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for

IAS EXAMINATION

From

16th to 21st Feb 2026

INDEX

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POLITY & GOVERNANCE

1.1. RAJYA SABHA ELECTIONS

Context: Recently, the Election Commission of India (ECI) announced biennial elections for 37 Rajya Sabha seats across 10 states, including Maharashtra, Tamil Nadu, and West Bengal, with polling scheduled for March 16, 2026.

1. **Constitutional Framework**
   - **Article 80:** Deals with the composition of the Council of States (Rajya Sabha).
   - **Maximum Strength:** 250 members (238 representing States/UTs and 12 nominated by the President).
   - **Current Strength:** 245 members (233 elected, 12 nominated).
   - **Fourth Schedule:** Specifies the allocation of seats to each State and Union Territory based on population.
2. **The Election Process**
   - **Electorate:** The representatives of each State are elected by the **elected members of the State Legislative Assembly (MLAs)**. Nominated members of the Assembly do not participate.
   - **System of Election:** Proportional Representation by means of a **Single Transferable Vote (STV)**.
   - **The Quota System:** To win, a candidate needs a specific number of votes (Quota).

$$\text{Quota} = \left(\frac{\text{Total Valid Votes}}{\text{Number of Seats to be filled} + 1} \right) + 1$$

   - **Voting Method:** Each voter (MLA) marks preferences (1, 2, 3...) against the names of candidates. If a candidate reaches the quota with first-preference votes, they are elected. Surplus votes are then transferred to the next preferred candidate.
3. **Key Legal Provisions (RPA 1951 & Amendments)**
   - **Open Ballot System (2003):** To curb "cross-voting" and corruption, the secret ballot was replaced with an open ballot. An MLA belonging to a political party must show their marked ballot paper to the **authorized agent** of that party.
   - **Domicile Requirement:** The 2003 amendment removed the requirement that a candidate must be an elector in the same state from which they are contesting. A person can now contest from any state as long as they are a registered voter in any parliamentary constituency in India.
   - **Cross-Voting & Anti-Defection:** Interestingly, the Supreme Court (Kuldip Nayar case) held that voting against the party's direction in Rajya Sabha elections does not automatically attract disqualification under the **Tenth Schedule (Anti-Defection Law)**, though the party can take disciplinary action.

4. **Duration and Nature of the House**
   - **Permanent Body:** Unlike the Lok Sabha, the Rajya Sabha is not subject to dissolution.
   - **Staggered Terms:** Members are elected for a **six-year term**, with one-third of the members retiring every two years.

Q. With reference to the election of members to the Rajya Sabha, consider the following statements:

1. *The representatives of the States are elected by both elected and nominated members of the State Legislative Assemblies.*
2. *The election is held through a secret ballot to ensure the independence of the legislators.*
3. *A candidate contesting for a seat in a particular State must be a registered elector in that same State.*
4. *The system of Proportional Representation by means of a Single Transferable Vote is utilized.*

Which of the statements given above is/are correct?

A) 4 only

B) 2 and 4 only

C) 1, 2 and 3 only

D) 1 and 4 only

Ans. (a)

Explanation:

- ***Statement 1 incorrect:*** *Only **elected** members of the State Legislative Assembly (MLAs) participate; nominated members are excluded.*
- ***Statement 2 incorrect:*** *Rajya Sabha elections use an **Open Ballot** system (since 2003) to prevent cross-voting.*
- ***Statement 3 incorrect:*** *After the 2003 amendment to the RPA 1951, a candidate can be an elector in **any** parliamentary constituency in India, not necessarily the state they are contesting from.*
- ***Statement 4 correct:*** *The Constitution explicitly mandates Proportional Representation by means of the **Single Transferable Vote (STV)** for the Rajya Sabha.*

1.2. VIBRANT VILLAGE PROGRAMME (VVP)

Context: Recently, the **Ministry of Home Affairs (MHA)** announced the launch of the second phase of the **Vibrant Villages Programme (VVP-II)**. The programme is expanding its reach from the northern borders to include **1,954 strategic villages** along the international land borders with Pakistan, Nepal, Bangladesh, Bhutan, and Myanmar across 15 States and 2 Union Territories. This expansion, highlighted by Home Minister Amit Shah's visit to the Bangladesh border in Assam, aims to counter demographic

changes and provide a civilian "eyes and ears" deterrence against trans-border crimes and external security threats.

1. Overview and Evolution

The Vibrant Villages Programme was initially announced in the Union Budget 2022-23 to develop villages along India's northern border. It has since evolved into two distinct phases to cover the entirety of India's international land borders.

Feature	Vibrant Village Programme-I (VVP-I)	Vibrant Village Programme-II (VVP-II)
Launch/Approval	February 15, 2023	April 2, 2025
Scheme Type	**Centrally Sponsored Scheme**	**Central Sector Scheme** (100% Central Funding)
Time Period	FY 2022-23 to 2025-26	FY 2024-25 to 2028-29
Financial Outlay	₹4,800 Crore	₹6,839 Crore
Coverage	Northern Border (Arunachal, HP, Sikkim, Uttarakhand, Ladakh)	All other International Land Borders (17 States/UTs)

2. Objectives and Key Goals

- **Reversing Out-migration:** The primary goal is to provide enough livelihood opportunities and amenities so that border residents do not migrate to urban centers.
- **"Eyes and Ears" Strategy:** By encouraging a civilian presence, the government aims to turn local residents into the first line of intelligence and observation for border-guarding forces like the ITBP.
- **Saturation Model:** The programme seeks to achieve 100% saturation of all Central and State government schemes (e.g., Jal Jeevan Mission, PM-AWAS) in the identified villages.
- **Connectivity:** Ensuring all-weather road connectivity (via PMGSY-IV), 4G telecom connectivity, and 24x7 electricity including renewable energy.

3. Implementation Framework

- **Village Action Plans:** These are prepared by the **District Administration** in collaboration with **Gram Panchayats** to ensure a bottom-up approach to development.
- **Hub and Spoke Model:** Growth centers are developed as "hubs" to support nearby "spoke" villages through social entrepreneurship and skill development.
- **Governance:** A **High-Powered Committee** chaired by the **Cabinet Secretary** oversees the implementation and provides necessary relaxations in schematic guidelines for remote areas.
- **Convergence:** The programme explicitly avoids duplication with the **Border Area Development Programme (BADP)** by focusing on specific village-level interventions.

4. Key Focus Interventions

- **Economic Drivers:** Development of sustainable eco-agribusinesses based on the **"One Village-One Product"** concept.

- **Tourism:** Promoting "Frontier Tourism" and cultural heritage to create local jobs in the hospitality sector.
- **Digital Integration:** Utilizing the **PM Gati Shakti** platform for integrated planning and real-time monitoring of infrastructure projects.
- **Social Infra:** Establishment of Smart Classes in schools and Ayushman Arogya Mandirs (Health & Wellness Centers) for every 1,000–1,500 people.

Q. Consider the following statements regarding the Vibrant Villages Programme (VVP):

1. *While VVP-I is a Centrally Sponsored Scheme, VVP-II has been designed as a Central Sector Scheme with 100% funding from the Union Government.*
2. *The programme aims to develop the border villages as "last villages" of the country to emphasize their remote and strategic nature.*
3. *The District Administration, with the help of Gram Panchayats, is responsible for creating the Vibrant Village Action Plans.*

How many of the statements given above are correct?

A) Only one

B) Only two

C) All three

D) None

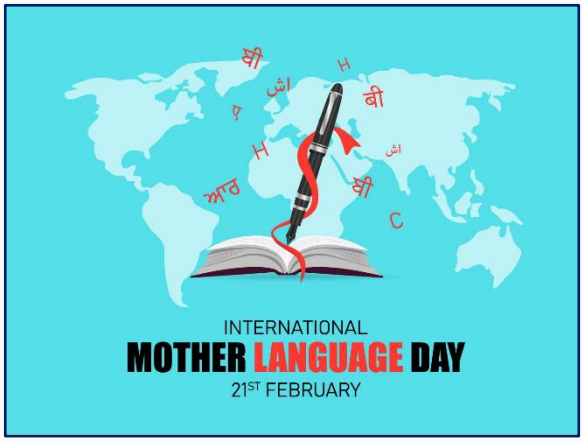
Ans. (b)

Explanation:

- ***Statement 1 is correct:*** *VVP-I (northern borders) is a Centrally Sponsored Scheme (cost-sharing), whereas VVP-II (other borders) was approved in 2025 as a 100% Central Sector Scheme.*
- ***Statement 2 is incorrect:*** *The government has explicitly stated a shift in perception, viewing these villages not as the "last villages" but as the **"first villages"** of India to integrate them into the national mainstream.*
- ***Statement 3 is correct:*** *The bottom-up planning process involves the District Administration and Gram Panchayats formulating specific Village Action Plans.*

1.3. INTERNATIONAL MOTHER LANGUAGE DAY

Context: Recently, on February 21, 2026, the global community observed International Mother Language Day, marking the **Silver Jubilee (25th anniversary)** of its first worldwide celebration in 2000. The day was commemorated in India with high-level events emphasizing the integration of technology and mother tongues under the 2026 theme, **"Youth voices on multilingual education."** This year's observance is particularly significant as it coincides with the midpoint of the **International Decade of Indigenous**



Languages (2022–2032), prompting renewed calls for the preservation of India's 197 endangered languages.

