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for

IAS EXAMINATION



From

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INDEX

1. POLITY & GOVERNANCE	1
1.1. Ordinance-Making Power of the President & Supreme Court Judge Strength	1
1.2. Parliamentary Panel to Review National Testing Agency Reforms	4
1.3. Sc Allows Euthanasia of 'Rabid, Dangerous' Dogs	6
1.4. Legal Battle Over UAPA Bail Curbs	8
1.5. Sedition Law in India (Section 124a IPC)	10
1.6. Sample Registration Survey (SRS) 2024	12
2. INTERNATIONAL RELATIONS	14
2.1. Strategic Overhaul of India's Pharma Trade in South Asia	14
2.2. Multilateral Exercise Pragati 2026 Begins in Meghalaya	15
3. ECONOMY	18
3.1. NCDEX to Launch India's First Weather Derivatives	18
3.2. The Index of Eight Core Industries Underscores Economic Distress	20
3.3. Capital Flight and Dynamics of Foreign Investments (RBI Data 2026)	21
3.4. Currency Depreciation and RBI Intervention	23
4. ENVIRONMENT & GEOGRAPHY	26
4.1. DRI Recovers Two Indian Red Sand Boa Snakes	26
4.2. Breakthrough Genetic Mapping Toolkit to Combat Global Pangolin Trafficking	27
4.3. Center's Final Stand: No New Hydro Power Projects in Upper Ganga Reaches	30
4.4. Nurdle Pollution	32
5. SCIENCE & TECHNOLOGY	34
5.1. The Predictability Pandemic	34
5.2. Ebola Resurgence in Central Africa	35
5.3. Zwan-Wolf Effect	37
5.4. Suryastra: India's First Private-Sector Precision Rocket System	39
5.5. Gaganyaan's Life-Support System	40
6. HISTORY & CULTURE	43
6.1. The Anaimangalam Copper Plates	43

1.1. ORDINANCE-MAKING POWER OF THE PRESIDENT & SUPREME COURT JUDGE STRENGTH

Context

Recently, the President Droupadi Murmu promulgated the **Supreme Court (Number of Judges) Amendment Ordinance, 2026** under **Article 123** of the Indian Constitution.



1. Key Highlights of the Development:

- **Strength Increased:** The ordinance increases the maximum sanctioned strength of Supreme Court judges (excluding the Chief Justice of India) from **33 to 37**.
- **Total Capacity:** Including the Chief Justice of India (CJI), the total sanctioned strength will rise from **34 to 38**.
- **Statutory Amendment:** The ordinance amends Section 2 of the **Supreme Court (Number of Judges) Act, 1956**.
- **Judicial Pendency:** To tackle a major crisis of judicial pendency, as the Supreme Court's backlog has crossed **93,000 cases**, threatening to touch six figures.
- **1950 (Original Constitution):** Article 124(1) originally envisaged 1 CJI + "not more than 7 judges" (7+1=8).

2. Ordinance-Making Power of the President (Article 123)

The ordinance-making power is the most important legislative power of the President, designed specifically to deal with unforeseen or urgent situations.

1. Four Core Constitutional Limitations:

1. **Recess of Parliament:** The President can *only* promulgate an ordinance when **both Houses of Parliament are not in session**, or when **either of the two Houses is not in session**. An ordinance issued while both Houses are in session is **completely void**.
2. **Immediate Action:** The President must be satisfied that circumstances exist which render it **necessary** to take immediate action.
3. **Co-extensive with Parliament:** The ordinance-making power is co-extensive with the legislative power of Parliament. This means:
 - An ordinance can only be issued on subjects where Parliament can make laws (Union and Concurrent lists).
 - It is subject to the same constitutional limitations as an Act of Parliament (e.g., **cannot violate Fundamental Rights**).
 - **Important Note:** An ordinance **cannot** be used to amend the Constitution.
4. **Retrospective & Amending Nature:** An ordinance can be retrospective (act from a past date) and can alter or amend any act of Parliament or even another ordinance.

II. Parliamentary Approval & Lifespan of an Ordinance

Every ordinance promulgated must be laid before both Houses of Parliament when they reconvene.

- **Mandatory Tabling:** Once the Parliament is back in session, the ordinance must be officially presented (laid) before both Houses.
- **Six-Week Deadline:** The legislature must pass a resolution approving the ordinance within six weeks of reassembling.
- **Bicameral Nuance:** If Lok Sabha and Rajya Sabha are called to reassemble on different dates, the six-week timeline is calculated from the later of the two dates.
- **Disapproval & Withdrawal:** An ordinance ceases to operate immediately if both Houses pass resolutions rejecting it. The President can also withdraw an ordinance at any time, on the **advice of the Council of Ministers.**

III. Calculating the Maximum Life of an Ordinance:

- **Maximum Gap Between Sessions:** Under Article 85, the maximum gap between two sessions of Parliament cannot exceed **6 months.**
- **Post-Reassembly Window:** The ordinance gets an additional **6 weeks** once Parliament reconvenes.
- **Maximum Validity:**
6 months + 6 weeks = Approx. 7.5 months

3. Landmark Judicial Pronouncement

- RC Cooper Case (1970):** The Supreme Court ruled that the President's "satisfaction" regarding the necessity of immediate action is **not justifiable to be completely above judicial review.** It can be challenged in court if it is proved that the power was exercised with *malafide* intent or to bypass Parliamentary debate.
- DC Wadhwa Case (1987):** The Court observed that the Executive cannot usurp the law-making functions of the Legislature. It held that the **"re-promulgation of ordinances"** repeatedly without attempting to place them before the legislature constitutes a fraud on the Constitution and is subversion of the democratic legislative process.
- Krishna Kumar Singh Case (2017):** The Supreme Court solidified that:
 - The authority to issue ordinances is not an absolute alternative to the law-making powers of the Parliament.
 - The requirement to place the ordinance before the Legislature is **mandatory.** Failure to place it before Parliament is a constitutional abuse.

5. Core Differences: President vs. Governor

Comparative Feature	President of India	Governor of a State
Constitutional Article	Article 123	Article 213

Legislative Recess Requirement	Can issue an ordinance when either House (Lok Sabha or Rajya Sabha) or both Houses of Parliament are not in session.	Can issue an ordinance when the Legislative Assembly is not in session (unicameral), or when both Houses (Assembly and Council) are not in session (bicameral).
Legislative Competence	Co-extensive with the law-making power of Parliament. Can only issue ordinances on subjects in the Union List and Concurrent List .	Co-extensive with the law-making power of the State Legislature. Can issue ordinances on subjects in the State List and Concurrent List .
Presidential Instructions	Can act independently based on the aid and advice of the Union Cabinet. No prior permission is ever required.	Cannot issue certain ordinances without prior instructions from the President under three specific conditions. <ul style="list-style-type: none"> • Prior Presidential sanction required. • Governor may reserve the Bill for the President. • Valid only after Presidential assent.
Constitutional Amendments	Cannot amend the Constitution.	Cannot amend the Constitution.
Lapse / Approval Body	Must be laid before and approved by both Houses of Parliament .	Must be laid before and approved by the State Legislative Assembly (and Council, if bicameral).
Repugnancy Rule	An ordinance overriding a state law on a Concurrent subject will prevail.	An ordinance on a Concurrent subject that conflicts with a Central Parliamentary Law is void , unless it was issued on the prior instructions of the President.

6. Quick Prelims Pointers

- **Who decides the strength of the SC? Parliament** possesses the exclusive authority to increase the number of judges in the Supreme Court by law (Article 124(1)). This is why an executive ordinance must amend a Parliamentary Act (*Supreme Court Act, 1956*).
- **State Counterpart:** The Governor of a state possesses a parallel ordinance-making power under **Article 213**, which shares identical operational mechanics but is restricted to state legislative competencies.

Q. With reference to the Ordinance-making power of the President under Article 123 of the Indian Constitution, consider the following statements:

1. The President can promulgate an ordinance even when both Houses of Parliament are in session.
2. An ordinance has the same force and effect as an Act of Parliament.

3. An ordinance can amend the Constitution of India.
4. The maximum possible life of an ordinance can extend to about seven and a half months.
Which of the statements given above are correct?

- (a) 2 and 4 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1 and 4 only

Answer: (a) 2 and 4 only

Explanation:

- **Statement 1 is Incorrect:** Ordinance can only be issued when Parliament is not in session.
- **Statement 2 is Correct:** It has the same force as an Act of Parliament.
- **Statement 3 is Incorrect:** Ordinance cannot amend the Constitution.
- **Statement 4 is Correct:** Maximum validity can be approximately **6 months + 6 weeks**.

1.2. PARLIAMENTARY PANEL TO REVIEW NATIONAL TESTING AGENCY REFORMS

Context

Against the backdrop of intensifying controversies surrounding public



entrance examinations, the **Parliamentary Standing Committee on Education, Women, Children, Youth and Sports** has issued a notice to review the implementation of structural reforms within the **National Testing Agency (NTA)**

1. Understanding Parliamentary Committees

- Parliamentary committees are panels of Members of Parliament (MPs) appointed or elected to scrutinize legislation, review government budgets, and investigate specific policy issues. Because modern legislative business is complex and time is limited, these committees allow MPs to examine details away from the busy floor of the House.
- **Constitutional Basis:** These committees draw their legitimacy and authority from **Article 105** (dealing with privileges of Members of Parliament) and **Article 118** (granting Parliament the power to make rules for regulating its procedure and conduct of business).

2. Classification of Parliamentary Committees

Parliamentary Committees are broadly classified into two categories:

- **Standing Committees: Permanent** and regular committees constituted periodically (usually every year) in pursuance of an Act of Parliament or Rules of Procedure and Conduct of Business. They work on a continuous basis.
- **Ad-hoc Committees: Temporary** committees appointed for a specific task. They cease to exist once they complete their assigned mandate and submit a report (e.g., Joint Parliamentary Committees or Select Committees on specific Bills).

3. Department-Related Standing Committees (DRSCs)

The committee reviewing the NTA reforms belongs to the robust framework of **Department-Related Standing Committees (DRSCs)**.

- **Origin:** First introduced in 1993 on the recommendation of the Rules Committee of the Houses. Initially, 17 committees were formed, which were expanded to **24 DRSCs in 2004**.
- **Composition Matrix:** Each DRSC consists of **31 members**:
 - **21 members** are nominated from the **Lok Sabha** by the Speaker.
 - **10 members** are nominated from the **Rajya Sabha** by the Chairman.
- **Tenure:** The term of office of the members of these committees **does not exceed one year**.
- **The Minister Exclusion Rule: A Minister is not eligible to be nominated/elected as a member of these committees.** If a member, after nomination to the committee, is appointed as a Minister, they cease to be a member from the date of such appointment. This ensures the separation of powers and impartial oversight over the executive.
- **Division of Jurisdiction:** Out of the 24 DRSCs, **8 function under the Rajya Sabha** (including the Committee on Education, Women, Children, Youth and Sports), and **16 function under the Lok Sabha**.

Primary Functions of DRSCs

1. To consider the **Demands for Grants** of the concerned ministries before they are formally voted upon in the Lok Sabha.
2. To examine Bills pertaining to the concerned ministries as referred to them by the Chairman or the Speaker.
3. To consider **Annual Reports** of the ministries and long-term policy documents presented to Parliament.

