in this area can lead to landslides, changes in river course, and increased vulnerability to natural disasters downstream, all of which are concerns for countries reliant on the river. This **does** contribute to the strategic concern.

- China has indeed built and plans more hydropower projects on the Yarlung Tsangpo (the Brahmaputra's name in Tibet) upstream of the U-Bend. These projects are a major source of concern for India regarding potential impacts on downstream water flow, sediment load, and ecological balance. This also **does** contribute to the strategic concern.
- Both reasons independently contribute to and explain why the Great U-Bend is a region of strategic concern. They represent different facets of the strategic importance – one natural and geological, the other anthropogenic and political.

11. Dahlak Archipelago

Context: Eritrean President Isaias Afwerki has warned neighbour Ethiopia against launching a new war between the bitter foes, with tensions high in the Horn of Africa region.

Dahlak Archipelago:

- The **Dahlak Archipelago** is a group of islands belonging to Eritrea, located in the central Red Sea, about 58 km east of the port city of Massawa. The archipelago comprises over **200 islands and islets**, though only a handful are inhabited, with a total population of about 3,000 people.
 - **Largest Island:** Dahlak Kebir, which covers an area of about 643 km².
 - **Other Major Islands:** Dhuladhiya, Dissei, Dohul, Erwa.
 - **Geography:** The islands are mostly flat, arid, and of coral origin, featuring extensive coral reefs and intact marine environments.

- **Climate:** Extremely hot, with temperatures ranging from 25°C in cooler months to up to 45°C in the summer.
- **Biodiversity:** The waters are rich in marine life, hosting corals highly tolerant to warm conditions, numerous species of fish (with significant endemic presence), sea turtles, dolphins, and the endangered dugong. The islands are also important for migratory birds, with over 100 species observed.

Historical and Cultural Features

- **Ancient Trade and Settlement:** The islands were significant stops on ancient Red Sea trade routes and are mentioned by classical authors as early as 100 B.C. Exports included tortoise shells and pearls.
- **Medieval Remains:** There are necropolises from the 10th century and ruins of churches from the 13th century, especially on Dahlak Kebir, reflecting both Christian and Islamic historical influences.
- **Pearl Diving:** Traditionally renowned for their pearl fisheries, a fact noted since Roman times, though this industry has declined with the advent of artificial pearl cultivation.
- **Inhabitants:** The primary language is Dahalik, and the communities are a mix of Afar, Arabs, and other groups, historically engaging in fishing, pearl diving, and limited pastoralism.

Conservation and Tourism

- **Marine Reserve:** The ecosystem is relatively pristine compared to other coral reef regions due to its geographical isolation and limited development.
- **Access and Accommodation:** Tourist infrastructure is minimal, with only basic wild camping available (e.g., Dur Gaam and Dur Ghella), and all visits are typically organized from Massawa by boat.
- **Activities:** The islands are particularly attractive for snorkeling, scuba diving, and birdwatching, offering encounters with largely untouched nature.



12. Congo River Alliance

Context: The DRC government and the rebel group **M23 (March 23 Movement)**, under the **Congo River Alliance**, signed a **Declaration of Principles in Doha**, mediated by Qatar, to pursue peace.

Congo River Alliance:

- The **Congo River Alliance** (French: Alliance Fleuve Congo, acronym: AFC) is a major Congolese rebel coalition formed on December 15, 2023, seeking to overthrow the government of the Democratic Republic of the Congo (DRC).

Background and Formation

- Led by **Corneille Nangaa**, a former president of the Independent National Electoral Commission of the DRC (2015–2021).
- Formed as a political and military coalition in Nairobi, it brought together 17 political parties, additional political groupings, and armed rebel factions, primarily in eastern and southeastern DRC, including Katanga, the Kivus, and Ituri regions.
- The coalition's most significant and militarily capable member is the **March 23 Movement (M23)**, a group with longstanding Rwandan backing.

Goals and Objectives

- The declared aim is to **topple President Félix Tshisekedi's government**, seize Kinshasa (the capital), and bring about regime change.

- The AFC claims to work toward “national unity and stability,” but its tactics and rhetoric indicate a focus on reorganizing state power and territorial control, especially in resource-rich eastern regions.
- M23’s involvement extends the alliance’s military reach, facilitating territory seizures, including attempts to capture key eastern cities.