1. **Historical Evolution**
    - **The Origin:** The initiative to observe this day was a proposal by **Bangladesh** to honor the martyrs of the 1952 Language Movement (Bhasha Andolan).
    - **The 1952 Incident:** On February 21, 1952, students in Dhaka were killed by police fire while protesting for the recognition of **Bengali** as a national language of Pakistan.
    - **Recognition:** UNESCO approved the proclamation in **1999**, and the first official celebration was held in **2000**. The UN General Assembly formally recognized the day in its 2002 resolution.
2. **Theme 2026: Youth & Technology**
    - **Theme:** "Youth voices on multilingual education."
    - **Significance:** It highlights the role of young people in using digital tools and AI to revitalize underrepresented languages and ensure inclusive education.
3. **Constitutional Safeguards in India**

    India provides extensive protection for linguistic diversity:
    - **Article 29:** Protects the right of any section of citizens to conserve their distinct language, script, or culture.
    - **Article 30:** Grants linguistic and religious minorities the right to establish and administer educational institutions.
    - **Article 350A:** Mandates that states and local authorities provide instruction in the **mother tongue at the primary stage** of education for linguistic minority children.
    - **Article 350B:** Directs the appointment of a **Special Officer for Linguistic Minorities** by the President of India.
    - **Eighth Schedule:** Lists **22 recognized languages**. Currently, English is NOT included in this schedule.
4. **UNESCO's Categories of Language Endangerment**

    UNESCO classifies languages based on their "intergenerational transmission":
    - **Vulnerable:** Children speak the language, but it may be restricted to specific areas (e.g., home).
    - **Definitely Endangered:** Children no longer learn the language as their mother tongue in the home.
    - **Severely Endangered:** Spoken by grandparents; the parent generation may understand it but does not speak it to children.
    - **Critically Endangered:** The youngest speakers are grandparents and older, and they speak it only partially and infrequently.
5. **Government of India Initiatives**
    - **NEP 2020:** Encourages the medium of instruction to be in the mother tongue/regional language at least until Grade 5.
    - **Bhashini Initiative:** An AI-led language translation platform to break language barriers in digital services.

- **SPPEL:** The "Scheme for Protection and Preservation of Endangered Languages" documents languages spoken by fewer than 10,000 people.

Q. With reference to International Mother Language Day and linguistic safeguards in India, consider the following statements:

1. *The 2026 theme for International Mother Language Day focuses on the role of youth in multilingual education.*
2. *Article 350A of the Indian Constitution was part of the original document enacted in 1950.*
3. *According to UNESCO, a language is 'Definitely Endangered' if the parent generation understands it but does not speak it to their children.*

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

Correct Answer: (A)

- ***STATEMENT 1 CORRECT:*** *The 2026 theme is* ***"Youth voices on multilingual education,"*** *emphasizing youth as active agents in language revitalization.*
- ***STATEMENT 2 INCORRECT:*** *Article 350A was not in the original Constitution; it was added by the* ***7th Constitutional Amendment Act of 1956*** *following the States Reorganisation Commission's report.*
- ***STATEMENT 3 INCORRECT:*** *UNESCO classifies a language as* ***'Definitely Endangered'*** *when children no longer learn it as a mother tongue in the home. The description provided (parents understand but don't speak to children) refers to* ***'Severely Endangered'****.*

1.4. SANKALP SCHEME

Context: Recently, the Public Accounts Committee (PAC) of Parliament pulled up the government for the slow pace of implementation of the **SANKALP scheme**. While the government emphasized its commitment to the "Sankalp" (sacred duty) of empowering the underprivileged during the Budget 2026–27 session, the PAC flagged significant gaps in utilizing the World Bank-assisted funds and achieving targets for decentralizing the skilling ecosystem at the district level.

1. **Overview of SANKALP**
   - **Full Form:** Skill Acquisition and Knowledge Awareness for Livelihood Promotion.
   - **Nodal Ministry:** Ministry of Skill Development and Entrepreneurship (**MSDE**).
   - **Type of Scheme:** It is a **Centrally Sponsored Scheme**.
   - **Launch Date:** January 19, 2018 (with implementation periods recently extended to meet outcome-based targets).
   - **Objective:** To strengthen institutional mechanisms at the National, State, and District levels and to increase access to quality, market-relevant training for the workforce.
2. **Funding and Implementation**
   - **World Bank Assistance:** The scheme is supported by a loan from the **World Bank** (International Bank for Reconstruction and Development).
   - **Instrument:** It uses the **"Program for Results" (PforR)** instrument, meaning funds are disbursed by the World Bank only upon the achievement of pre-agreed **Disbursement Linked Indicators (DLIs)**.
   - **Verification:** The **Indian Institute of Management (IIM) Indore** acts as the Independent Verification Agency (IVA) to verify the achievements before fund release.
3. **Key Result Areas (KRAs)**

   The scheme focuses on four core result areas to transform the skilling landscape:

   1. **Institutional Strengthening:** Building the capacity of State Skill Development Missions (SSDMs) and District Skill Committees (DSCs).
   2. **Quality Assurance:** Improving the quality of skill development programs through better trainers, standardized assessments, and certification.
   3. **Inclusion:** Ensuring access to skilling for marginalized populations, including women, Scheduled Castes (SC), Scheduled Tribes (ST), and Persons with Disabilities (PwD).
   4. **Expanding Skills through PPPs:** Engaging the private sector through Public-Private Partnerships to make skilling demand-driven.
4. **SANKALP vs. STRIVE**
   - **SANKALP:** Focuses on the **institutional and governance** aspect of skilling (short-term training, district planning, and policy convergence).
   - **STRIVE:** (Skills Strengthening for Industrial Value Enhancement) Focuses on improving the **relevance and efficiency of ITIs** (Industrial Training Institutes) and apprenticeship programs.
5. **Key Initiatives under SANKALP**
   - **Mahatma Gandhi National Fellowship (MGNF):** A two-year academic program that combines classroom sessions at IIMs with intensive field immersion at the district level to help District Skill Committees (DSCs) in preparing District Skill Development Plans (DSDPs).
   - **Skill India Portal:** A digital platform to aggregate and converge skill-related data across various central and state ministries.
   - **Awards for Excellence in District Skill Development Planning:** An initiative to incentivize districts to prepare high-quality, data-driven skilling plans.

Q. With reference to the SANKALP scheme, consider the following statements:

1. *It is a Central Sector Scheme implemented under the Ministry of Education.*
2. *It is supported by loan assistance from the World Bank using a "Program for Results" instrument.*
3. *One of its primary objectives is the decentralization of skill planning through District Skill Committees (DSCs).*

Which of the statements given above is/are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 3 only

(d) 1, 2, and 3

Ans. (b)

Explanation:

- ***Statement 1 incorrect:*** *SANKALP is a* ***Centrally Sponsored Scheme*** *(not Central Sector) and it is implemented by the* ***Ministry of Skill Development and Entrepreneurship (MSDE)****, not the Ministry of Education.*
- ***Statement 2 correct:*** *SANKALP is indeed a World Bank-assisted project that uses the* ***"Program for Results" (PforR)*** *model, where funding is linked to the achievement of specific results (DLIs).*
- ***Statement 3 correct:*** *A core feature of SANKALP is* ***institutional strengthening at the district level****, empowering District Skill Committees (DSCs) to create localized District Skill Development Plans (DSDPs).*

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2.1. WEST BANK

Context: Recently, the West Bank has dominated global headlines as 85 countries issued a joint statement at the United Nations strongly condemning Israel's latest plan to begin a massive land registration process in the territory.