4. About National Testing Agency (NTA)

- **Status:** Established in 2017 as an independent, autonomous, and self-sustained premier testing organization under the Ministry of Education.
- **Legal Structure:** It is registered as a **Society under the Societies Registration Act, 1860**, rather than being a statutory body established by a specific Act of Parliament.
- **Mandate:** To conduct highly efficient, transparent, and international-standard entrance tests (such as NEET-UG, JEE-Main, UGC-NET) to assess candidate competence for admissions and recruitments.

Q. With reference to Department-Related Standing Committees (DRSCs), consider the following statements:

1. DRSCs were first introduced in 1993.
2. A Union Minister can be a member of a DRSC related to his ministry.
3. The term of office of DRSC members does not exceed one year.

Which of the statements given above is/are correct?

- (a) 1 and 3 only
(b) 2 only

(c) 1 and 2 only

(d) 1, 2 and 3

Answer: (a) 1 and 3 only

Explanation:

- **Statement 1 is Correct** — DRSCs were introduced in 1993 on the recommendation of the Rules Committee.
- **Statement 2 is Incorrect** — Ministers are not eligible to be members of these committees to ensure impartial parliamentary oversight.
- **Statement 3 is Correct** — The tenure of DRSC members is generally one year.

1.3. SC ALLOWS EUTHANASIA OF 'RABID, DANGEROUS' DOGS

Context

- Recently, the Supreme Court of India, while addressing concerns over the stray dog menace, ruled that public safety and human life must take precedence over the interests of stray animals. A Bench comprising Justices Vikram Nath, Sandeep Mehta, and N.V. Anjaria held that **Article 21** includes the **right to move freely and safely in public spaces**. The Court also clarified that municipal authorities may adopt legally permissible measures, including euthanasia, for rabid, incurably ill, or dangerous stray dogs.



1. Key Judicial & Policy Mandates

- **Status of Stray Dogs in Public Spaces:** The Supreme Court said that under the **Animal Birth Control (ABC) Rules, 2023 and the Prevention of Cruelty to Animals Act, 1960**, stray dogs do not have an unlimited right to stay in public places if they become dangerous or create safety risks for people.
- **Ban on Re-release in Institutional Areas:** Stray dogs removed from high-footfall public locations—such as educational institutions, hospitals, bus depots, and railway stations—cannot be "re-released" back into these specific institutional areas even after completing vaccination and sterilization.
- **Mandatory ABC Centres:** The Court directed all States and Union Territories to establish **at least one fully functional Animal Birth Control (ABC) Centre in every district**.
- **Public Health Response:** Governments must ensure the adequate availability of **anti-rabies vaccines** and **immunoglobulin** in all government medical facilities to handle emergency dog-bite incidents.

2. About Animal Birth Control (ABC) Rules, 2023

- The Animal Birth Control (ABC) Rules, 2023, were notified by the **Ministry of Fisheries, Animal Husbandry & Dairying under the Prevention of Cruelty to Animals Act, 1960**.
- It aims to regulate stray dog population control through sterilisation and immunisation, **not culling**.

- The responsibility of carrying out ABC programmes lies with the respective **local bodies**, municipalities, municipal corporations, and panchayats.
- **Classification of animals:-**
 - (1) Pet animals – dogs owned and kept indoor by individuals; (2) Street dogs or community owned Indian dogs or abandoned pedigree dogs which are homeless, living on the street or within a gated campus.

3. About the Rabies Virus

- **Nature of the Disease:** Rabies is a viral disease (RNA Virus) caused by the rabies virus, a neurotropic virus that attacks the central nervous system.
- **Fatality:** It is 100% fatal once clinical symptoms appear. However, it is preventable through timely vaccination.
- **Transmission:** Spread through saliva via bites, scratches, or broken skin, Human-to-human transmission has not been confirmed.
- **Primary vector:** Dogs (99% cases) Other Carrier (Cats, bats, raccoons, foxes etc.)
- **Prevention:** Full anti-rabies vaccination is required, Rabies immunoglobulin or monoclonal antibodies are needed for severe exposure.
- **Global Target:** The World Health Organization (WHO), Food and Agriculture Organization (FAO), and World Organisation for Animal Health (WOAH) have set a collective global goal of "**Zero Human Rabies Deaths by 2030**" (commonly driven by the 'Zero by 30' campaign focusing heavily on mass dog vaccination).

Q. With reference to the recent Supreme Court ruling on stray dogs and rabies, consider the following statements:

1. The Supreme Court allowed legally permissible euthanasia for rabid, incurably ill, or dangerous stray dogs.
2. Under the Animal Birth Control (ABC) Rules, 2023, stray dogs removed from hospitals and railway stations can be re-released into the same areas after sterilisation.
3. Rabies is a viral disease that becomes almost 100% fatal once clinical symptoms appear.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer:

(c) 1 and 3 only

Explanation:

- **Statement 1 is correct:** The Supreme Court allowed legally permissible euthanasia for rabid, incurably ill, or dangerous stray dogs.
- **Statement 2 is incorrect:** The Court ruled that stray dogs removed from high-footfall public places cannot be re-released into the same institutional areas even after sterilisation and vaccination.
- **Statement 3 is correct:** Rabies is a viral disease and is almost 100% fatal once symptoms appear.

1.4. LEGAL BATTLE OVER UAPA BAIL CURBS

Context

- Recently, the Delhi Police, represented by the Additional Solicitor General (ASG), requested the Supreme Court to refer the contentious issue of **statutory bail restrictions** under the Unlawful Activities (Prevention) Act, 1967 (UAPA) to a larger Bench for review.
- The dispute centers on **whether prolonged pre-trial detention and delayed trials** can override the stringent bail provisions of UAPA, raising critical questions about balancing national security with the Right to Life and Personal Liberty under Article 21.



1. Core Legal Disputes & Judicial Observations

- **The Conflicting Judgments:**
 - A Bench of Justices B.V. Nagarathna and Ujjal Bhuyan granted bail to a narco-terror accused, reiterating that “bail is the rule and jail is the exception,” even under UAPA, when there is excessive delay in trial and prolonged incarceration.
 - In contrast, a coordinate Bench in the Umar Khalid case denied bail to the 2020 Delhi riots accused.
- **Prosecution’s Core Argument:** Additional Solicitor General S.V. Raju argued that under the strict provisions of the Unlawful Activities (Prevention) Act, 1967 (UAPA), bail cannot be granted easily to an accused person. The use of the word “shall” in the law reflects the legislature’s intention to maintain a strict approach toward bail.
- **Important Judgment in the K.A. Najeeb Case (2021):** In Union of India v. K.A. Najeeb, the Supreme Court held that if there is excessive delay in the trial process and the accused’s fundamental right to a speedy trial under Article 21 is violated, courts can grant bail even under the stringent provisions of UAPA.

2. About the Unlawful Activities (Prevention) Act, 1967 (UAPA)

- The Unlawful Activities (Prevention) Act (UAPA) is India's primary anti-terror law, first enacted in 1967. It is designed to prevent unlawful activities and combat terrorist acts that threaten the sovereignty, integrity, and security of India
- **Punishment:** Carries severe penal provisions; the highest punishments under this Act include the death penalty and life imprisonment.
- **Territorial Jurisdiction:** It applies to both **Indian citizens and foreign nationals**. It is extraterritorial in nature—meaning individuals can be charged under this Act even if the crime is committed on foreign soil outside India.
- **The 2019 Amendment:** Empowered the Central Government to designate not just organizations, but **individual persons as 'Terrorists'** if they commit, prepare for, or promote terrorism.
- **Stringent Bail Conditions:** Bail is extremely difficult to obtain. **Under Section 43D(5)**, a court can deny bail if it is of the opinion that there is a prima facie case that the allegations are true.

- **Property Seizure:** The Director General of the National Investigation Agency (NIA) is empowered to grant approval for the seizure or attachment of properties during a UAPA investigation

3. Constitutional Balancing Tool: Article 21 vs. Statutory Laws

- **Speedy Trial as a Fundamental Right:** The Supreme Court has consistently held that the right to a speedy trial is an integral part of the **Right to Life and Personal Liberty** wrapped under **Article 21**.
- While statutory laws (like UAPA passed by the Parliament) can place restrictions on bail, they **cannot completely abrogate or override constitutional fundamental rights**. If an individual is jailed for a prolonged period without trial, statutory restrictions like Section 43D(5) yield to the enforcement of Article 21 by constitutional courts.

About Article 21

- Article 21 of the Indian Constitution guarantees the fundamental right to protection of life and personal liberty, stating: "**No person shall be deprived of his life or personal liberty** except according to a procedure established by law."
- It is available to all citizens and non-citizens alike.
- Through landmark Supreme Court judgments, Article 21 has been interpreted to encompass a vast array of rights that contribute to a dignified human life. Some of the recognized rights include:
 - **Right to Privacy:** Established as an intrinsic part of life and liberty (K.S. Puttaswamy v. Union of India).
 - **Right to Livelihood:** Recognized as a component of the right to life (Olga Tellis v. Bombay Municipal Corporation).
 - **Right to a Clean Environment:** Protection against pollution and environmental degradation.
 - **Right to Health and Medical Care:** Ensures timely medical treatment and safeguards bodily integrity.
 - **Right to Speedy Trial:** Protection against prolonged incarceration without trial (Union of India v. K.A. Najeeb).
 - **Right to Education:** Elevated to a separate, specific fundamental right under Article 21A for children aged 6 to 14.

Q. Consider the following statements regarding the Unlawful Activities (Prevention) Act, 1967 (UAPA):

1. UAPA imposes stringent conditions on granting bail to an accused person.
2. Courts cannot grant bail under UAPA even if there is an extraordinary delay in trial proceedings.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Answer: A

Explanation:

Statement 1 is correct: UAPA contains strict provisions that make granting bail difficult in terrorism-related cases.

Statement 2 is incorrect: in *Union of India v. K.A. Najeeb* (2021), the Supreme Court held that courts can grant bail if there is an excessive delay in trial and the accused's right to a speedy trial under **Article 21 is violated**.

1.5. SEDITION LAW IN INDIA (SECTION 124A IPC)

Context

- Recently, the Supreme Court of India has clarified that trials, appeals, or proceedings involving the offense of sedition under **Section 124A of the Indian Penal Code (IPC)** can proceed in courts across the country **if the accused has no objection**.



Understanding Sedition

1. Historical Perspective (Colonial Roots)

- Origin:** Sedition law was originally drafted in 1837 by **Thomas Babington Macaulay** but was omitted when the IPC was enacted in 1860. It was later introduced into the IPC via **Section 124A in 1870** by an amendment introduced by Sir James Stephen.
- Colonial Utility:** It was heavily used by the British administration to suppress the Indian National Movement.
- Key Historical Trials:**
 - Jogendra Chandra Bose (1891):** The first prominent case.
 - Bal Gangadhar Tilak (1897 & 1908):** Tried for his writings in the journal *Kesari*.
 - Mahatma Gandhi (1922):** Tried for his articles in the publication *Young India*. Gandhi famously called Section 124A the "prince among the political sections of the IPC designed to suppress the liberty of the citizen."

2. Legal & Statutory Perspective

- Definition under Section 124A IPC:** It defines sedition as any action—by words (spoken or written), signs, or visible representation—that brings or attempts to bring **hatred or contempt, or excites disaffection towards the Government** established by law in India.
- Nature of the Offence:**
 - It is a **non-bailable** offense.
 - It is a **cognizable** offense (police can arrest without a warrant).
 - Punishment ranges from imprisonment for three years to a **life term**, to which a fine may be added.