Key Activities and Significance

- The AFC and its key grouping, M23, have been linked to numerous armed actions and the occupation of lucrative mines in eastern DRC.
- The coalition actively encourages defection among DRC military personnel and seeks additional rebel group participation.
- The movement’s regional significance is heightened by alleged support from Rwanda, raising the potential for shifts in Great Lakes regional power dynamics.
- Both the United States and United Nations have imposed sanctions on the AFC and M23 due to the destabilizing effect on the DRC and wider region.

13. FIDE Women’s World Cup 2025

Context: **Divya Deshmukh** created history by becoming the first Indian woman to win the **FIDE Women’s Chess World Cup 2025**, defeating veteran **Koneru Humpy** in the final held in Batumi, Georgia.

About FIDE Women’s World Cup 2025:

- The FIDE Women’s World Cup is typically held **every two years**.
- FIDE 2025** was the third edition of the Women’s Chess World Cup and featured 107 players from 46 federations.
- The tournament employs a **single-elimination (knockout) format**. Players are directly eliminated upon losing a match.
- Match Structure in Each Round:**
 - Classical Games:** Each match begins with two classical time control games, played over two days. Players are typically allotted 90 minutes

for the first 40 moves, with an additional 30 minutes for the rest of the game, and a 30-second increment per move from move one.

- **Tie-breaks (if needed):** If the classical games are tied, tie-break games are played on the third day, with progressively shorter time controls:

- **First Tie-breaker:** Two rapid games (e.g., 15 minutes + 10-second increment per move).
- **Second Tie-breaker (if still tied):** Two quicker rapid games (e.g., 10 minutes + 10-second increment).
- **Blitz Games (if still tied):** Two blitz games (e.g., 5 minutes + 3-second increment).
- **Armageddon Game (if still tied):** A final, high-pressure decider where White gets more time (e.g., 3 minutes) but Black wins if the game is a draw (e.g., 2 minutes, with a 2-second increment from move 61).

- **Qualification for Candidates:** The top three finishers in the Women's World Cup typically qualify for the next Women's Candidates Tournament.

14. Paithani Sarees

Context: Prime Minister in the monthly radio programme 'Mann Ki Baat' praised the traditional craftsmanship of Paithani sarees.

About Paithani Sarees

- **Origin and History:** Paithani sarees originated over 2000 years ago in Paithan, a town near Aurangabad in Maharashtra, on the **banks of the Godavari River**.
 - The weaving tradition can be traced back to the **Satavahana dynasty (2nd century BCE)**.
- **Royal Patronage:** Paithani sarees were woven for and worn by royalty and aristocrats, including the Satavahanas, the Peshwas of Pune, the Nizams of Hyderabad, and Mughal rulers.
- **Material and Craftsmanship:** Traditionally made from fine silk with pure gold and silver zari (metallic thread), Paithani sarees are handwoven using the tapestry weaving

technique. They are renowned for their intricate **floral and peacock motifs**.

- **GI Tagging:** Paithani sarees have been granted the Geographical Indication (GI) tag in 2010.

	Sarees	States/UTs
1	Kosa Silk	Chhattisgarh
2	Maheshwari	Madhya Pradesh
3	Gadwal	Telangana
4	Paithani	Maharashtra

15. National Overseas Scholarship scheme

Context: The Union Social Justice Ministry is in the process of seeking additional allocation for administering the National Overseas Scholarship scheme for marginalised students.

About

- **Aim:** To empower low-income students from marginalized communities, including the **Scheduled Castes, Denotified Nomadic and Semi-Nomadic Tribes, Landless Agricultural Labourers, and Traditional Artisans**.
- The scholarship supports their pursuit of higher education, such as Master's degree or Ph.D. courses, by providing opportunities to study abroad.
- **Eligibility:** Candidates should have secured at least 60% marks or equivalent grade in the qualifying examination;
 - the candidates total family income from all sources should be less than Rs. 8.00 lakh per annum;
 - should be less than 35 years of age on selection year;
 - and have an unconditional offer of admission from top 500 QS ranked foreign Universities as per the latest QS rankings.
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