1. **Geographical Overview**
   - **Location:** The West Bank is a landlocked territory in West Asia, located on the western bank of the **Jordan River**.
   - **Borders:** It is bordered by **Jordan** and the **Dead Sea** to the east, and by **Israel** to the north, west, and south along the "Green Line" (1949 Armistice Line).
   - **Terrain:** The region is characterized by a north-south orientation of limestone hills, namely the **Samarian Hills** in the north and the **Judean Hills** in the south.
   - **Key Water Bodies:** The Jordan River serves as the primary freshwater source and the natural eastern boundary, while the Dead Sea is the lowest point on Earth.
2. **The Oslo Accords and Administrative Divisions**
   - **Oslo II Accord (1995):** This interim agreement divided the West Bank into three distinct administrative zones to facilitate a gradual transition to Palestinian self-rule.
   - **Area A (18%):** Full civil and security control lies with the **Palestinian Authority (PA)**; it includes major cities like Ramallah and Nablus.
   - **Area B (22%):** The PA handles civil administration (health, education), while security is jointly controlled by Israel and the PA.
   - **Area C (60%):** Israel retains full civil and security control; this area contains the vast majority of Israeli settlements and is the current focus of land registration disputes.
3. **Strategic Cities and Locations**
   - **Ramallah:** Serves as the de facto administrative capital of the Palestinian Authority.
   - **Hebron (Al-Khalil):** A major flashpoint city containing the **Cave of the Patriarchs**, a site holy to both Jews and Muslims.
   - **Jericho:** Located in the Jordan Valley, it is one of the oldest continuously inhabited cities in the world and lies below sea level.
   - **Jenin:** Home to a significant refugee camp and a frequent center for security operations.
4. **International Legal Framework**
   - **Status:** The United Nations and the International Court of Justice (ICJ) categorize the West Bank as **occupied territory** rather than a part of Israel.

- **Resolutions: UNSC Resolution 242** (1967) and **Resolution 338** (1973) form the legal basis for the "Land for Peace" principle, calling for Israeli withdrawal from territories occupied in the Six-Day War.

Q. With reference to the geography and administration of the West Bank, consider the following statements:

1. *The West Bank shares a maritime border with the Mediterranean Sea to its west.*
2. *Under the Oslo Accords, Area C is the largest administrative division and remains under full Israeli civil and security control.*
3. *The city of Jericho is located in the Jordan Valley and is situated below sea level.*

How many of the above statements are correct?

A) Only one

B) Only two

C) All three

D) None

Ans. (b)

Explanation:

- ***STATEMENT 1 IS INCORRECT:*** *The West Bank is a* ***landlocked*** *territory; while it is near the Mediterranean coast, it is separated from the sea by the sovereign territory of Israel.*
- ***STATEMENT 2 IS CORRECT:*** *Area C covers approximately 60% of the West Bank and is the only zone where Israel maintains exclusive control over both security and civil matters (planning/construction).*
- ***STATEMENT 3 IS CORRECT:*** *Jericho is situated in an oasis in the Jordan Valley and is globally recognized as one of the lowest-lying cities on Earth.*

2.2. INDIA AI IMPACT SUMMIT 2026

Context: The fourth AI Impact Summit 2026 commenced at the **Bharat Mandapam in New Delhi**, marking a significant step in India's leadership within the digital domain. Unlike developed nations that often focus primarily on regulatory frameworks, India is championing a "human-centric" approach that prioritizes "economic good" for all.

This summit serves as a platform for India to advocate for equitable access to AI resources and fair rule-making, particularly for developing economies in the Global South.

1. **Core Pillars and Thematic Structure**
   - **The Three "Chakras"**: The summit is structured across three thematic pillars—**People, Planet, and Progress**.
   - **Scale of Participation**: The event features over **3,000 speakers** across **500 sessions**, with participation from approximately **100 countries**.
   - **India AI Expo**: Prime Minister Narendra Modi inaugurated the "India AI Expo 2026," showcasing AI technology demonstrations from start-ups and pavilions from 13 countries.
2. **Strategic Diplomacy and Global Leadership**
   - **Bilateral Engagements**: The summit facilitates high-level diplomacy, including bilateral talks between Prime Minister Modi and French President **Emmanuel Macron**, as well as engagements with Brazilian President **Luiz Inácio Lula da Silva**.
   - **Tech Industry Collaboration**: Global tech leaders, including **Sundar Pichai (Google)**, **Sam Altman (OpenAI)**, and **Bill Gates**, are expected to participate, highlighting the intersection of private tech innovation and public policy.
   - **UN Involvement**: UN Secretary-General **António Guterres** is among the attendees, emphasizing the summit's importance in the global governance of Artificial Intelligence.
3. **Key Focus Areas for Prelims**
   - **Venue**: Bharat Mandapam, New Delhi (the same venue as the 2023 G-20 Summit).
   - **Event Frequency**: This is the **fourth AI Summit**, following previous iterations held in the U.K., South Korea, and **France.**
   - **Inclusive Innovation**: A notable feature is the scheduled **"all-woman" hackathon** aimed at fostering diversity in the AI development space.
   - **The AI for ALL Global Impact Challenge**: It received over 1,350 applications from more than 60 countries, focusing on scalable AI solutions across healthcare, agriculture, climate resilience, governance, education, and financial inclusion.
   - **The AI by HER**: It is Global Impact Challenge, which received over 800 applications from more than 50 countries, is dedicated to advancing women-led innovation in artificial intelligence.
   - **The YUVAi Global Youth Challenge:** which received over 2,500 applications from 38 countries, showcases the innovation and problem-solving capabilities of young AI leaders aged 13 to 21.

Q. With reference to the 'AI Impact Summit 2026' held in New Delhi, consider the following statements:

I. It is the fourth iteration of the global AI summit, following previous events held in the United Kingdom, South Korea, and France.

II. The summit is structured around three thematic pillars, referred to as "Chakras": People, Planet, and Progress.

III. Unlike developed nations' regulatory-first approach, India's stance at the summit emphasizes a "human-centric" model focused on "economic good" for all.

Which of the statements given above are correct?

(a) I and II only

(b) II and III only

(c) I and III only

(d) I, II and III

Ans. (d)

Explanation:

Statement I is Correct: *The **AI Impact Summit 2026** in New Delhi is indeed the fourth major milestone in the global AI safety and action sequence. It follows the **Bletchley Park Summit** (UK, 2023), the **Seoul Summit** (South Korea, 2024), and the **AI Action Summit** (France, 2025).*

Statement II is Correct: *The summit is uniquely organized around three thematic pillars known as **"Chakras"**:*

- ***People:*** *Focusing on inclusive skills and human rights.*
- ***Planet:*** *Emphasizing sustainable, energy-efficient AI.*
- ***Progress:*** *Using AI as an engine for global economic growth.*

Statement III is Correct: *A major diplomatic highlight of this summit is India's push for a **"Human-Centric"** approach. While Western summits have prioritized "existential risks" and "strict regulation," India (as a leader of the **Global South**) emphasizes using AI to solve real-world problems in agriculture, healthcare, and education to ensure "economic good" for developing nations.*

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ECONOMY

3.1. TOBACCO TAXATION REFORM 2026: STRATEGIC TRANSITION

Context: The Union Finance Ministry has notified a comprehensive restructuring of the tobacco taxation regime effective **February 1, 2026**, following the passage of the **Central Excise (Amendment) Act, 2025**. This marks a shift from general revenue compensation to a dedicated health-cum-security fiscal framework.

1. **Structural Changes in Levies**

I. Phase-out of GST Compensation Cess

- The GST compensation cess on tobacco products has officially ended, as the original objective of bridging state revenue gaps has been fulfilled.
- This temporary instrument is replaced by a permanent levy under the **Health Security-cum-National Security Act, 2025**.
- The new cess creates a non-lapsable revenue stream specifically for long-term security preparedness and health capacity building.

II. Revised GST Slabs and Divergent Rates

- **Standard Tobacco Products:** Cigarettes and chewing tobacco have been moved to the **40% GST slab** to reduce affordability.
- **Beedi Taxation:** Beedis are categorized in a significantly lower **18% GST slab**.
- **Demerit Goods:** All tobacco products remain classified as "demerit goods," justifying higher tax brackets compared to essential items.

III. Retail Sale Price (RSP) Valuation Mechanism

- For smokeless tobacco (gutkha, khaini, jarda), GST is now calculated based on the **Retail Sale Price (RSP)** declared on the packaging.
- This mechanism aims to curb under-reporting and tax evasion prevalent in the unorganized tobacco sector.

2. **Socio-Economic and Health Facts**

I. Consumption Patterns and Demographics

- **Rural Prevalence:** Beedi smoking is twice as prevalent in rural areas (8.3%) compared to urban centers (4.5%) among men.
- **Wealth Correlation:** Beedi use is inversely proportional to wealth; consumption is highest among the poorest 20% of the population.
- **Intensity of Use:** Over **80% of beedi smokers** consume more than five sticks daily, surpassing the frequency observed among cigarette users.

II. Comparative Health Risks

- **Respiratory Impact:** Beedi smokers are **2.87 times** more likely to suffer from asthma, compared to 1.82 times for cigarette smokers.

- **Mortality Risks:** Beedi consumption is associated with a **2.6 times** higher risk of tuberculosis mortality.
- **Cancer Profile:** Beedi smoking is linked to elevated risks for lung and laryngeal cancers, often exceeding the risks associated with cigarettes.