- **Special Note:** The colonial-era sedition law under Section 124A of the Indian Penal Code (IPC) has been replaced by **Section 152 of the Bharatiya Nyaya Sanhita (BNS)**. While the term "**sedition**" is removed, the new provision broadens the scope to criminalize acts threatening India's sovereignty, unity, and integrity.

3. Constitutional Perspective (Fundamental Rights vs. State Security)

- **Article 19(1)(a):** Guarantees freedom of speech and expression.
- **Article 19(2):** Places **reasonable restrictions** on free speech. The grounds include the sovereignty and integrity of India, the security of the State, friendly relations with foreign States, public order, decency, or morality.

4. Landmark Judicial Pronouncements

Case Law	Key Ruling / Principle
Kedar Nath Singh v. State of Bihar (1962)	A Constitution Bench upheld the validity of Section 124A but significantly narrowed its scope. The court ruled that a person can be charged with sedition <i>only</i> if their speech involves incitement to violence or intention/tendency to create public disorder. Strong criticism of the government without inciting violence is not sedition.
Balwant Singh v. State of Punjab (1995)	The Supreme Court held that merely shouting slogans (e.g., "Khalistan Zindabad") a few times, without any accompanying threat to public response or incitement to violence, does not amount to sedition.

Q. With reference to the law of sedition in India, consider the following statements:

1. Section 124A of the Indian Penal Code was introduced in 1870 during British rule.
2. Under the Kedar Nath Singh case (1962), mere criticism of the government without incitement to violence amounts to sedition.
3. Sedition under Section 124A IPC was a cognizable and non-bailable offense.

Which of the statements given above is/are correct?

- (a) 1 and 3 only
- (b) 2 and 3 only
- (c) 1 and 2 only
- (d) 1, 2 and 3

Answer: (a) 1 and 3 only

Explanation:

- **Statement 1 is correct:** Section 124A was added to the IPC in 1870 during British rule.
- **Statement 2 is incorrect:** In Kedar Nath Singh v. State of Bihar, the Supreme Court ruled that only speech involving incitement to violence or public disorder can be treated as sedition. Mere criticism of the government is not sedition.
- **Statement 3 is correct:** Sedition under Section 124A IPC was a cognizable and non-bailable offense.

1.6. SAMPLE REGISTRATION SURVEY (SRS) 2024

Context

The recently released **Sample Registration System (SRS) Bulletin 2024** indicates a clear trend of demographic transition in India, showing a notable decline in the country's birth rate, death rate, and Infant Mortality Rate (IMR) over the decade from 2014 to 2024.



1. Key Data Trends (2014 vs. 2024)

Indicator	2014	2024	Absolute Difference / Trend
Birth Rate (per 1,000 population)	21	18.3	Down by 2.7 points
Death Rate (per 1,000 population)	6.7	6.4	Down by 0.3 points (Marginal decline)
Infant Mortality Rate (IMR) (per 1,000 live births)	39	24	Down by 15 points (Significant gain)

2. Core Concepts & Key Findings

- I. **Demographic Transition:** India is actively progressing through the stages of demographic transition, characterized by shifting from high birth and death rates to lower birth and death rates as economic development and healthcare improve.
- II. **Rural vs. Urban Disparities:**
 - **Birth Rate:** Rural birth rate fell from 22.7 to 20.2, while the urban birth rate fell from 17.4 to 14.7.
 - **Death Rate:** Rural death rate fell from 7.3 to 6.8. Interestingly, the urban death rate saw a marginal increase from 5.5 (in 2014) to 5.6 (in 2024).
 - **IMR Deficit:** The urban areas registered a sharp decline in IMR from 26 to 17 (a 9-point drop). Rural areas dropped 16 points from 43 to 27, but rural figures still lag significantly behind national single-digit targets, dragging down the national average.
- III. **Natural Growth Rate (NGR):**
 - **Definition:** The rate at which a population increases or decreases solely due to births and deaths, **excluding the effects of migration**. It is expressed as a percentage.
 - **State Performances:** **Kerala** has the lowest Natural Growth Rate (NGR) among larger states at **3.9**.
 - **Tamil Nadu** follows closely with an NGR of **4.8**.
 - Among Union Territories, **Andaman and Nicobar Islands** lead with an NGR of **4.1**.
- IV. **Infant Mortality Rate (IMR) Performers:**
 - **Kerala** has the lowest IMR in the country, achieving a single-digit IMR of **8**.
 - **Tamil Nadu** holds the second position among larger states with an IMR of **11**.

- **Goa** (smaller state) has an IMR of **11**, and **Andaman and Nicobar Islands** (UT) show an IMR of **9**.

3. Important Keywords to Remember

- **Sample Registration System (SRS):** A large-scale demographic survey in India that provides annual estimates of infant mortality rate, birth rate, death rate, and other fertility/mortality indicators at the national and sub-national levels. It is conducted by the **Office of the Registrar General & Census Commissioner, Ministry of Home Affairs**.
- **Crude Birth Rate (CBR):** The annual number of live births per 1,000 population.
- **Crude Death Rate (CDR):** The annual number of deaths per 1,000 population.
- **Infant Mortality Rate (IMR):** The number of deaths of children under one year of age per 1,000 live births. It is a crucial indicator of the socio-economic development and health ecosystem of a region.
- **Natural Growth Rate (NGR):** Natural Growth Rate = Crude Birth Rate - Crude Death Rate (adjusted to a percentage, without accounting for net migration).
- **Total Fertility Rate (TFR):** It is the average number of children a woman would have in her lifetime.

Q. With reference to the Sample Registration System (SRS) Bulletin 2024, consider the following statements:

1. Infant Mortality Rate (IMR) in India declined significantly between 2014 and 2024.
2. Kerala recorded the highest Natural Growth Rate (NGR) among larger Indian states.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Answer: (a) 1 only

Explanation:

- **Statement 1 is correct:** India's IMR declined from 39 in 2014 to 24 in 2024.
- **Statement 2 is incorrect:** Kerala recorded the lowest Natural Growth Rate (NGR) among larger states, not the highest.

INTERNATIONAL RELATIONS

2.1. STRATEGIC OVERHAUL OF INDIA'S PHARMA TRADE IN SOUTH ASIA

Context

- Recently, the Government of India has initiated a comprehensive review to identify and resolve market access barriers faced by Indian pharmaceutical exports in all **SAARC nations** and **Iran**.



1. Key Interventions and Nodal Agencies

- **Executing Body:** The exercise is spearheaded by the **Foreign Trade (South Asia) Division** under the **Department of Commerce**, in coordination with **Pharmexcil** (Pharmaceuticals Export Promotion Council of India).
- **Targeted Nations:** Sri Lanka, Nepal, Bangladesh, Afghanistan, Maldives, Pakistan, Bhutan, and Iran.
- **Objective:** To formulate product-specific strategies and consolidate solutions for a high-level dialogue involving Indian Missions, the Ministry of External Affairs, and Export Promotion Councils.

2. Key Issues to be Addressed:

The intervention specifically targets two major categories of international trade restrictions:

- **SPS Measures (Sanitary and Phytosanitary):** Regulations applied to protect human, animal, or plant life/health from risks arising from additives, contaminants, or disease-carrying organisms.
- **TBT (Technical Barriers to Trade):** Mandatory technical regulations, standards, and conformity assessment procedures that create unnecessary obstacles to international trade.

3. Geopolitical Impact Assessment

- **West Asia Crisis Linkage:** The government is actively assessing how the ongoing geopolitical conflict and crisis in West Asia have disrupted pharmaceutical supply chains and trade volumes with these specific neighbouring countries.

4. Key Economic Data (FY 2024-25)

- **Regional Export Volume:** India's pharmaceutical exports to the eight targeted nations stood at **\$1.2 billion**.
- **Global Export Volume:** This accounts for a small fraction of India's total global pharmaceutical exports, which reached **\$30.47 billion** in the same fiscal year.

5. About SAARC

I. General Overview

- **Full Form:** South Asian Association for Regional Cooperation.

- **Establishment:** It was founded on **8 December 1985** with the signing of the SAARC Charter in **Dhaka** (Bangladesh).
- **Headquarters / Secretariat:** **Kathmandu**, Nepal (established in 1987).

II. Member Countries (8)

- Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.
- **Afghanistan** is the newest member. It joined the organization during the 14th SAARC Summit in **2007**.

III. Key Objectives

- To promote the welfare of the people of South Asia and improve their quality of life.
- To accelerate economic growth, social progress, and cultural development in the region.

Q. Consider the following statements about India's pharmaceutical trade initiatives:

- I. It aims to resolve non-tariff barriers such as Sanitary and Phytosanitary (SPS) measures faced by Indian pharmaceutical exporters.
- II. The scope of this market access exercise is exclusively restricted to the member nations of the South Asian Association for Regional Cooperation (SAARC).

Which of the statements given above is/are correct?

- I only
- II only
- Both I and II
- Neither I nor II

Answer: A

Explanation:

Statement I is correct: The initiative specifically targets the resolution of Sanitary and Phytosanitary (SPS) measures and Technical Barriers to Trade (TBT), which act as significant non-tariff market access barriers for pharmaceutical exports.

Statement II is incorrect: The exercise to identify and resolve these market access issues is not exclusively limited to SAARC nations; it also actively includes Iran.

2.2. MULTILATERAL EXERCISE PRAGATI 2026 BEGINS IN MEGHALAYA

Context

- Recently, the 13-nation military exercise PRAGATI 2026 began **at Meghalaya (Umroi Military Station)**, highlighting India's growing role in regional security and defence cooperation in the Indian Ocean Region (IOR).

1. Key Highlights of Exercise PRAGATI 2026

- **Nomenclature:** PRAGATI stands for **Partnership of Regional Armies for Growth and Transformation** in the Indian Ocean Region.
- **Format & Scale:** It is a 13-nation *multilateral* land force exercise hosted by the Indian Army.



- **Geographical Focus:** It focuses on counter-terrorism operations executed specifically across **semi-mountainous and jungle terrain**.
- **Defense Indigenization:** Beyond tactical drills, the exercise serves as a strategic platform under the *Atmanirbhar Bharat* initiative. Domestic Indian defense and tech companies use this venue to showcase indigenous equipment, weaponry, and innovations to friendly foreign nations.

2. Participating Nations Mapping

Apart from host **India**, 12 friendly nations spanning South Asia, Southeast Asia, and the island territories of the Indian Ocean are participating. Recognizing this specific group of countries is highly relevant for Prelims International Relations (IR) options:

- **South Asia:** Bhutan, Nepal, the Maldives, Sri Lanka.
- **Southeast Asia (ASEAN bloc):** Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Vietnam.
- **Western Indian Ocean Island:** Seychelles.

3. Other Important Joint Military Exercises Held in India (2026)

Exercise Name	Participating Nations	Type of Exercise	Key Focus Area / Terrain
MILAN 2026	India + Multi-nation Navies (Over 50 countries invited)	Multilateral (Navy)	Large-scale maritime maneuvers, anti-submarine warfare, and interoperability in the Indo-Pacific. Held at Visakhapatnam.
Yudh Abhyas	India & United States	Bilateral (Army)	High-altitude warfare, counter-insurgency operations, and joint humanitarian assistance.
Garuda Shakti	India & Indonesia	Bilateral (Special Forces)	Jungle warfare, tactical counter-terrorism operations, and military intelligence sharing.
Mitra Shakti	India & Sri Lanka	Bilateral (Army)	Semi-urban and counter-insurgency joint operational drills.
Surya Kiran	India & Nepal	Bilateral (Army)	High-altitude mountain warfare, disaster relief maneuvers, and terrain survival techniques.
Harimau Shakti	India & Malaysia	Bilateral (Army)	Jungle warfare tactics, sub-conventional operations, and drone/tech integration.

