



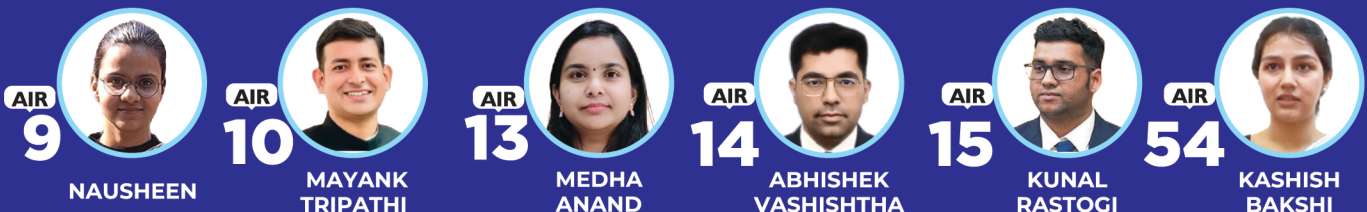
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ANSWER KEY
with **EXPLANATIONS**

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SET - B



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8	A	D	A	A
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74	A	C	D	A
75	C	A	C	B

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94	D	A	B	A
95	A	C	D	A
96	D	*	C	C
97	A	A	A	C
98	A	A	A	C
99	A	C	A	B
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Answer Key with Explanation

1. Consider the following types of vehicles:

- I. Full battery electric vehicles
- II. Hydrogen fuel cell vehicles
- III. Fuel cell electric vehicles

How many of the above are considered as alternative powertrain vehicles?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (c) All the three

Explanation:

- ◆ All three options are **alternative powertrain vehicles** because they employ **non-conventional propulsion systems** aimed at reducing reliance on fossil fuels and lowering emissions.
- ◆ **Statement I is Correct: Full battery electric vehicles (BEVs)**
 - BEVs are powered entirely by electricity stored in rechargeable battery packs. They have no internal combustion engine and emit no tailpipe pollutants. These are powered solely by electricity stored in batteries, with **no internal combustion engine**.
 - Example: Tesla Model 3, Tata Nexon EV
- ◆ **Statement II is Correct: Hydrogen fuel cell vehicles**
 - These vehicles use hydrogen gas in fuel cells to generate electricity, which then powers electric motors. They emit only water vapor and warm air. These generate electricity through a **chemical reaction between hydrogen and oxygen**, emitting only water.
 - Example: Toyota Mirai, Hyundai NEXO
- ◆ **Statement III is Correct: Fuel cell electric hybrid vehicles (FCEVs)**
 - These combine a **hydrogen fuel cell system** with a **battery and/or regenerative braking system**, functioning as hybrids.
 - These vehicles offer **dual-mode** propulsion (e.g., battery + fuel cell) and are under R&D or pilot adoption stages.
 - Conceptually similar to **plug-in hybrid electric vehicles (PHEVs)**, but with a **fuel cell replacing or supplementing** the engine.
- ◆ Thus, **all three** are categorized as **alternative powertrain vehicles** due to their deviation from conventional internal combustion technologies.

Supplementary notes:

- ◆ Alternative powertrain vehicles are those that move away from conventional internal combustion engines. They include:

- Battery Electric Vehicles (BEVs)
 - Plug-in Hybrid Electric Vehicles (PHEVs)
 - Fuel Cell Electric Vehicles (FCEVs)
- ◆ These technologies reduce dependency on fossil fuels and cut down greenhouse gas emissions.
 - ◆ Alternative powertrain vehicles are those that use **non-conventional propulsion systems** as an alternative to **traditional internal combustion engines (ICEs)**, which typically run on petrol or diesel. These vehicles aim to reduce dependency on fossil fuels and minimize environmental impact through cleaner, more efficient energy sources.

Core Concept: Powertrain

- ◆ The **powertrain** refers to all the components that generate power and deliver it to the road, including the engine or motor, transmission, driveshaft, differential, and axles.
- ◆ In **alternative powertrain vehicles**, the traditional **ICE is replaced or supplemented** by **electric motors, hydrogen fuel cells, hybrid systems, or biofuel-based engines**.