Q. With respect to the tobacco taxation changes effective from February 2026, consider the following statements:

I. The GST compensation cess has been replaced by a purpose-specific levy under the Health Security-cum-National Security Act, 2025.

II. All tobacco products, including beedis, are now strictly taxed at a uniform GST slab of 40%.

III. Retail Sale Price (RSP) based valuation has been introduced for smokeless tobacco to address tax evasion.

IV. Beedi smokers in India exhibit a higher daily frequency of consumption compared to cigarette smokers.

Which of the statements given above are correct?

(a) I, II, and III only

(b) II, III, and IV only

(c) I, III, and IV only

(d) I, II, III, and IV

Ans. (c)

Explanation:

- ***Statement I is correct:*** *The compensation cess was phased out in favor of the new health and security levy.*
- ***Statement II is incorrect:*** *There is a divergence in rates; beedis are taxed at 18% while other products are at 40%.*
- ***Statement III is correct:*** *RSP-based valuation is the new mechanism for smokeless tobacco products.*
- ***Statement IV is correct:*** *Data indicates over 80% of beedi smokers use more than five sticks daily, a higher proportion than cigarette smokers.*

3.2. EXPORT PROMOTION MISSION

Context: Recently, the Ministry of Commerce and Industry launched seven additional interventions under the **Export Promotion Mission (EPM)**, a comprehensive ₹25,060-crore initiative aimed at strengthening India's export ecosystem until 2030-31.

1. Export Promotion Mission (EPM)

Announced in the Union Budget 2025-26, the EPM serves as an umbrella framework to consolidate various fragmented schemes into a single, result-oriented mechanism.

- **Structure:** It operates through two categories:
  - **Niryat Protsahan (Financial):** Focuses on interest subvention, credit guarantees, and export factoring to lower the cost of credit.
  - **Niryat Disha (Non-Financial):** Focuses on market readiness, international branding, quality compliance, and logistics support.
- **Key Interventions:** Includes the **Direct E-commerce Credit Facility** (up to ₹50 lakh with 90% guarantee) and support for **Overseas Warehousing** (up to 30% of project cost).

2. RoDTEP Scheme (Remission of Duties and Taxes on Exported Products)

The RoDTEP scheme replaced the Merchandise Exports from India Scheme (MEIS) to ensure Indian exports are **WTO-compliant**.

- **Objective:** To refund "embedded" central, state, and local duties (like Mandi tax, coal cess, and electricity duty) that are not rebated under GST.
- **Mechanism:** Rebates are issued as **transferable e-scrips** maintained in an electronic ledger by the CBIC.
- **Extension:** The scheme is currently valid for all sectors, including SEZ and EOU units, until **March 31, 2026**.

3. EPCG Scheme (Export Promotion Capital Goods)

- **Feature:** Allows the import of **capital goods** (machinery) at **zero customs duty**.
- **Obligation:** The exporter must fulfill an **Export Obligation (EO)** equivalent to **6 times the duty saved**, within a period of 6 years.
- **Target:** Primarily aimed at technological upgradation and modernization of the manufacturing and service sectors.

4. Advance Authorization Scheme (AAS)

- **Feature:** Allows **duty-free import of inputs** (raw materials) that are physically incorporated into an export product.
- **Requirement:** It requires a minimum **15% value addition**.
- **Condition:** Inputs are subject to "Actual User" condition and are not transferable even after the export obligation is met.

Q. With reference to the Remission of Duties and Taxes on Exported Products (RoDTEP) scheme, consider the following statements:

1. *It was introduced to replace the Merchandise Exports from India Scheme (MEIS) to comply with World Trade Organization (WTO) norms.*
2. *The rebates under this scheme are provided in the form of non-transferable physical certificates.*
3. *The scheme covers taxes and levies at the central, state, and local levels that are not refunded under any other mechanism.*

Which of the statements given above is/are correct?

A) 1 and 2 only

B) 1 and 3 only

C) 2 and 3 only

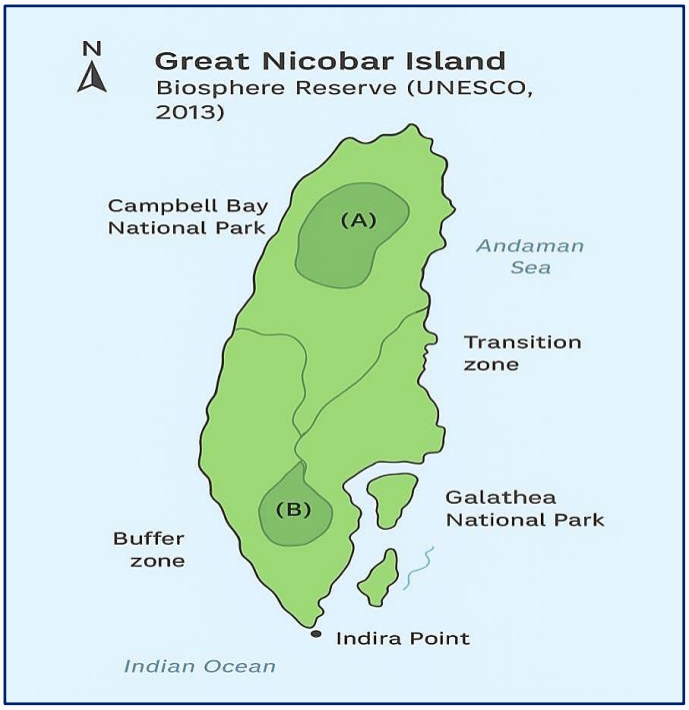
D) 1, 2, and 3

Ans. (b)

Explanation:

- ***Statement 1 is correct:*** *The RoDTEP scheme was launched in January 2021 to replace the MEIS after India lost a challenge at the WTO, as MEIS was deemed an illegal export subsidy.*
- ***Statement 2 is incorrect:*** *Rebates are issued as* ***transferable electronic scrips (e-scrips)****, not non-transferable physical certificates. They can be used to pay basic customs duties or sold to other importers.*
- ***Statement 3 is correct:*** *RoDTEP specifically targets "embedded" taxes like Mandi tax, duty on fuel used in transportation, and electricity duty which are outside the ambit of GST.*

3.3. NGT CLEARS ₹92,000-CR. GREAT NICOBAR PROJECT



Context: The **National Green Tribunal (NGT)** recently cleared the path for the ₹92,000-crore mega-infrastructure project on Great Nicobar Island. The tribunal dismissed petitions challenging the project's **Environmental Clearance (EC)**, noting the project's "strategic importance" and the adequacy of existing environmental safeguards.

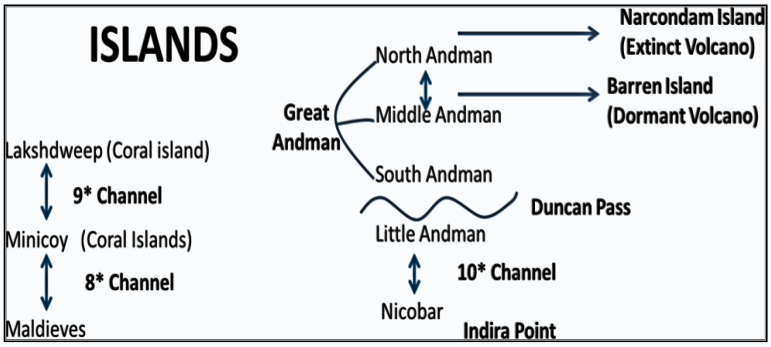
1. **Components of the Project**
   - The integrated project is designed to transform the island into a major hub through the following developments: **International Transshipment Port**, **International Airport**, **Power Plant, Greenfield Township**.
   - **Promoting Body:** NITI Aayog
   - **Implementing Agency:** Andaman and Nicobar Islands Integrated Development Corporation Limited (ANIIDCO)
     - ANIIDCO was incorporated on 28th June 1988 under the Companies Act 1956 for rapid economic growth of the Islands.
   - **Operates under:** Ministry of Home Affairs
2. **Environmental Safeguards and Directions**

   The NGT and the Ministry of Environment have laid down specific conditions to mitigate ecological damage:
   - **Coral Reef Protection**: The Ministry is directed to protect existing coral reefs and undertake **coral regeneration** through proven scientific methods.

- **Shoreline Management**: The Environment Ministry is responsible for ensuring that constructions do not lead to **shoreline erosion** or changes in the coast.
- **Species Protection**: Specific focus is placed on protecting the nesting sites of **Leatherback turtles** and avoiding the loss of turtle nesting beaches.
- **Implementation Plan**: The Ministry must prepare and approve a formal "implementation plan" for these conservation efforts

3. About Andaman and Nicobar Islands (ANI)

- ANI is a UT with 572 islands (Bay of Bengal), of which 38 are inhabited.
- **Comprises two groups:** Andaman Islands and Nicobar Islands, divided by the 10° Channel.
- **Duncan Passage** separates Little Andaman from South Andaman.