Q. With reference to Exercise PRAGATI 2026, consider the following statements:

1. It is a multilateral land force exercise hosted by the Indian Army.
2. The exercise focuses on counter-terrorism operations in semi-mountainous and jungle terrain.
3. Seychelles is the only participating country from the Western Indian Ocean region.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer: (d) 1, 2 and 3

Explanation:

- **Statement 1 is correct:** PRAGATI 2026 is a 13-nation multilateral land force exercise hosted by the Indian Army.
- **Statement 2 is correct:** The exercise emphasizes counter-terrorism operations in semi-mountainous and jungle terrain.
- **Statement 3 is correct:** Seychelles is the only participating nation from the Western Indian Ocean island region.

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Prelims Test Series

3.1. NCDEX TO LAUNCH INDIA'S FIRST WEATHER DERIVATIVES

Context

- Recently, the **National Commodity and Derivatives Exchange (NCDEX)** announced the launch of RAINMUMBAI on May 29, 2026, India's **first exchange-traded weather derivatives** contract. It aims to help farmers and businesses reduce financial risks caused by unpredictable monsoon and changing weather patterns.



1. Key Features of the 'RAINMUMBAI'

- **Target Audience:** Specifically designed for farmers, agribusinesses, insurance entities, and corporate sectors whose revenue models are highly **sensitive to rainfall variations**.
- **Regulatory Approval:** Fully cleared and regulated by the **Securities and Exchange Board of India (SEBI)**.
- **Knowledge & Data Partners:** Developed in academic collaboration with **IIT Bombay**.
- Utilizes baseline, authentic rainfall data provided by the **India Meteorological Department (IMD)**.
- **Data Sources:** The underlying settlement value of the derivative will rely directly on surface rainfall data and **Automatic Weather Stations (AWS)** observations stationed specifically at **Santracruz and Colaba** in Mumbai.

2. What is a Weather Derivative?

- **Definition:** A financial instrument whose payoff depends on concrete, measurable weather indexes (such as total rainfall, temperature, or wind speed) over a specified period.
- **Key Distinction from Insurance:** Traditional insurance requires the policyholder to **prove a demonstrable physical loss** to get a payout (e.g., ruined crops).
- Weather derivatives pay out based purely on the **index threshold being crossed** (e.g., if rainfall falls below a predetermined millimeter mark), regardless of actual physical damage. This dramatically reduces the time and paperwork needed for settlements.
- **How Weather Derivative Work?**
 - The payout depends on a weather index (rainfall, temperature, snowfall, etc.), not on physical damage.
 - If actual weather deviates from a pre-decided benchmark, compensation is provided.
- **Example:**
 - A farmer expects normal monsoon rainfall:
 - If rainfall falls below the agreed level, the derivative contract pays compensation.
- This reduces income loss due to poor monsoon.

3. Important Institutional Bodies

A. National Commodity and Derivatives Exchange (NCDEX)

- It is a nation-level, technology-driven **online commodity exchange** in India.
- Though it trades various commodities, it has a prominent focus on **agricultural commodities** (like chana, castor seed, coriander, etc.), making it crucial for agricultural pricing architecture.
- It is regulated by **SEBI** (following the merger of the Forward Markets Commission with SEBI in 2015).

B. Securities and Exchange Board of India (SEBI)

- A **statutory body** established under the provisions of the *SEBI Act, 1992*.
- It protects the interests of investors in securities and regulates the securities and commodities derivatives market in India.

C. India Meteorological Department (IMD)

- Established in 1875, it is the principal government agency responsible for meteorological observations, weather forecasting, and seismology.
- It functions under the **Ministry of Earth Sciences (MoES)**.

Q. With reference to the recently launched 'RAINMUMBAI' weather derivatives contract, consider the following statements:

1. It is India's first exchange-traded weather derivatives contract launched by the National Commodity and Derivatives Exchange (NCDEX).
2. Weather derivatives provide payouts only after proving actual physical damage caused by weather events.
3. The contract uses rainfall data provided by the India Meteorological Department (IMD).

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer: (c) 1 and 3 only

Explanation:

- **Statement 1 is correct:** RAINMUMBAI is India's first exchange-traded weather derivatives contract launched by NCDEX.
- **Statement 2 is incorrect:** Weather derivatives provide payouts based on weather index thresholds, not actual physical damage.
- **Statement 3 is correct:** The contract relies on rainfall data from IMD and Automatic Weather Stations (AWS).

3.2. THE INDEX OF EIGHT CORE INDUSTRIES UNDERSCORES ECONOMIC DISTRESS

Context

- Recently, India's Index of Eight Core Industries (ICI) recorded a modest growth of 1.7%, indicating a weak start to the fiscal year.
- The annual average growth slowed to 2.8% (2025-26), compared to 4.5% in the previous year (2024-25) and more than 7% growth during the earlier three years, reflecting a slowdown in industrial demand and economic activity.



1. Key Structural Findings from the Article

- **The Energy/Fuel Paradox:** Out of the eight core sectors, **five contracted** simultaneously—**Crude Oil, Natural Gas, Coal, Fertilizer, and Petroleum Refinery Products**. The crude oil and natural gas sectors contracted for 16 and 22 consecutive months respectively, showing long-term domestic resource challenges.
- **The Drivers of Growth:** Only three sectors recorded positive growth—**Steel, Cement, and Electricity**. This growth highlights that **capital infrastructure** pushed by government capital expenditure remains the sole active engine, while rural and fuel demand are faltering.
- **Monsoon/Climate Risks:** The report highlights that a **below-normal monsoon** combined with **above-normal El Niño** patterns has further dampened rural demand and caused a contraction in fertilizer output.

2. All About the 8 Core Industries

The Index of Eight Core Industries (ICI) is a production volume index that measures the collective and individual performance of production in selected elite infrastructure industries. It serves as a crucial **lead indicator** of the industrial and infrastructure landscape.

- **Compiling & Releasing Authority:** Compiled monthly by the **Office of the Economic Adviser (OEA)** under the **Department for Promotion of Industry and Internal Trade (DPIIT)**, *Ministry of Commerce and Industry*.
- **Base Year: 2011–12.**
- **Linkage with IIP:** The eight core industries constitute **40.27%** of the total weight of items included in the broader **Index of Industrial Production (IIP)**.

Rank	Core Sector Industry	Individual Weight in IIP (%)
1	Petroleum Refinery Products (<i>Highest Weight</i>)	28.04%
2	Electricity Generation	19.85%
3	Steel Production	17.92%
4	Coal Production	10.33%
5	Crude Oil Production	8.98%
6	Natural Gas Production	6.88%

7	Cement Production	5.37%
8	Fertilizer Production (<i>Lowest Weight</i>)	2.63%
—	Combined Weight	40.27%

Important Keywords to Remember

- **Index of Industrial Production (IIP):** A composite indicator tracking the growth rate of industry groups classified under **Mining, Manufacturing, and Electricity**. It is compiled and published monthly by the **National Statistical Office (NSO)**, *Ministry of Statistics and Programme Implementation (MoSPI)*.
- **Purchasing Managers' Index (PMI):** An economic indicator derived from monthly surveys of private sector companies. A PMI **above 50** indicates expansion over the previous month; **below 50** indicates contraction; and **exactly 50** indicates no change. It tracks manufacturing and services activity earlier than official government data.

Q. With reference to the Index of Eight Core Industries (ICI), consider the following statements:

1. The Index of Eight Core Industries is compiled monthly by the Office of the Economic Adviser under the Ministry of Commerce and Industry.
2. Fertilizer production carries the highest weight among the eight core industries in the Index of Industrial Production (IIP).

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Answer: (a) 1 only

Explanation:

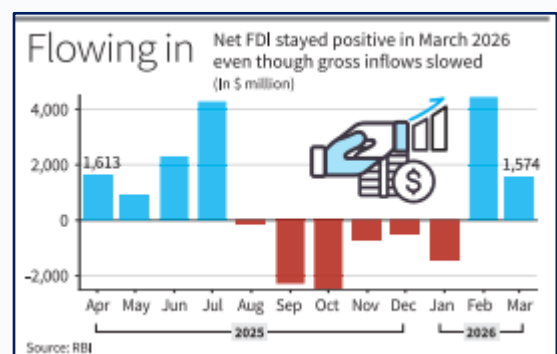
Statement 1 is correct: The ICI is compiled and released monthly by the Office of the Economic Adviser (OEA) under DPIIT, Ministry of Commerce and Industry.

Statement 2 is incorrect: Petroleum Refinery Products carry the highest weight (28.04%), while Fertilizers have the lowest weight (2.63%) in the IIP.

3.3. CAPITAL FLIGHT AND DYNAMICS OF FOREIGN INVESTMENTS (RBI DATA 2026)

Context

- Recently, RBI data showed that India's net foreign investment sharply fell to $-\$11.7$ billion in March 2026, mainly due to heavy foreign capital outflows after the West Asia geopolitical crisis.
- The decline was caused by massive selling by Foreign Portfolio Investors (FPIs), even though Foreign Direct Investment (FDI) remained positive for the second straight month.



1. Key Data Trends & Macro Insights from the Article

- **The Outflow Metrics:** Foreign Portfolio Investors (FPIs) pulled out a massive net **\$-13.3 billion** from the Indian markets in March 2026 alone, with the selling streak continuing into April and May.
- **The FDI Cushion:** Net FDI stood positive at **1.6 billion** for March 2026, driven by lower levels of profit repatriation and outward FDI by Indian firms. Gross FDI inflows for the month stood at 6.2 billion.
- **Macroeconomic Impact:** The rapid dollar outflow by FPIs has put immense pressure on the **Indian Rupee (depreciation)** and has simultaneously eaten into the RBI's **Foreign Exchange (Forex) Reserves** as the central bank manages currency volatility.

2. FDI vs. FPI

Understanding the conceptual boundaries between Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI) is a high-yield area for Prelims.

1. Foreign Direct Investment (FDI)

- **Definition:** Investment made by a foreign entity to acquire a lasting management interest (usually defined as **10% or more** of the equity shares) in an enterprise operating in India.
- **Nature:** Long-term, stable, and physical asset-driven (plant, machinery, infrastructure).
- **Key Feature:** It brings not just capital, but also technology, management expertise, and best practices. It is **non-debt creating** and cannot be easily liquidated overnight.
- **Routes:** Can enter via the **Automatic Route** (no prior government approval required) or the **Government Route** (requires approval via the Foreign Investment Facilitation Portal administered by DPIIT).
- **Regulatory Body:** Foreign Direct Investment (FDI) in India is primarily regulated by the Department for Promotion of Industry and Internal Trade (DPIIT) under the Ministry of Commerce and Industry, and the Reserve Bank of India (RBI)

2. Foreign Portfolio Investment (FPI)

- **Definition:** Investment by non-residents in passive financial assets such as shares, bonds, or derivatives of Indian companies, where the stake is **less than 10%** of the company's paid-up capital.
- **Nature:** Short-term, highly volatile, and liquid transaction capital.
- **Key Feature:** Popularly referred to as "**Hot Money**" because investors can easily liquidate their holdings and exit the country at the first sign of global risk aversion or interest rate hikes abroad (as seen during the West Asia crisis).
- **Regulatory Body:** FPIs are strictly regulated by the **Securities and Exchange Board of India (SEBI)**.