- **Closer to equator**: Located between 6° to 14°
- Separated from Thailand and Myanmar by the **Andaman Sea**.
- Island chain is a submerged extension of the **Arakan Mountains.**
- **Dugong** (sea mammal) is the official animal, endemic to the Indo-Pacific coast, especially Andaman.
- In 2018, three islands were renamed to honour **Subhas Chandra Bose**:
  - Ross → Netaji Subhash Chandra Bose Island
  - Neil → Shaheed Island
  - Havelock → Swaraj Island
- In September 2024, the capital of the ANI (Port Blair) was renamed **Sri Vijaya Puram.**

4. PVTGs in Andaman & Nicobar Islands (ANI)

- ANI has **five PVTGs**: Great Andamanese, Jarawa, Onge, Sentinelese, and Shompen.
- They are geographically isolated, depend on hunter-gathering or simple horticulture, have very small populations, and are **highly vulnerable.**
- **Recently,** members of the **Shompen tribe voted for the first time** in the ANI Lok Sabha constituency.

5. Hotspot Status and biodiversity:

- Nicobar fall under the Sundaland Biodiversity Hotspot.
- **Great Nicobar Biosphere Reserve:** It covers 885 km² across **Campbell Bay and Galathea National Parks (core zone).**

Q. Consider the following statements with reference to the Great Nicobar Island (GNI) Project:

1. *The Great Nicobar Project, initiated by Ministry of Ports, Shipping and Waterways, aims to leverage the island's strategic location near the Malacca Strait.*
2. *The core components of the GNI Project include; an International Container Transshipment Terminal (ICTT), a dual-use military civilian airbase, and a mega solar–gas hybrid power plant.*
3. *Galathea Bay, included in the project region, is a nesting site of the Leatherback turtle.*

Which of the above statements is/are correct?

a) 1 only

b) 1 and 2 only

c) 2 and 3 only

d) 3 only

Ans. (c)

Explanation:

- *The Great Nicobar Island (GNI) Development project, officially named the **"Holistic Development of Great Nicobar Island,"** is a massive infrastructure plan spearheaded by NITI Aayog and executed by the Andaman and Nicobar Islands Integrated Development Corporation (ANIIDCO). **So, statement 1 is not correct.***
- *The Great Nicobar Island Development Project includes an International Container Transshipment Terminal (ICTT), a greenfield international airport, two greenfield cities, a coastal mass rapid transit system, and a free trade zone. **So, statement 2 is correct***
- *Key concerns: Great Nicobar, over 85% rainforest-covered, is a biodiversity hotspot; Galathea Bay, a Ramsar wetland, is a key nesting site for endangered Leatherback turtles. **So, Statement 3 is correct.***

***

4.1. LOGGERHEAD SEA TURTLES

Context: Recently, a 17-year study published in the journal *Animals* (2026) has highlighted that **Loggerhead sea turtles (*Caretta caretta*)** are shrinking in size and producing fewer eggs due to the dual pressures of **warming oceans** and declining marine productivity.

1. **Physical Characteristics**
   - **Appearance:** They are named for their **massive heads** and exceptionally strong jaws, which allow them to crush hard-shelled prey.
   - **Size:** They are the **world's largest hard-shelled turtles**. In terms of overall size, they are second only to the leatherback turtle (which has a soft shell).
2. **Habitat and Distribution**
   - **Global Range:** They have a **cosmopolitan distribution**, inhabiting the temperate and subtropical waters of the Atlantic, Pacific, and Indian Oceans, as well as the Mediterranean Sea.
   - **Indian Context:** While five species of sea turtles are found in Indian waters (Olive Ridley, Green, Hawksbill, Leatherback, and Loggerhead), the **Loggerhead is not known to nest on Indian beaches**. It is occasionally spotted in the Gulf of Mannar and offshore waters during migration.
3. **Unique Behavioral Traits**
   - **Diet:** They are **omnivorous but primarily carnivorous**, feeding on bottom-dwelling invertebrates like crabs, clams, mussels, and jellyfish.
   - **Magnetoreception:** These turtles use the **Earth's geomagnetic field** as both a map and a compass to navigate thousands of kilometers during trans-oceanic migrations.
   - **Temperature-Dependent Sex Determination (TSD):** Like many reptiles, the sex of the hatchlings is determined by the temperature of the sand. **Warmer temperatures** produce females, while cooler temperatures produce males.
4. **Conservation Status and Protection**
   - **IUCN Red List: Vulnerable**.
   - **CITES: Appendix I** (prohibits international trade).
   - **Wildlife Protection Act (WPA), 1972: Schedule I** (highest level of legal protection in India).
5. **Threats**
   - **Climate Change:** Rising temperatures lead to a "feminization" of the population (excessive female hatchlings) and reduced body size.
   - **Bycatch:** Accidental entanglement in fishing gear (trawls and longlines) is a leading cause of mortality.
   - **Pollution:** Ingestion of marine debris, particularly plastics which are mistaken for jellyfish.

- **Light Pollution:** Artificial lights on beaches disorient hatchlings, preventing them from finding the ocean.

6. Major turtle spice in India

Species Name	IUCN Status	Key Characteristics	Presence in India
Olive Ridley (*Lepidochelys olivacea*)	**Vulnerable**	Smallest and most abundant; famous for **Arribada** (mass nesting).	**Major nesting:** Odisha (Gahirmatha, Rushikulya, Devi River).
Green Turtle (*Chelonia mydas*)	**Endangered**	Only **strictly herbivorous** species as adults; named for the color of its fat.	**Major nesting:** Gujarat, Lakshadweep, and Andaman & Nicobar.
Hawksbill (*Eretmochelys imbricata*)	**Critically Endangered**	Distinctive hawk-like beak; hunted for its beautiful shell (tortoiseshell).	Found in coral reefs of **Andaman, Nicobar, and Lakshadweep**.
Leatherback (*Dermochelys coriacea*)	**Vulnerable**	**Largest** of all sea turtles; has a rubbery shell instead of a hard one.	Nesting restricted to **Andaman and Nicobar Islands**.

Q. With reference to the Loggerhead Sea Turtle (Caretta caretta), consider the following statements:

1. *It is the only hard-shelled sea turtle species that is strictly herbivorous in its adult stage.*
2. *The sex of its hatchlings is determined by the incubation temperature of the nest rather than genetics.*
3. *While it is found in Indian waters, it does not have any recorded nesting sites on the Indian mainland.*

How many of the statements given above are correct?

(a) Only one

(b) Only two

(c) All three

(d) None

Ans. (b)

Explanation:

- ***Statement 1 incorrect:*** *Loggerhead turtles are omnivorous and primarily carnivorous. They have powerful jaws designed to crush hard-shelled prey like crustaceans and mollusks.*
- ***Statement 2 correct:*** *Loggerheads exhibit temperature-dependent sex determination (TSD), where warmer sands result in more female hatchlings.*
- ***Statement 3 correct:*** *Although the Loggerhead is one of the five species found in the Indian Ocean and near the Indian coast, it is the only one among them that does not nest on Indian shores (nesting is mostly in Oman and Australia in this region).*

4.2. NILGIRI TAHR

Context: Recently, on February 20, 2026, the **Tamil Nadu Forest Department**, in collaboration with the Kerala Forest Department, released the findings of the **First Synchronised Nilgiri Tahr Survey 2026**, which revealed a 21% increase in the species' population over the last two years.

1. **Biological & Behavioral Profile**
   - **Endemicity:** It is the only mountain ungulate endemic to the **Western Ghats** of India (found only in Tamil Nadu and Kerala).
   - **Saddlebacks:** Adult males develop a light grey or white patch on their backs as they mature, leading to the nickname "Saddlebacks."
   - **Physical Traits:** They are diurnal (active during the day), stocky goats with curved horns and specialized hooves with a rubbery core for gripping steep, slippery cliffs.
   - **State Symbol:** It is the **State Animal of Tamil Nadu**.
2. **Habitat & Ecosystem**
   - **Shola-Grassland Mosaic:** They reside in high-altitude **montane grasslands** (1,200m to 2,600m) interspersed with stunted evergreen forests known as **Sholas**.
   - **Preferred Terrain:** They are highly adapted to steep cliffs and rocky outcrops, which serve as crucial escape routes from predators like tigers, leopards, and dholes.
   - **Key Populations:**
   - **Eravikulam National Park (Kerala):** Holds the largest and densest single population globally.
   - **Mukurthi National Park (Tamil Nadu):** Established specifically for the conservation of the Nilgiri Tahr.
   - **Anamalai Tiger Reserve (Grass Hills):** Another significant stronghold.
3. **Conservation Status & Threats**
   - **IUCN Red List: Endangered**.
   - **Wildlife (Protection) Act, 1972: Schedule I** (Highest level of legal protection in India).
   - **Primary Threats:**
   - **Habitat Fragmentation:** Caused by invasive species (Wattle, Eucalyptus), hydroelectric projects, and monoculture plantations.
   - **Climate Change:** Scientists predict a loss of nearly 60% of their suitable habitat by the 2030s due to rising temperatures.
   - **Infectious Diseases:** Vulnerability to diseases transmitted from domestic livestock.
4. **Project Nilgiri Tahr (2022–2027)**
   - **Launch:** Inaugurated by the Tamil Nadu government with an outlay of ₹25 crore.
   - **Objectives:** Radio-telemetry studies, reintroduction to historical habitats, and clearing invasive species from grasslands.