Important Macroeconomic Keywords to Remember

- **Hot Money:** Foreign Portfolio Investment (FPI) is often referred to as "hot money" because it is highly liquid, driven by short-term profit, and can flee an economy at the first sign of trouble.

- **Currency Depreciation:** A fall in the value of a currency in a floating exchange rate system due to market forces (high demand for US Dollars relative to the Rupee).
- **Foreign Exchange Reserves:** Assets held on reserve by a central bank in foreign currencies. In India, it comprises **Foreign Currency Assets (FCA), Gold, Special Drawing Rights (SDRs) with the IMF, and the Reserve Tranche Position with the IMF.**

Q. With reference to Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI), consider the following statements:

1. Foreign Direct Investment (FDI) generally involves a long-term management interest of 10% or more in an enterprise.
2. Foreign Portfolio Investment (FPI) is often called “hot money” because it is highly liquid and can quickly move out during global uncertainties.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Answer: (c) Both 1 and 2

Explanation:

Statement 1 is correct: FDI involves a lasting management interest, usually 10% or more equity ownership in a company.

Statement 2 is correct: FPI is known as “hot money” because investors can rapidly withdraw funds during crises or market instability.

3.4. CURRENCY DEPRECIATION AND RBI INTERVENTION

Context

Following sustained market losses, the Indian Rupee (INR) has depreciated significantly, closing near ₹97 to the US Dollar (\$). This has triggered a macroeconomic debate on whether the Reserve Bank of India (RBI) should intervene to defend the currency or let market forces determine its equilibrium level.



Core Economic Concepts & Mechanisms

1. Currency Depreciation vs. Devaluation

- **Depreciation:** A fall in the value of a currency in a **floating/market-driven exchange rate system**, caused by market forces of demand and supply.
- **Devaluation:** An official, deliberate downward adjustment of the value of a country's currency by its **central bank/government** under a **fixed exchange rate system**.

2. Twin Drivers of Current Rupee Depreciation

- **External Spikes:** Rising global oil prices and external inflationary pressures.

- **Speculative Capital Outflows:** Foreign Institutional Investors (FIIs/FPIs) pulling capital out due to **expectations of rising interest rates by foreign central banks** or lower expected returns on Indian stocks.

3. The Current Account Deficit (CAD) Connection

- **Definition:** CAD occurs when a country imports more goods, services, and transfers than it exports.
- **The Balancing Act:** A CAD requires a matching inflow of foreign capital (FDI/FPI) to maintain exchange rate stability. If capital inflows are insufficient to cover the deficit, demand for foreign exchange (USD) exceeds its supply, causing the local currency (INR) to **depreciate**.

Macroeconomic Impacts of Depreciation

A. Positive Impacts

- **Boosts Exports:** A weaker rupee makes domestic goods cheaper and more competitive in the international market.
- **Curtails Imports:** Imports become more expensive, naturally discouraging non-essential import demand.
- **Adjustment:** Theoretically, higher exports and lower imports work together to naturally compress and correct the Current Account Deficit.

B. Negative Impacts

- **Imported Inflation:** India is heavily dependent on imports for essential goods like crude oil. A falling rupee increases the domestic cost of these essentials, fueling domestic inflation.
- **Front-Loading of Purchases:** If consumers expect the rupee to fall further (and prices to rise tomorrow), they front-load purchases (e.g., rushing to buy fuel), which spikes short-term import demand and **worsens the deficit**.
- **Delayed Export Response:** A weak rupee **does not automatically boost exports** if global buyers expect the currency to fall even further, **causing them to delay purchases** to get cheaper rates later.

The Debate: To Intervene or Not?

I. Arguments FOR Allowing Free Depreciation (Non-Intervention)

- Advocates (including perspectives like Gita Gopinath) suggest letting the market find its own level.
- Intervention artificially props up the rupee, which only delays inevitable market adjustments and obstructs the free flow of market forces.

II. Arguments AGAINST Free Depreciation (Pro-Intervention)

- Unchecked depreciation driven by speculative capital (rather than economic fundamentals) causes extreme volatility.
- It inflicts severe inflationary pain on a populace already vulnerable to high global energy prices.

- **Global Precedent:** Even developed economies intervene during extreme volatility (e.g., Japan's signaling of 'decisive action' to maintain the Yen against the Dollar).

RBI's Intervention Tools

- **Spot Market Intervention:** The first line of defense. When the rupee depreciates sharply, the RBI **sells US Dollars (USD)** from its Foreign Exchange Reserves and **buys Indian Rupees (INR)**. This reduces the supply of INR and fills the shortage of USD, arresting the fall.
- **Policy Rate (Repo) Hikes:** Increasing interest rates improves the yield differential between India and developed markets (like the US Fed). This naturally incentivizes global capital to stay in India rather than flying out.
- **Regulatory Measures:** The RBI eases guidelines on External Commercial Borrowings (ECBs) and nonresident deposits (like FCNR) to stimulate steady dollar inflows.

Q. With reference to Currency Depreciation and RBI intervention, consider the following statements:

1. Currency depreciation occurs due to market forces in a floating exchange rate system.
2. Devaluation refers to an official reduction in currency value under a fixed exchange rate system.
3. When the Indian Rupee depreciates sharply, the RBI can support it by selling US Dollars from its foreign exchange reserves.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer: (d) 1, 2 and 3

Explanation:

- **Statement 1 is correct:** Depreciation happens in a market-driven exchange rate system due to demand and supply forces.
- **Statement 2 is correct:** Devaluation is an official downward adjustment of a currency under a fixed exchange rate regime.
- **Statement 3 is correct:** The Reserve Bank of India sells US Dollars and buys Indian Rupees to stabilize the rupee during sharp depreciation.

4.1. DRI RECOVERS TWO INDIAN RED SAND BOA SNAKES

Context

- Officials from the Hyderabad zonal unit of the **Directorate of Revenue Intelligence (DRI)** intercepted a suspect and seized two live Indian Red Sand Boa snakes during a decoy undercover operation in Warangal, Telangana. The individual was attempting to sell the reptiles in the grey/black market.
- This bust highlights the persistent threat of illegal wildlife trafficking in India and underscores the role of central economic intelligence agencies in combating non-fiscal environmental crimes.



About Red Sand Boa

- **Scientific Name:** *Eryx johnii*
- **Common Names:** Indian Sand Boa, John's Sand Boa, Brown Sand Boa. In local parlance, it is often referred to as 'Mandul' or 'Du-tondya' (the one with two mouths).
- **Physical Characteristics:** It is a **non-venomous, harmless** snake primarily reddish-brown in color with a thick-set body.
 - It is the **largest of the sand boas** in the world, capable of growing over 4 feet long.
 - **"Double-Headed" Appearance:** It features a characteristically blunt, wedge-shaped tail that closely resembles its head. This serves as a defense mechanism to confuse predators.
- **Behavior and Habitat:** It is **nocturnal** (active at night) and **fossorial** (spends the majority of its time underground in loose sand or burrows).
 - It is **ovoviviparous**, meaning embryos develop inside eggs that remain within the mother's body until they are ready to hatch, resulting in live births.
- **Geographical Distribution:** Endemic to Iran, Pakistan, and India.
 - In India, it is found throughout dry and arid regions. Notably, it is generally **absent in the North-Eastern states**.
- **Ecological Significance:** Often called the **"farmer's friend"** because its primary diet consists of destructive rodents, bats, lizards, and occasionally other snakes, helping naturally regulate pest populations.

Conservation & Legal Status

- **IUCN Red List:** Near Threatened (NT)
- **CITES:** Appendix II (regulates its international commercial trade)
- **Wildlife (Protection) Act, 1972:** Scheduled under **Schedule I** (making its possession, trade, or hunting a punishable criminal offense).

About DRI

- The **Directorate of Revenue Intelligence (DRI)** is the apex anti-smuggling intelligence agency of India.
- It functions under the **Central Board of Indirect Taxes and Customs (CBIC), Department of Revenue, Ministry of Finance.**
- While its primary mandate is safeguarding economic frontiers (curbing trade frauds and duty evasions), it also acts as a frontline agency enforcing allied environmental laws like the Wildlife (Protection) Act to curb cross-border wildlife trafficking.

Q. With reference to the Indian Red Sand Boa (*Eryx johnii*), consider the following statements:

1. It is a non-venomous snake known for its blunt tail that resembles its head.
2. It is an oviparous species that lays eggs outside the body.
3. It is listed under Appendix II of CITES.
4. In India, it is commonly found in the North-Eastern states.

Which of the statements given above are correct?

- (a) 1 and 3 only
- (b) 2 and 4 only
- (c) 1, 2 and 3 only
- (d) 1, 3 and 4 only

Answer: (a) 1 and 3 only

Explanation:

- **Statement 1 is Correct** — The Indian Red Sand Boa is a non-venomous snake with a tail resembling its head, giving a “double-headed” appearance.
- **Statement 2 is Incorrect** — It is **ovoviviparous**, meaning eggs hatch inside the mother’s body, resulting in live births.
- **Statement 3 is Correct** — It is listed under **CITES Appendix II.**
- **Statement 4 is Incorrect** — It is generally absent in the North-Eastern states of India.

4.2. BREAKTHROUGH GENETIC MAPPING TOOLKIT TO COMBAT GLOBAL PANGOLIN TRAFFICKING

Context

- Recently, a breakthrough study published in *PLoS Biology* by an international team of researchers has introduced an advanced **population genomics** approach to map the trade routes of the world's most-trafficked mammals: **Pangolins**.
- By overcoming the hurdle of highly degraded DNA in smuggled materials (such as seized scales), the researchers have constructed a high-resolution, geo-referenced **“genetic map.”** This database allows state law enforcement and wildlife agencies to pinpoint the geographic origin of seized pangolins with remarkable precision, helping to choke the illegal trade at its source.



1. About Population Genomics

- Population genomics is an advanced branch of genetics that studies genetic variations across entire populations using **large-scale genome sequencing**. It combines genomics, evolutionary biology, bioinformatics, and population genetics to understand how genes vary within and between populations.
- It has gained importance globally due to rapid advances in **DNA sequencing technologies, precision medicine, disease surveillance, and biodiversity conservation**.

I. Core Methodological Process

A typical population genomics study involves a structured, data-driven workflow:

- **Sampling:** Collecting biological specimens across different environments, geographical locations, or distinct phenotypes.
- **High-Throughput Sequencing:** Utilizing technologies like Whole Genome Sequencing (WGS) or Restriction site-associated DNA sequencing (RAD-seq) to capture thousands of genetic variations simultaneously.
- **Bioinformatics & Filtering:** Aligning raw data against a reference genome and filtering for high-quality markers (e.g., finding the 671 differentiating genetic points in the pangolin study).
- **Statistical Analysis:** Applying complex mathematical models and algorithms to identify "outlier loci" (genes that deviate significantly from neutral expectations, signaling evolutionary pressure or distinct ancestry).

II. Key Applications

A. Wildlife Conservation & Anti-Trafficking (Conservation Genomics)

- **Choking Illegal Trade:** As demonstrated in the pangolin study, it allows law enforcement to build high-resolution, geo-referenced "genetic maps." Seized wildlife parts (even with degraded DNA) can be traced back to the exact forest or region they were poached from.
- **Managing Inbreeding:** It assesses the absolute genetic health, effective population size, and level of inbreeding in critically endangered, isolated species (e.g., Asiatic Lions in Gir, Cheetahs in Kuno), steering captive breeding and translocation programs.