Q. With reference to the "Nilgiri Tahr," consider the following statements:

1. *It is the only mountain ungulate species found in India that is endemic to the Western Ghats.*
2. *Under the Wildlife (Protection) Act, 1972, it is categorized under Schedule II to allow for limited regulated hunting.*
3. *The Eravikulam National Park in Kerala is home to the largest surviving population of this species in the wild.*

How many of the above statements are correct?

A) Only one

B) Only two

C) All three

D) None

Ans. (b)

Explanation:

- ***Statement 1 is correct:*** *While India has other mountain ungulates (like the Himalayan Tahr), the Nilgiri Tahr is the* ***only one*** *endemic to the Western Ghats/Southern India.*
- ***Statement 2 is incorrect:*** *The Nilgiri Tahr is listed under* ***Schedule I*** *of the WPA 1972, providing it the absolute highest level of protection; hunting is strictly prohibited.*
- ***Statement 3 is correct:*** *Eravikulam National Park is widely recognized as the primary stronghold, hosting approximately half of the global population.*

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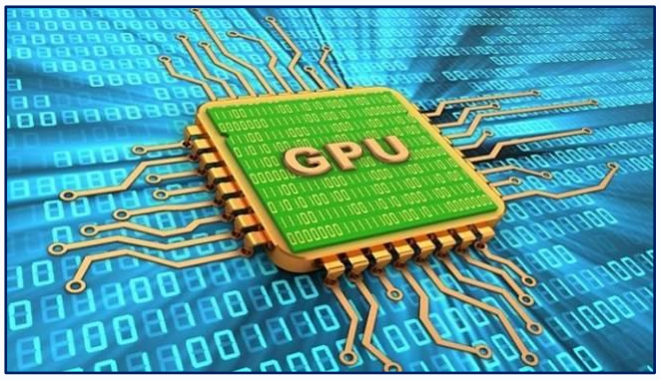
5.1. GRAPHICS PROCESSING UNIT (GPU)



Context: Recently, during the **IndiaAI Impact Summit** in New Delhi, the Government of India announced plans to triple the country's sovereign GPU capacity to **100,000 units** by the end of the year. This initiative, part of the **₹10,372-crore IndiaAI Mission**, aims to provide subsidized high-performance computing to startups and researchers, reducing India's dependence on global technology giants like Nvidia while fostering a domestic ecosystem for Large Language Models (LLMs) and deep learning.

1. **Architectural Philosophy: Serial vs. Parallel**
    - **Central Processing Unit (CPU):** It is designed as a "General Purpose" processor that excels at **Sequential (Serial) Processing**. It contains a few powerful cores (typically 4 to 64) optimized for low-latency, complex logical branching, and system management.
    - **Graphics Processing Unit (GPU):** It is a "Specialized" processor designed for **Parallel Processing**. It houses thousands of smaller, more efficient cores that can handle multiple independent tasks simultaneously.
2. **How a GPU Works: The Technical Mechanism**
    - **SIMD Architecture:** GPUs operate on the **Single Instruction, Multiple Data (SIMD)** principle, where a single command is executed across thousands of data points (pixels or parameters) at once.
    - **The Rendering Pipeline:** For visual tasks, GPUs use a four-step process:
    - **Vertex Processing:** Calculating 3D positions using matrix mathematics.
    - **Rasterization:** Converting geometric shapes into a grid of pixels.
    - **Shading:** Determining color, light, and texture for each pixel.
    - **Output:** Writing the final frame to the **Video RAM (VRAM)**.
    - **AI Transformation:** In AI training, the GPU skips the visual steps and uses its cores for **Matrix Multiplication**, which is the mathematical foundation of neural networks.
3. **Key Internal Components**
    - **Cores:** Standard units like **CUDA Cores** (Nvidia) or **Stream Processors** (AMD) handle general math. Specialized **Tensor Cores** are designed specifically for the "deep learning" math required by AI.
    - **VRAM (Video RAM):** Unlike system RAM, VRAM (e.g., GDDR6X or HBM3) has massive **bandwidth**, allowing it to feed huge amounts of data to the thousands of cores without creating a bottleneck.
    - **Thermal Design:** High-end GPUs in 2026 consume over **1000W** of power, necessitating advanced liquid cooling systems in modern data centers.

4. **Strategic Modern Applications**
   - **Artificial Intelligence:** Training Large Language Models (LLMs) and running real-time "inference" for chatbots and autonomous vehicles.
   - **Cryptocurrency:** Performing "Proof of Work" (PoW) hashing at high speeds (though being phased out by some blockchains like Ethereum).
   - **Scientific Simulation:** Modeling climate change, molecular dynamics for drug discovery, and genomic sequencing.
   - **Digital Twins:** Creating real-time virtual replicas of factories or cities for industrial optimization.

Q. With reference to Graphics Processing Units (GPUs), consider the following statements:

1. *Unlike a CPU which is optimized for sequential processing, a GPU uses a parallel architecture to handle thousands of tasks simultaneously.*
2. *The term "General-Purpose Computing on Graphics Processing Units" (GPGPU) refers to the use of GPUs for non-graphics tasks like scientific research and AI.*
3. *Integrated GPUs share the system's main RAM, whereas Discrete GPUs possess their own dedicated high-bandwidth memory called VRAM.*

How many of the above statements are correct?

A) Only one

B) Only two

C) All three

D) None

Ans. (c)

Explanation:

- ***Statement 1 is correct:*** *This is the core difference; CPUs handle complex logic one after another (serial), while GPUs handle many simple tasks at once (parallel).*
- ***Statement 2 is correct:*** *GPGPU is the shift that allowed GPUs to be used for things like weather forecasting and AI instead of just video games.*
- ***Statement 3 is correct:*** *Integrated GPUs (found in basic laptops) use the computer's shared RAM, which is slower, while Discrete (dedicated) GPUs have specialized VRAM (like GDDR6) for high performance.*

5.2. RARE EARTH MAGNETS

Context: Recently, on February 19, 2026, Union Minister for Mines G. Kishan Reddy announced that India is set to commence domestic production of **Rare Earth Permanent Magnets (REPMs)** by the end of this year.

This move follows the Union Cabinet's earlier approval of a **₹7,280-crore scheme** aimed at establishing an integrated manufacturing ecosystem to reduce the country's near-total (100%) dependence on imports,

particularly from China, which currently controls over 90% of the global processing and manufacturing capacity for these critical components.

1. **What are Rare Earth Magnets?**
   - **Definition:** These are powerful permanent magnets made from alloys of **Rare Earth Elements (REEs)**—a group of 17 metallic elements (15 lanthanides plus scandium and yttrium).
   - **Properties:** They are known for having extremely high magnetic strength (energy density) and high coercivity (resistance to being demagnetized) compared to traditional magnets.
   - **Vulnerability:** While physically strong in magnetic terms, they are often brittle and highly susceptible to corrosion, which is why they are typically coated with protective layers like **Nickel-Copper-Nickel plating**.
2. **Two Primary Types Rare Earth Magnets:**
   - **Neodymium Magnets (NdFeB):** Composed of Neodymium, Iron, and Boron. They are the strongest type of permanent magnet commercially available and are essential for electric vehicle (EV) motors.
   - **Samarium-Cobalt Magnets (SmCo):** These were the first rare earth magnets developed. Although slightly weaker than neodymium magnets, they have a higher **Curie temperature** (can operate at up to 700°C) and superior resistance to oxidation, making them vital for aerospace and missile systems.
3. **Strategic Importance for India**
   - **Clean Energy:** They are indispensable for the "direct drive" generators in wind turbines and traction motors in Electric Vehicles.
   - **Defence:** Used in precision-guided munitions, drones, radar systems, and communication equipment.
   - **Economic Security:** India possesses the world's **5th largest reserves** of rare earths (approx. 6.9 million tonnes), yet it currently imports almost all its finished magnets.
   - **China Factor:** China's recent export restrictions on rare earth technology and minerals have created a "supply chain squeeze," necessitating India's push for "Atmanirbharta" (self-reliance).
4. **The Rare Earth Magnet Scheme (2025-26)**
   - **Outlay:** ₹7,280 crore over a 7-year period.
   - **Target:** To create a domestic capacity of **6,000 Metric Tonnes Per Annum (MTPA)**.
   - **Focus:** Integrated manufacturing that covers the entire value chain: **Rare Earth Oxides** → **Metals** → **Alloys** → **Finished Sintered Magnets**.
   - **Incentives:** Includes ₹6,450 crore as sales-linked incentives and ₹750 crore as capital subsidies.

Q. With reference to Rare Earth Magnets, consider the following statements:

1. *Neodymium magnets (NdFeB) are generally more resistant to corrosion and high temperatures than Samarium-Cobalt (SmCo) magnets.*
2. *The primary source of rare earth elements in India is the monazite sands found in coastal regions.*
3. *China currently accounts for more than 90% of the global manufacturing of sintered rare earth permanent magnets.*

How many of the above statements are correct?

A) Only one

B) Only two

C) All three

D) None

Ans. (b)

Explanation:

- ***Statement 1 is incorrect:*** *Samarium-Cobalt (SmCo) magnets actually have much higher temperature resistance and better corrosion resistance than Neodymium (NdFeB) magnets, which are prone to rusting if not plated.*
- ***Statement 2 is correct:*** *In India, rare earth elements like Neodymium and Praseodymium are primarily extracted from* ***Monazite****, which is found in the beach sands of Kerala, Tamil Nadu, and Odisha.*
- ***Statement 3 is correct:*** *China dominates the downstream value chain, controlling roughly 91-94% of the global production of sintered rare earth magnets.*

5.3. BIO-BASED CHEMICALS AND ENZYMES

Context: Recent policy deliberations and government strategies have emphasized the need to scale up **bio-based manufacturing** as a key component of **India's bio-economy** agenda, with the objective of reducing dependence on **fossil-fuel-derived chemicals** and advancing environmentally sustainable industrial development.

1. **Core Concepts: Definitions & Applications**
   - **Bio-based Chemicals:** These are chemicals **made from renewable biological sources** or feedstocks like (e.g., sugarcane, corn, starch, biomass residues). They are produced mainly through fermentation or biological processing and are considered environmentally friendly.
     - **Examples:** Organic acids (lactic acid), **bio-alcohols**, solvents, surfactants, and intermediates for plastics, cosmetics, and pharmaceuticals.
   - **Enzymes:** Enzymes are **natural biological catalysts** that speed up **chemical reactions**.
     - **Environmental Benefit:** They function at **lower temperatures and pressures**, significantly **reducing energy consumption** and emissions compared to traditional methods.

2. **India's Strategic Position and Policy**

- **Policy Framework:** India has designated bio-based chemicals and enzymes as a priority area under the **Department of Biotechnology's BioE3 policy**.
- **Economic Drivers:** Scaling this sector aims to reduce import dependence on petrochemicals (e.g., India imported approximately **$479.8 million** worth of acetic acid in 2023) and create new markets for agricultural produce.

About BioE3 Policy

- The Government of India has introduced (in 2024-25 budget) the BIO-E3 Policy to accelerate the growth of the country's **bio-economy** by promoting **bio-based innovation**, **entrepreneurship**, and **environmentally sustainable manufacturing**.
- **Aims and objective**: It aims to achieve a **$300 billion bioeconomy by 2030**, utilizing AI, biofoundries, and hubs to drive innovation in climate-resilient agriculture, precision biotherapeutics, and green chemicals.
- **Strategic Sectors**: The policy focuses on six thematic areas, including high-value **bio-based chemicals and enzymes**, smart proteins**, precision biotherapeutics**, carbon capture & utilization, climate resilient agriculture, and futuristic marine and space research.
- **Policy Impact and Goals:** It supports India's commitment to net-zero carbon emissions by 2070 and Viksit Bharat @2047.

3. **Global Perspectives: International Strategies**

Region/Country	Key Strategy/Program	Focus Area
European Union (EU)	Bioeconomy Strategy and Action Plan	Coordinated support linking industrial transformation to climate goals and waste reduction.
United States (U.S.)	USDA BioPreferred Program	Mandates federal procurement preference for certified bio-based products to create early markets.
China	Bioeconomy Development Plans	Explicitly prioritizes high-value bio-based chemicals and enzyme technologies as strategic sectors.
Japan	METI/NARO Projects	Integrates bio-based chemical research with manufacturing readiness.

4. **Challenges and Risks to Scale-up**

- **Cost Disadvantage:** High comparative cost of bio-based products relative to established petrochemical alternatives creates a significant entry barrier for private investment.
- **Resource Availability:** Issues regarding the availability of reliable feedstocks and the supporting infrastructure required for large-scale production.
- **Market Adoption:** Challenges in seamlessly substituting existing inputs in manufacturing pipelines and the willingness of downstream manufacturers to switch.

Q. With reference to the 'BioE3 Policy' and bio-based chemicals in India, consider the following statements:

I. Bio-based chemicals are industrial chemicals derived primarily from petrochemical feedstocks through enzymatic catalysts.

II. Enzymes are preferred in biomanufacturing because they function at lower temperatures and pressures compared to traditional chemical catalysts.

III. The USDA BioPreferred Program is an international initiative led by India to mandate the global procurement of bio-based detergents.

Which of the statements given above is/are correct?

(a) I only

(b) II only

(c) I and III only

(d) II and III only

Answer: B

Explanation:

Statement I is incorrect**: They are derived from biological feedstocks (sugarcane, corn), **not petrochemicals.

***Statement II is correct:** Enzymes are **natural biological catalysts** that speed up **chemical reactions**. They help industries operate at lower temperature and pressure, making processes more energy-efficient and less polluting.*

***Statement III is incorrect:** It is a U.S. program, not an Indian-led international initiative.*

5.4. LAUNCH VEHICLE DEBRIS FOUND IN MALDIVES

Context: Recently, debris carrying the logo of ISRO and India's National Emblem was discovered on an uninhabited island of the Maldives. The debris is believed to have originated from India's heavy-lift launch vehicle **LVM-3**, highlighting issues related to space missions and debris management.

1. **Technical Identification**
   - **Launch Vehicle Mark-3 (LVM3)**: The debris-specifically a **payload fairing (PLF)**—is believed to be from ISRO's **heaviest rocket**, the LVM3.
   - **Mission Links**: The debris likely originated from the **LVM3-M6/BlueBird Block-2 Mission** launched in December 2025 or the **CMS-03 communication satellite** launch in November 2025.
   - **Rocket Configuration:** The **LVM3 is a three-stage vehicle** comprising two solid strap-on motors, a liquid core stage, and a cryogenic upper stage.

2. Different types of launch vehicles

Launchers or Launch Vehicles are used to carry spacecraft to space. India has three active operational launch vehicles: Polar Satellite Launch Vehicle (PSLV), Geosynchronous Satellite Launch Vehicle (GSLV), Geosynchronous Satellite Launch Vehicle Mk-III (LVM3).

I. PSLV (Polar Satellite Launch Vehicle)

- It is the Indian Space Research Organisation's (ISRO) reliable third-generation, 4-stage "**workhorse"** launch vehicle, first successful in 1994
- Has **four variants** based on strap-on boosters: 6, 4, 2, and Core-Alone.
- Used for launching:
  - Earth Observation satellites
  - Navigation satellites
- **Key Missions:** Successfully launched India's first space observatory, Astrosat, Chandrayaan-1 in 2008, and Mangalyaan in 2013.

II. GSLV (Geosynchronous Satellite Launch Vehicle)

- It is a **three-stage**, 49–52m tall, 420-tonne rocket developed by ISRO to launch heavy communication satellites (up to ~2.5 tonnes) into **Geostationary Transfer Orbit (GTO).**
- Uses **indigenous Cryogenic Upper Stage**.
- **Key missions** include launching NavIC navigation satellites (NVS-01, NVS-02)

III. Launch Vehicle Mark III (LVM-III)

- The Launch Vehicle Mark III (LVM3), formerly known as **GSLV Mk III**, is ISRO's **most powerful**, **three-stage** medium-lift launch vehicle designed for heavy satellite deployment.
- **Key Missions:** LVM3 successfully launched the Chandrayaan-2 and Chandrayaan-3 missions.
- Can launch:
  - **4-tonne satellites to Geostationary Transfer Orbit (GTO).**
  - **10-tonne payloads to Lower Earth Orbit (LEO)**
- Selected for **Gaganyaan Human Space Mission**.