B. Human Evolution, History, and Anthropology

- **Mapping Migrations:** It tracks human out-of-Africa migration routes starting 50,000–100,000 years ago, highlighting how different ancient populations mixed.
- **Adaptive Selection:** It identifies how humans adapted genetically to their changing environments over millennia, such as the evolutionary development of lactose tolerance (the ability to digest milk) in dairy-farming ancestral communities.

C. Public Health & Precision Medicine

- **Epidemiology:** Tracking the mutation vectors, origins, and structural evolution of pathogens during pandemics (e.g., tracing variants of SARS-CoV-2 or tracking antibiotic-resistant bacteria strains).

- **Targeted Healthcare:** Understanding how different ethnic populations possess unique susceptibilities to chronic conditions, monogenic diseases, or varied drug metabolisms, leading to tailored therapeutic interventions.

D. Sustainable Agriculture & Climate Resilience

- **Crop Wild Relatives:** Identifying climate-resilient genes in wild variants of domesticated crops (like rice or chickpeas).
- **Marker-Assisted Breeding:** Accelerating the development of crop varieties capable of withstanding extreme environmental pressures, such as drought, soil salinity, or emerging pests, without waiting generations for natural selection.

2. Major International Trafficking Hotspots Identified

The study identified three range-wide critical hotspots for the most heavily traded species:

Pangolin Species	Identified International Trafficking Hotspot
White-bellied Pangolin	Southwestern Cameroon (Africa)
Sunda Pangolin	Southwestern Borneo (Southeast Asia)
Chinese Pangolin	Around Myanmar (spanning into Yunnan, China)

3. About Pangolin

I. General Profile

- Pangolins are the **only mammals wholly covered in large, protective keratin scales** (the same material as human fingernails and rhino horns).
- They are **solitary, nocturnal, and insectivorous** (their diet consists almost entirely of ants and termites, which they extract using a remarkably long, sticky tongue).
- They lack teeth and **roll into a tight, near-impenetrable ball** when threatened by predators.

II. Species & Distribution

There are **eight extant species** of pangolins distributed across two continents: four in Africa and four in Asia.

- **Indian Perspective:** India is home to two species:
 1. **Indian Pangolin (*Manis crassicaudata*):** Found extensively across peninsular India, extending to Pakistan, Bangladesh, and Sri Lanka. It is absent in the high Himalayas and the North-East.
 2. **Chinese Pangolin (*Manis pentadactyla*):** Found in the Himalayan foothills, Northeastern India, Bangladesh, Myanmar, and Southern China.

III. Conservation Status Matrix

Pangolins are among the most critically protected species globally due to the intense pressure of poaching for traditional medicine (scales) and bushmeat luxury consumption.

- **CITES Status: Appendix I** for all eight species since 2017 (Strictly prohibits all international commercial trade).

- **IUCN Red List Status:**
 - *Critically Endangered:* Chinese Pangolin, Sunda Pangolin, Philippine Pangolin.
 - *Endangered:* **Indian Pangolin**, White-bellied Pangolin, Giant Ground Pangolin.
 - *Vulnerable:* Temminck's Ground Pangolin, Black-bellied Pangolin.
- **Wildlife (Protection) Act, 1972 (India):** Placed under **Schedule I**, granting them the highest level of legal protection in India, equivalent to the Tiger or Asian Elephant.

Q. With reference to Population Genomics, consider the following statements:

1. It studies genetic variations across entire populations using large-scale genome sequencing.
2. It combines genomics, evolutionary biology, bioinformatics, and population genetics.
3. Population genomics is used only in human disease research and has no role in wildlife conservation.

Which of the statements given above are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer: (a) 1 and 2 only

Explanation:

- **Statement 1 is** Correct — Population genomics analyzes genome-wide genetic variation across populations.
- **Statement 2 is** Correct — It integrates genomics, bioinformatics, evolutionary biology, and population genetics.
- **Statement 3 is** Incorrect — Population genomics has major applications in wildlife conservation, anti-trafficking efforts, agriculture, and biodiversity studies.

4.3. CENTER'S FINAL STAND: NO NEW HYDRO POWER PROJECTS IN UPPER GANGA REACHES

Context

- **Recently**, the Union Government informed the Supreme Court that no new hydropower projects will be allowed in the upper Ganga basin in Uttarakhand due to ecological and seismic concerns.
- Only seven already commissioned or nearly completed projects will continue, citing the harmful cumulative impact of "bumper-to-bumper" dams in the fragile Himalayan region.



1. Ecological and Legal Background

- **Origin:** The legal battle stems from the **June 2013 Kedarnath disaster**. The Supreme Court directed the Environment Ministry to evaluate if hydroelectric projects amplified the tragedy.
- **Expert Committees:**

- **Expert Body-I (Ravi Chopra Committee - 2014):** Concluded that 23 out of 24 examined projects would severely impact the Alaknanda and Bhagirathi river basins.
- **Vinod Tare Committee (IIT-Kanpur):** Flawed design/siting of multiple proposed projects.
- **Expert Body-II (B.P. Das Committee - 2020):** Took a more permissive view (recommending 26 projects), but the Centre ultimately accepted only seven.
- **Geographical Fragility Factor:** The decision is driven by extreme vulnerability to **landslides, flash floods, Glacial Lake Outburst Floods (GLOFs)**.

2. Hydropower Projects and Associated Rivers

Hydropower Project	Associated River / Basin
Tehri Pumped-Storage Project (1,000 MW)	Bhagirathi River
Tapovan Vishnugad (520 MW)	Dhauliganga River
Vishnugad Pipalkoti (444 MW)	Alaknanda River
Singoli Bhatwari (99 MW)	Mandakini River
Phata Byung (76 MW)	Mandakini River
Madhyamaheshwar (15 MW)	Madhyamaheshwar Ganga (Tributary of Mandakini)
Kailganga-II (6 MW)	Kaliganga River (Tributary of Mandakini)

Q. With reference to the recent decision on hydropower projects in the upper Ganga basin, consider the following statements:

1. The Union Government informed the Supreme Court that no new hydropower projects will be allowed in the upper Ganga basin of Uttarakhand.
2. The Ravi Chopra Committee recommended that most examined hydropower projects would severely affect the Alaknanda and Bhagirathi basins.
3. The decision was mainly driven by concerns related to cyclones and coastal erosion in the Himalayan region.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer: (a) 1 and 2 only

Explanation:

- **Statement 1 is correct:** The Centre informed the Supreme Court that no new hydropower projects will be permitted in the upper Ganga basin.
- **Statement 2 is correct:** The Ravi Chopra Committee concluded that 23 of the 24 examined projects would severely impact the Alaknanda and Bhagirathi river basins.
- **Statement 3 is incorrect:** The decision was driven by risks such as landslides, flash floods, earthquakes, and Glacial Lake Outburst Floods (GLOFs), not cyclones or coastal erosion.

4.4. NURDLE POLLUTION

Context

- Recently, the Kerala coast near Thiruvananthapuram continues to face severe pollution from nurdles (plastic pellets) even one year after the Liberian-flagged ship MSC Elsa 3 sank off the coast.



1. What are Nurdles?

- Definition:** Nurdles are tiny, pre-production plastic pellets that serve as the raw material for manufacturing nearly all plastic products.
- Classification:** They are classified as **primary microplastics** because they are intentionally manufactured to be small, unlike secondary microplastics which break down from larger plastic items (like bags or bottles).
- Physical Characteristics:** They typically measure between **1 mm to 5 mm** in diameter.
 - They possess high **buoyancy**, allowing them to float easily, spread rapidly via ocean currents, and wash ashore over vast distances.

2. Chemical Composition: Polyethylene & PVC

- Materials:** Nurdles are primarily made from polymers such as **Polyethylene (PE)** or **Polyvinyl Chloride (PVC)**.
- Toxicity Profile:** In their pure, manufactured form, these polymers are **not inherently toxic** in themselves.
- Bioaccumulation:** Because of their chemical properties, nurdles act like "sponges" in the ocean. They highly attract and concentrate **Persistent Organic Pollutants (POPs)**, heavy metals, and toxins from the surrounding seawater onto their surfaces.

3. Polyethylene vs Polyvinyl chloride

Feature	Polyethylene (PE)	Polyvinyl chloride (PVC)
Flexibility	Highly flexible, lightweight, and ductile.	Naturally rigid and brittle (requires <i>plasticizers</i> to make it flexible).
Density & Strength	Lower density; moderate tensile strength.	High density; exceptional structural strength and rigidity.
Thermal Properties	Lower melting point; melts easily.	Higher melting point; inherently fire-retardant due to chlorine content.
Recycling Challenges	Highly recyclable	Notoriously difficult to recycle
Applications	Squeeze bottles, plastic grocery bags, cling wraps, milk jugs, shampoo bottles, agricultural pipes, geomembranes, and pre-production nurdles etc.	Construction pipes (plumbing), window frames, electrical conduits, medical tubing, blood bags, cable insulation, imitation leather, and flooring.

4. Environmental and Health Footprint

The environmental impacts of these two plastics vary deeply due to their distinct chemical hazards during manufacturing and disposal.

I. Hazardous Byproducts

- **PE:** Relatively clean to manufacture compared to PVC. It burns to produce carbon dioxide and water if combustion is complete, though incomplete burning releases carbon monoxide and particulate matter.
- **PVC:** Dubbed the "**Poison Plastic.**" Throughout its lifecycle (production, use, and disposal), PVC releases highly toxic, bioaccumulative **chlorinated organic chemicals**, including **dioxins** and **furans** (both are persistent organic pollutants or POPs).

II. The Plasticizer Dilemma

- **Pure PVC** is unusable for flexible products without chemical additives called **phthalates**. Phthalates are used to soften plastics, making them more flexible or more durable.
- **Phthalates** are not chemically bound to the PVC matrix and easily leach out into liquids, soils, or the human body.
- They are recognized **endocrine disruptors**, linked to reproductive anomalies, and are heavily restricted in children's toys and specific medical devices globally. PE does not require these plasticizers.

Q. With reference to Nurdles Pollution, consider the following statements:

1. Nurdles are classified as primary microplastics because they are intentionally manufactured in small sizes.
2. Polyethylene (PE) requires phthalate plasticizers to become flexible.
3. PVC can release toxic chlorinated compounds like dioxins during its lifecycle.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 1 and 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

Answer: (b) 1 and 3 only

Explanation:

Statement 1 is correct: Nurdles are intentionally manufactured tiny plastic pellets and are therefore classified as primary microplastics.

Statement 2 is incorrect: PVC requires phthalates for flexibility, while PE is naturally flexible and does not require such plasticizers.

Statement 3 is correct: PVC releases toxic chlorinated compounds such as dioxins and furans during production, use, and disposal.

5.1. THE PREDICTABILITY PANDEMIC

Context

- As Large Language Models (LLMs) and **predictive AI keyboards** (such as Gboard, Microsoft SwiftKey, and generative chatbots) become integrated into daily human communication, data scientists and cognitive psychologists have raised critical flags regarding "**The Predictability Pandemic.**"
- The widespread adoption of predictive algorithms is shifts human interaction from an active, creative construction of language to a passive selection of machine-generated suggestions. This shift introduces significant risks, notably **Model Collapse**, a systemic threat to the future training architecture of advanced artificial intelligence models.



1. What are Predictive Keyboards?

Predictive keyboards are AI-based software systems that:

- Predict the next word or phrase while typing.
- Learn from user behaviour and communication patterns.
- Use machine learning and natural language processing (NLP).

Examples:

- Smartphone autocorrect systems
- AI writing assistants
- Email smart replies
- Chat-based AI systems

2. Major Side Effects

I. "Model Collapse" (The AI Threat)

- **What it means:** AI models learn how to write by reading human text on the internet.
- **The Problem:** As more people use AI or smart keyboards to write, the internet gets filled with generic, AI-generated text. When future AI models learn from this artificial text instead of real human writing, they start repeating the same mistakes and eventually break down. This is called **Model Collapse**.

II. Cognitive Offloading & "The Google Effect"

- **What it means:** Our brains like to save energy. When we know a tool (like a calculator, GPS, or predictive text) can do the job for us, our brain stops trying to remember it.
- **The Result:** If you know Google or your keyboard will finish a fact or sentence for you, your brain stops practicing how to remember or build those thoughts from scratch.

III. Losing Our Unique Vocabulary

- **What it means:** Humans have "emotional granularity," which means we can pick precise words to describe exactly how we feel (like choosing between *gloomy*, *bitter*, or *exhausted*).
- **The Result:** Smart keyboards prefer common words. They constantly suggest generic phrases like "I'm fine" or "I'm sad". If we keep clicking them just to save time, our active vocabulary shrinks, making our language boring and flat.

Q. With reference to "The Predictability Pandemic" and predictive AI systems, consider the following statements:

1. Predictive keyboards use Machine Learning and Natural Language Processing (NLP).
2. "Model Collapse" refers to the breakdown of AI quality when models increasingly learn from AI-generated content instead of original human-created data.
3. The "Google Effect" suggests that frequent dependence on digital tools can reduce human memory retention and cognitive effort.

Which of the statements given above are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer: (d) 1, 2 and 3

Explanation:

Statement 1 is Correct: Predictive keyboards function using **Machine Learning (ML)** and **Natural Language Processing (NLP)** to predict words, phrases, and communication patterns.

Statement 2 is Correct: **Model Collapse** occurs when AI systems increasingly train on AI-generated content instead of authentic human-created data, leading to repetitive outputs, reduced originality, and degradation in model quality.

Statement 3 is Correct: The **Google Effect** refers to cognitive offloading, where humans rely on digital tools (like Google, GPS, calculators, or predictive keyboards) instead of actively remembering information or constructing thoughts independently.

5.2. EBOLA RESURGENCE IN CENTRAL AFRICA

Context

- The World Health Organization (WHO) has officially declared the ongoing Ebola outbreak in the Democratic Republic of Congo (DRC) and Uganda as a **Public Health Emergency of International Concern (PHEIC)**.
- The outbreak originated in the Ituri province (eastern DRC) and has geographically expanded, reaching as far as Kinshasa (the capital, 1,000 km away) and crossing international borders into Uganda.



1. Decoding the Ebola Virus Disease (EVD)

- **Pathogen:** It is a severe, often fatal viral disease caused by a group of viruses known as **orthoebolaviruses** (formerly ebolavirus). The current outbreak is specifically driven by the **Bundibugyo virus**, a rare variant.
- **Nature of Disease:** It is classified as a **hemorrhagic fever virus**. It disrupts the body's clotting system, leading to internal bleeding as blood leaks from small vessels.
- **Historical Context:** EVD was first identified in 1976 in dual outbreaks in southern Sudan and the DRC, primarily affecting remote villages in Central and West Africa.

2. Transmission Dynamics: How Does it Spread?

- **Zoonotic Origin:** The virus is initially transmitted to humans from wild animals, including fruit bats, porcupines, and non-human primates.
- **Human-to-Human Spread:** It spreads through direct contact with infected bodily fluids (such as blood, vomit, secretions, or semen) and surfaces contaminated with these fluids.
- **Key Exclusions:** Ebola is **not transmitted by air**.
- **Infectious Period:** Infected individuals are not contagious during the incubation period (which typically lasts 5 to 15 days, but can range from 2 to 21 days). They only become infectious once symptoms appear and remain so as long as the virus is in their blood.

3. Fatality and Treatment Landscape

- **Fatality Rate:** The disease is severe, with an average case fatality rate of around **50%** (historically varying between 25% and 90% depending on the outbreak and viral strain).
- **Treatment Constraints:** There is currently **no known cure**, and critically, there are **no approved vaccines or therapeutics** available for the Bundibugyo variant.
- **Medical Management:** Chances of survival depend on early supportive care, which primarily consists of maintaining fluid and electrolyte balance, alongside the administration of blood and plasma to control bleeding.

4. What is a Public Health Emergency of International Concern (PHEIC)?

- **Institutional Framework:** It is the highest level of formal health alert declared by the WHO under the **International Health Regulations (IHR)**.
- **Core Criteria:** A PHEIC is declared when a public health event is determined to be serious, sudden, unusual, or unexpected.
- **Global Significance:** The declaration indicates a high risk of international spread, making it a global health risk that necessitates an immediate, coordinated international medical response.

Q. With respect to the clinical management of the Ebola Virus Disease, consider the following statements:

Statement-I: The current supportive therapy for an infected patient heavily involves the administration of blood and plasma.

Statement-II: Ebola is a hemorrhagic fever virus that disrupts the body's clotting system and causes severe internal bleeding.

Which one of the following is correct in respect of the above statements?

- (a) Both Statement-I and Statement-II are correct and Statement-II explains Statement-I
- (b) Both Statement-I and Statement-II are correct, but Statement-II does not explain Statement-I
- (c) Statement-I is correct, but Statement-II is incorrect
- (d) Statement-I is incorrect, but Statement-II is correct

Answer: (a)

Explanation:

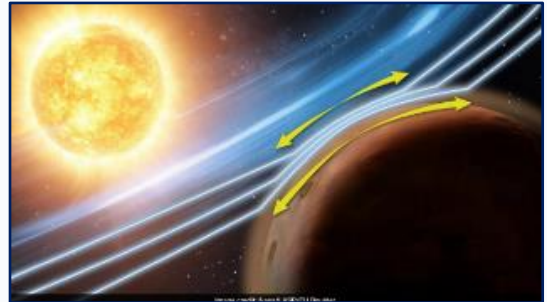
Statement-I is correct: According to the text, in the absence of a known cure, current therapy primarily consists of maintaining fluid and electrolyte balance and administering blood and plasma to the patient.

Statement-II is correct and explains Statement-I: The conceptual reason (explanation) for this specific medical treatment is the fundamental nature of the disease; Ebola acts as a hemorrhagic fever virus that damages the clotting system and triggers internal bleeding, making blood and plasma replacement a critical life-saving measure.

5.3. ZWAN-WOLF EFFECT

Context

- Recently, a study published in Nature Communications found evidence of a rare space phenomenon called the **“Zwan-Wolf effect” on Mars**. Using data **from MAVEN**, scientists discovered that this effect changes how solar wind interacts with planets that do not have a strong global magnetic field, like Mars.
- In December 2023, a powerful solar storm called a **Coronal Mass Ejection (CME)** hit Mars. This created strong magnetic disturbances in Mars’s weak magnetic field, helping scientists detect the rare Zwan-Wolf effect, which is usually too weak to observe.



1. What is the Zwan-Wolf Effect?

- The Zwan-Wolf effect has been observed on Mars. This effect occurs when particles in the ionosphere are pushed into specific regions by the solar wind.
- **How does it Happen?**
 - **Compression at Boundaries:** As this magnetized solar wind approaches the magnetic field or the plasma boundary of a planet, it undergoes severe compression near the planet's magnetic boundaries.
 - **Pressure Gradient Setup:** This compression creates a steep pressure gradient along the magnetic field lines.
 - **The Diverter Mechanism:** This pressure gradient acts as a **"stream diverter,"** squeezing and pushing the charged particles along the magnetic field lines and forcing them away from the central stream.
 - **The Net Result:** Consequently, closer to the stream boundary, an area forms with a significantly **lower density of charged particles**. This is called the Zwan –Wolf Effect.

- On Earth, this mechanism deflects much of the solar wind and protects us from the Sun's constant bombardment.

2. About the MAVEN Mission

- **Agency:** Launched by NASA in 2013.
- **Objective:** To explore Mars's upper atmosphere, ionosphere, and its specific interactions with the Sun and solar wind.

Some Important Mars Mission

Space Mission	Country / Space Agency
Viking 1	United States / NASA
Mars Orbiter Mission (MOM) / <i>Mangalyaan</i>	India / ISRO
Perseverance (Mars 2020)	United States / NASA

3. Understanding Coronal Mass Ejections (CMEs)

- A Coronal Mass ejection (CME) is a massive **expulsion of magnetized plasma and solar wind** from the Sun's corona into space.
- When they strike a planet, they cause severe space weather events, triggering geomagnetic storms on Earth, and can acutely alter ionospheric densities on weaker-magnetized bodies like Mars.
- **Impacts on Earth and Technology**
 - **Geomagnetic Storms:** CMEs can disrupt power grids and damage electrical systems.
 - **Communication & Navigation:** They disturb the ionosphere, affecting radio communication and GPS signals.
 - **Space Assets:** Satellites and astronauts face harmful radiation exposure.
 - **Auroras:** Charged particles interacting with Earth's atmosphere create Northern and Southern Lights.

Q. "With reference to the 'Zwan-Wolf effect', which is sometimes seen in the news, it is primarily associated with:"

- Black hole radiation
- Solar wind interaction with planetary magnetic boundaries
- Formation of asteroids
- Lunar eclipses

Answer: B

Explanation:

It describes the phenomenon where electrically charged particles in a planet's ionosphere are squeezed and compressed along magnetic structures, known as magnetic flux tubes, as a result of pressure gradients created by the solar wind

5.4. SURYAISTRA: INDIA'S FIRST PRIVATE-SECTOR PRECISION ROCKET SYSTEM

Context

- **Recently**, Pune-based private defence company Nibe Ltd. successfully conducted field firing trials of its indigenous **Suryastra rocket system** at Chandipur, Odisha.
- It marks the first time an Indian private defence firm has independently demonstrated a long-range indigenous rocket system with advanced tactical capabilities under the **Atmanirbhar Bharat** initiative.



1. Technical Capabilities of the Suryastra Rocket System

- **Classification:** It is India's first indigenous **universal multi-calibre rocket launcher system** designed for precision **surface-to-surface** tactical deep strikes.
- **Strike Ranges Tested:** The trials successfully validated dual long-range capabilities:
 - **Short/Medium Range Configuration:** Strike range of **150 km** with a Circular Error Probable (CEP) accuracy of just 1.5 meters.
 - **Extended Range Configuration:** Strike range of **300 km** (utilizing *Predator Hawk* rockets) with a CEP accuracy of 2 meters.
- **Operational Significance:** It effectively bridges the critical operational gap between traditional area-bombardment field artillery (like the Pinaka MLRS, which has a shorter baseline range) and heavy surface-to-surface ballistic missiles.

2. Policy and Industrial Alignment

- **Procurement Track:** The project was developed and fast-tracked under an **Indian Army Emergency Procurement order** to augment stand-off firepower along contested borders.
- **Strategic Manufacturing Pivot:** Historically, long-range heavy rocket artillery production in India was **exclusively restricted to the public sector** (DRDO and DPSUs). This trial signifies a major regulatory and technological shift, proving that the domestic private sector can handle high-tech missile and rocket integration.