Q. With reference to LVM-3 (Launch Vehicle Mark-3), consider the following statements:

I. It is the heaviest operational launch vehicle of India.

II. It is capable of launching about 4-tonne class satellites into GTO.

III. It has been selected as the launch vehicle for India's Gaganyaan mission.

Which of the statements given above is/are correct?

(a) I only

(b) I and II only

(c) II and III only

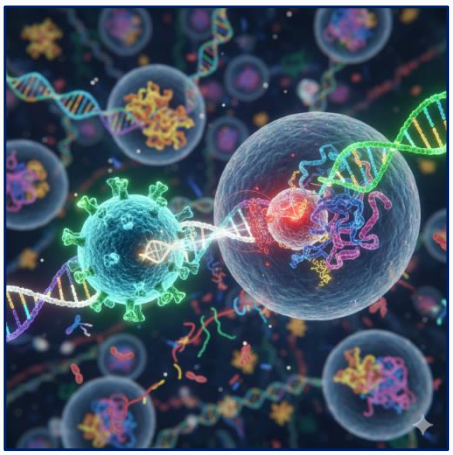
(d) I, II and III

Ans. (d)

Explanation:

- ***Statement I is Correct: LVM-3*** *is the* ***heaviest operational launch vehicle*** *developed by ISRO.*
- ***Statement II is Correct:*** *It can launch about* ***4-tonne class communication satellites into Geosynchronous Transfer Orbit (GTO)****.*
- ***Statement III is Correct:*** *The* ***human-rated version of LVM-3*** *has been selected for India's* ***Gaganyaan human spaceflight mission****.*

5.5. ADVANCEMENT IN GENETIC THERAPY: THE PERT STRATEGY



Context: Genetic disorders often stem from small errors in the DNA sequence, such as **nonsense mutations**, which account for approximately **one-quarter of all known disease-causing genetic changes**. These mutations insert a premature "stop signal" in the DNA, causing protein production to end too early and leaving the body without essential functional proteins. Traditionally, each disorder required a unique, expensive, and slow-to-develop therapy.

1. **The PERT Strategy: A Unified Approach**

   Researchers from the Broad Institute, Harvard, and the University of Minnesota have developed a single genome-editing strategy called **Prime-Editing-mediated Readthrough of premature Termination codons (PERT)**.

   - **Mechanism**: PERT "reprogrammes" one of the cell's own genes into a tool that overrides premature stop signals, allowing the cell to ignore the faulty instruction and complete the protein.
   - **Gene Repurposing**: The technique utilizes **tRNA (transfer RNA)** genes. Human cells contain 448 tRNA genes, many of which are redundant.
     - tRNA act as critical adaptor molecules in translation by carrying specific amino acids to the ribosome and matching them to corresponding codons on the mRNA.
   - **The "Suppressor tRNA"**: Using **prime editing**, researchers converted a non-essential natural tRNA gene into a **suppressor tRNA**—a molecule that reads through premature stop signals and inserts an amino acid where there should have been a "stop".

2. **Key Components and Innovation**

   - **Prime Editing (The Tool)**: This precise genome-editing approach uses a specialized molecule called a **prime-editing guide RNA (pegRNA)** to lead the editing machinery to the exact spot on the DNA.
     - **Prime-editing guide RNA (pegRNA)** is a specially engineered RNA used in **prime editing**, a precise CRISPR-based genome editing method.

- It combines the roles of a **guide RNA** (like in CRISPR-Cas9) and a **template for reverse transcription** to introduce specific edits without making double-strand breaks.

- **Selection Process**: Researchers identified four specific tRNAs- leucine, arginine, tyrosine, and serine—that showed the most promise for therapeutic use.
- **Efficiency**: In cultured human cells, this combination achieved **60-80% editing efficiency**, which is significantly higher than the standard **10-20% efficiency** of traditional precision gene insertion methods like **homology-directed repair**.

3. Experimental Success and Results

The PERT strategy was tested on models of several rare diseases caused by **nonsense mutations**:

- **Hurler Syndrome**: Restored 1.7-7% of normal enzyme activity in the brain, heart, and liver, which is known to meaningfully reduce disease severity.
- **Tay-Sachs & Batten Disease**: Enzyme activity rose to **17-70% of normal levels** in these models.
- **Niemann-Pick C1**: Cells produced measurable amounts of the full-length NPC1 protein, which is otherwise entirely absent in these patients.

Q. In the context of recent advancements in genetic engineering, what is 'PERT' (Prime-Editing-mediated Readthrough of premature Termination codons)?

(a) A method to replace mitochondrial DNA in embryos to prevent hereditary diseases.

(b) A technique to increase the shelf-life of crops by silencing ripening genes.

(c) A diagnostic tool used to identify the presence of 'junk DNA' in the human genome.

(d) A strategy that reprograms tRNA genes to override premature stop signals in DNA.

Ans. (d)

Explanation:

PERT uses prime editing to convert redundant tRNA genes into suppressor tRNAs that can bypass nonsense mutations.

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CULTURE

6.1. ROYAL INDIAN NAVY (RIN) REVOLT: 80 YEARS OF A FORGOTTEN UPRISING

Context: The year 2026 marks the **80th anniversary** of the Royal Indian Navy (RIN) Revolt, a watershed moment in India's struggle for independence that transcended communal divides and shook the foundations of British colonial rule.

1. Genesis of the Uprising

The revolt began on **February 18, 1946**, at the shore establishment **HMIS Talwar** in Bombay. What started as a hunger strike by naval ratings quickly escalated into a widespread insurrection. The primary catalysts included:

- **Inhumane Conditions:** Protest against sub-standard food and low wages.
- **Racial Discrimination:** Systematic mistreatment by British officers.
- **Political Undercurrents:** Influence of the **Indian National Army (INA)** trials and the charismatic leadership of Subhas Chandra Bose.

2. Scale and Spread of the Revolt

The uprising was not a localized "mutiny" but a coordinated naval and civilian defiance:

- **Geographical Reach:** Spread from Bombay to Karachi, Madras, Cochin, Vishakhapatnam, and Kolkata.
- **Participation:** Involved nearly **20,000 naval ratings**, 78 ships, and 20 shore establishments.
- **Symbolism:** Ratings hoisted the flags of the **Congress, Muslim League, and Communist Party** simultaneously on naval masts, signaling unprecedented unity.
- **Central Strike Committee:** Led by **M.S. Khan**, the committee demanded the release of political prisoners and the withdrawal of Indian troops from Indonesia and Egypt.

3. Popular Mobilization

The revolt triggered a massive civilian surge in Bombay, particularly within the mill districts (Kamatipura and Madanpura).

- **Hindu-Muslim Solidarity:** Protesters from both communities jointly organized *hartals* and engaged in pitched battles against British machine guns.
- **Casualties:** Over 200 civilians were killed as the British utilized armored vehicles and heavy ammunition to suppress the street-level uprising.
- **Surrender:** On the advice of **Sardar Vallabhbhai Patel** and **Muhammad Ali Jinnah**, who provided assurances against victimization (which were later largely ignored), the ratings surrendered on February 23, 1946.

4. Historical Significance & Legacy

- **Impact on British Rule:** The revolt convinced the British that the Indian Armed Forces could no longer be relied upon to maintain the Empire.
- **Decolonization Catalyst:** It accelerated the dispatch of the **Cabinet Mission** to India to negotiate the transfer of power.

Q. With respect to the Royal Indian Navy (RIN) Revolt of 1946, consider the following statements:

I. The uprising initially commenced at the shore establishment HMIS Talwar as a protest against racial discrimination and poor food quality.

II. The Naval Central Strike Committee was led by B.C. Dutt and exclusively demanded the improvement of service conditions.

III. The revolt received unified support from the top leadership of the Indian National Congress and the Muslim League, who encouraged the ratings to continue the strike.

IV. The uprising was characterized by a rare display of communal harmony, with protesters hoisting flags of the Congress, Muslim League, and the Communist Party together.

Which of the statements given above are correct?

(a) I and II only

(b) I and IV only

(c) II and III only

(d) I, II, and IV only

Ans. (b)

Explanation:

- ***Statement I is correct:*** *The revolt began on February 18, 1946, at HMIS Talwar in Bombay, primarily triggered by racial insults and poor living conditions.*
- ***Statement II is incorrect:*** *While B.C. Dutt was an early protagonist, the Naval Central Strike Committee was headed by M.S. Khan. Furthermore, their demands were not "exclusive" to service conditions; they included political demands like the release of INA prisoners.*
- ***Statement III is incorrect:*** *The senior leadership of both the Congress (Sardar Patel) and the Muslim League (Jinnah) did not support the violent nature of the mutiny and advised the ratings to surrender.*
- ***Statement IV is correct:*** *One of the most striking features of the 1946 revolt was the communal unity among the ratings and the public, symbolized by the tri-color, the crescent, and the hammer-and-sickle flags flying together.*

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