Q. With reference to the indigenous Suryastra Rocket System, consider the following statements:

1. It is India's first indigenous universal multi-calibre rocket launcher system developed by a private defence company.
2. The system demonstrated strike capabilities up to 300 km during field trials.
3. The project was developed under the Atmanirbhar Bharat initiative and Indian Army emergency procurement framework.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Answer: (d) 1, 2 and 3

Explanation:

- **Statement 1 is correct:** Suryastra is India's first indigenous universal multi-calibre rocket launcher system demonstrated by a private defence company.
- **Statement 2 is correct:** The system successfully tested strike ranges of 150 km and 300 km.
- **Statement 3 is correct:** The project aligns with the Atmanirbhar Bharat initiative and was fast-tracked under Indian Army emergency procurement.

5.5. GAGANYAAN'S LIFE-SUPPORT SYSTEM

Context

- As part of India's maiden human spaceflight program, **Gaganyaan**, ISRO is deploying an **Environmental Control and Life Support System (ECLSS)**. This system is designed to replicate Earth's atmospheric conditions inside the crew module while orbiting at an altitude of **400 km** in Low Earth Orbit (LEO).

Core Components of ECLSS

- The ECLSS manages four critical domains to keep astronauts alive and comfortable in microgravity: **Air, Water, Temperature, and Waste**.
- For short-term missions like Gaganyaan, all supplies are carried from Earth and waste is stored for post-mission disposal (unlike long-duration missions on the ISS, which actively recycle waste into resources).



1. Air Revitalisation System (ARS)

The ARS performs three primary functions: providing fresh oxygen (O₂), removing carbon dioxide (CO₂), and filtering trace contaminants/odors.

- **CO₂ Removal Mechanism:** Uses **Lithium Hydroxide (LiOH) canisters** to chemically scrub CO₂ from the cabin air.
 - **Lithium Hydroxide (LiOH)** is a highly **alkaline inorganic compound** primarily utilized in the production of high-performance EV battery cathodes, heavy-duty industrial lubricating greases, and specialized carbon dioxide scrubbers for aerospace and maritime environments.
- **Medical Risk Mitigated:** Prevents **Hypercapnia** (elevated CO₂ levels in the blood), which causes headaches, dizziness, and impaired cognitive function.
- **Daily Human Metabolic Metrics (Standard Requirements):**
 - **Oxygen Consumption:** A healthy crew member needs **0.84 kg of O₂ per day**.
 - **CO₂ Exhalation:** A healthy adult exhales approximately **1 kg of CO₂ per day**

- **Air Circulation Challenge:** In microgravity, natural convection does not occur. The ECLSS uses **small fans** to force air circulation, preventing lethal pockets of stagnant CO₂ or hazardous oxygen pockets from accumulating around the crew.

2. Pressure, Temperature, and Humidity Control

To ensure crew safety and protect onboard electronics, the cabin environment is tightly regulated within strict baseline parameters:

Parameter	Controlled Target Baseline	Technical Mechanism / Challenge
Atmospheric Pressure	101.3 kPa (Mimics Earth's sea-level pressure)	Regulated via electronic sensors and safety valves that perfectly balance air and oxygen levels.
Temperature	20°C to 26°C	Heat is generated by astronaut metabolism (100–150 W per crew member) and onboard avionics. An active cooling system circulates air through heat exchangers , which expel excess heat into space.
Relative Humidity	30% to 70%	Managed by condensing units that collect water. <ul style="list-style-type: none"> • Too low: Dry skin, eye irritation, and high risk of static electricity discharge (damages electronics). • Too high: Microbial growth and condensation, risking short-circuits or corrosion.

3. Water and Fluid Management in Microgravity

- **The Fluid Behavior Challenge:** In microgravity, water does not "pour" or flow due to gravity; instead, it surface-tensions into **floating globules**. These globules pose a severe risk of causing short-circuits in electronics or choking hazards if accidentally inhaled by astronauts.
- **Gaganyaan's Solution:** Potable water is stored in **pecially designed pouches featuring pressurized bladders**. These bladders mechanically force the water directly into the astronaut's mouth without allowing gas-liquid mixing.

4. Waste Management

- **Storage Philosophy:** For the short-duration Gaganyaan mission, liquid and solid wastes are mechanically collected and stored securely inside the module for disposal after landing, rather than being recycled in-situ.

About Gaganyaan

The Gaganyaan mission is India's premier human spaceflight program. It aims to launch a crew of three astronauts into a Low Earth Orbit (LEO) at an altitude of 400 km for a 3-to-7 day mission, and safely return them to Earth, landing in Indian sea waters.

Prior to the crewed launch, the program mandates several precursor uncrewed missions to test systems, including a module carrying the humanoid robot *Vyommitra*.

Q. With reference to the Environmental Control and Life Support System (ECLSS) of the Gaganyaan mission, consider the following statements:

1. The Air Revitalisation System (ARS) uses Lithium Hydroxide canisters to remove carbon dioxide from the cabin air.
2. In microgravity, natural convection helps maintain proper air circulation inside the crew module.
3. The Gaganyaan mission plans to recycle waste into usable resources during the mission, similar to the International Space Station (ISS).

Which of the statements given above is/are correct?

- (a) 1 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1, 2 and 3

Answer:

(a) 1 only

Explanation:

- **Statement 1 is correct:** The ARS uses Lithium Hydroxide (LiOH) canisters to scrub CO₂ from cabin air.
- **Statement 2 is incorrect:** In microgravity, natural convection does not occur; fans are required for air circulation.
- **Statement 3 is incorrect:** For short-duration missions like Gaganyaan, waste will be stored and disposed of after landing, not recycled like on the ISS.

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HISTORY & CULTURE

6.1. THE ANAIMANGALAM COPPER PLATES

Context

- Recently, the Leiden University Library in the Netherlands formally **repatriated the 11th-century Chola-era Anaimangalam Copper Plates** (popularly known as the **Leiden Plates**) to the Government of India.
- These plates were removed from Nagapattinam without indigenous consent during Dutch colonial rule (VOC control) in the 18th century, eventually entering Leiden University's collection in 1862.



1. Epigraphical Features of the Leiden (Anaimangalam) Plates

- **Composition:** The artifact consists of **two distinct sets**:
 1. **The Larger Leiden Plates:** A massive set of **21 large copper sheets** bound together by a heavy bronze ring carrying the **royal Chola seal**.
 2. **The Smaller Leiden Plates:** A set of **3 smaller copper sheets** bound by a ring featuring the royal seal of a later king, **Kulottunga Chola I** (reigned 1070–1120 CE), recording subsequent land additions.
- **Bilingual Framework:**
 - **Sanskrit Section (5 Plates):** Written in the **Grantha script**. It traces the mythical, divine solar lineage (*Suryavamsha*) and historical genealogy of the Chola monarchs.
 - **Tamil Section (16 Plates):** Written in the local Tamil script, outlining the granular details of local administration, land boundaries, tax exemptions, and executive execution.
- **The Royal Insignia (Chola Seal):** The binding ring contains the standard royal herald of imperial supremacy over rival dynasties:
 - A central **Tiger** (the dynastic emblem of the Cholas).
 - Two **Fish** (representing the subjugation of the Pandyas).
 - A **Bow** (representing the subjugation of the Cheras).
 - Complemented by fly-whisks (*chamaras*), a royal parasol, and a swastika.

2. Religious Pluralism & Socio-Economic History

The core value of the Leiden plates lies in what they reveal about the socio-political fabric of early medieval India:

- **Socio-Religious Harmony:** Though the Chola emperors were devout Shaivite Hindus (worshippers of Lord Shiva), the plates document state patronization of heterodox faiths.
- **The Grant Details:** The plates formalize a **Pallichchandam** (a specific tax-exempt land revenue grant dedicated explicitly to non-Hindu institutions like Jain basadis or Buddhist monasteries).

- **The Beneficiary:** The land revenue of the entire village of **Anaimangalam** was granted to sustain the **Chudamani Vihara** (also known as the *Chulamanivarma Vihara*), a magnificent Buddhist monastery constructed in the international port town of **Nagapattinam**.
- **Trans-Maritime Geopolitics:** The vihara was built by **King Sri Mara Vijayottungavarman** of the **Srivijaya Kingdom** (spanning Sumatra, Java, and the Indonesian archipelago). This proves the deep diplomatic, trade, and cultural networks bridging South India and Southeast Asia.

3. Core Personalities Implicated in the Inscription

- Raja Raja Chola I
- Rajendra Chola I
- Kulottunga Chola I

A. Raja Raja Chola I (r. 985–1014 CE)

- **Cultural Contribution:** Built the architectural marvel **Brihadisvara Temple** (Peruvudaiyar Kovil) at **Thanjavur**, dedicated to Lord Shiva. It is a pinnacle of Dravidian architecture and a UNESCO World Heritage site.
- Initiated a massive land survey project to streamline agrarian revenue and local administration.

B. Rajendra Chola I (r. 1012–1044 CE)

- **Cultural & Military Legacy:** Known for his aggressive maritime expeditions, conquering Srivijaya (Southeast Asia) to safeguard Chola trade routes.
- Marched northward to the Ganga river, earned the title **Gangaikonda Chola**, and established a new capital city: **Gangaikondacholapuram**.
- Constructed the vast western artificial lake/reservoir called **Chola Gangam** to upgrade regional irrigation.

C. Kulottunga Chola I (1070–1122 CE)

- **Contribution:** Kulottunga was a prolific builder and patron of the arts, integrating new elements into Dravidian temple architecture.
- **Chidambaram Nataraja Temple:** Kulottunga I and his son famously expanded the sprawling complex of the Chidambaram Nataraja Temple, increasing its footprint multiple times and renovating its halls.
- Kulottunga I is immortalized in Tamil epigraphy and literature with the title "**Sungam Tavirtta Chola**" (or **Shungamataravita**), meaning "the Chola who abolished tolls/customs duties".

Q. With reference to the Anaimangalam Copper Plates (Leiden Plates), consider the following statements:

1. The plates record a tax-exempt land grant to a Buddhist monastery at Nagapattinam.
2. The Sanskrit section of the plates was written in the Brahmi script.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only

- (c) Both 1 and 2
(d) Neither 1 nor 2

Answer: A

Explanation:

Statement 1 is Correct: The Anaimangalam (Leiden) Plates record a **Pallichchandam** (tax-exempt land grant) given to the **Chudamani Vihara**, a Buddhist monastery located at **Nagapattinam**.

Statement 2 is Incorrect: The Sanskrit portion of the plates was written in the **Grantha script**, not the Brahmi script.

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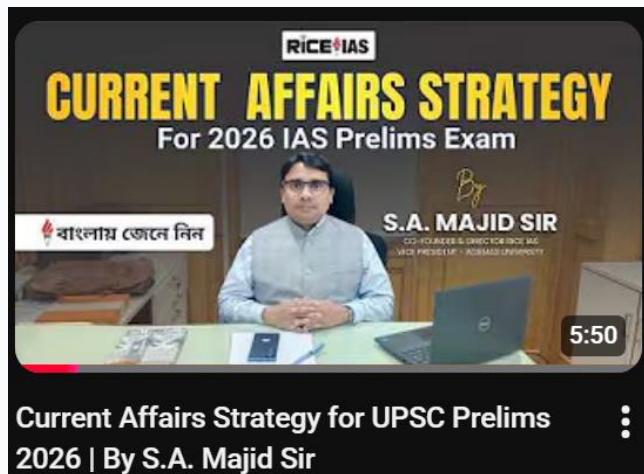
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