Types of Alternative Powertrain Vehicles:

- ◆ **Battery Electric Vehicles (BEVs):**
 - Powered entirely by **electricity stored in batteries**.
 - Examples: Tesla Model 3, Nissan Leaf, Tata Nexon EV
 - Powertrain: Electric motor + lithium-ion battery
 - **Zero tailpipe emissions**
- ◆ **Hydrogen Fuel Cell Electric Vehicles (FCEVs):**
 - Generate electricity **onboard** by combining hydrogen and oxygen in a **fuel cell stack**.
 - Examples: Toyota Mirai, Hyundai NEXO
 - Powertrain: Hydrogen fuel cell + electric motor
 - Emission: **Only water vapor**
- ◆ **Plug-in Hybrid Electric Vehicles (PHEVs):**
 - Have both a **combustion engine** and an **electric motor** with plug-in capability.
 - Can run on battery power alone for short distances.
 - Examples: Toyota Prius Prime, BMW 330e
- ◆ **Hybrid Electric Vehicles (HEVs):**
 - Combine an **internal combustion engine** with an **electric motor**.
 - The battery is **charged via regenerative braking** and engine operation.
 - Examples: Toyota Camry Hybrid
- ◆ **Fuel Cell Vehicles (FCVs):**
 - Similar to FCEVs but sometimes used in broader contexts, including non-hydrogen fuel cells (though rare in transport).
 - Use electrochemical reactions to generate electricity.
- ◆ **Compressed Natural Gas (CNG) or Biofuel Vehicles:**
 - Use **natural gas** or bio-derived fuels like **ethanol, methanol, or biodiesel**.
 - Cleaner than diesel/petrol but **still combustion-based**.

Source Links:

- ◆ Toyota Fuel Cell Hybrids – Technical Overview: <https://global.toyota/en/newsroom/corporate/37262294.html>
2. **With reference to Unmanned Aerial Vehicles (UAVs), consider the following statements:**
- I. All types of UAVs can do vertical landing.
 - II. All types of UAVs can do automated hovering.
 - III. All types of UAVs can use battery only as a source of power supply.

How many of the statements given above are correct?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (D) None

Explanation:

- ◆ **Statement I is Incorrect: All types of UAVs can do vertical landing.**
 - Not all UAVs can perform vertical landing. Only VTOL (Vertical Take-Off and Landing) drones such as quadcopters or specially designed fixed-wing hybrids can do this. Fixed-wing drones, which resemble small airplanes, typically require runways or launch/recovery systems.
- ◆ **Statement II is Incorrect: All types of UAVs can do automated hovering.**
 - Hovering requires multirotor or rotary-wing configurations. Fixed-wing UAVs cannot hover; they need forward motion to generate lift.
- ◆ **Statement III is Incorrect: All types of UAVs can use battery only as a source of power supply.**
 - Many small UAVs (especially for commercial, recreational, or surveillance uses) run on batteries. However, not all UAVs use only batteries—some use petrol, hybrid systems, or solar. The statement says “**can use**” battery only as power source, which is true for a substantial class of UAVs.

Supplementary notes:

- ◆ UAVs are classified based on configuration (fixed-wing, rotary-wing, hybrid), take-off/landing mode (VTOL, HTOL), range, altitude, and power source. Each configuration has specific strengths:
 - **Multirotor UAVs:** Can hover and land vertically, battery powered.
 - **Fixed-wing UAVs:** Longer endurance, cannot hover or land vertically.
 - **Hybrid UAVs:** Combine rotary and fixed-wing capabilities.
- ◆ **Unmanned Aerial Vehicles (UAVs)**, also known as **drones**, are aircraft that operate **without an onboard human pilot**. They can be controlled remotely or fly autonomously through onboard computers and sensors. UAVs vary significantly in size, function, range, and design — from hand-launched surveillance drones to large military-grade aircraft.
- ◆ **UAV Applications**
 - **Military & Security:** Surveillance (e.g., MQ-9 Reaper), precision strikes
 - **Civilian:** Aerial photography, disaster management, agriculture (precision spraying), logistics (e.g., drone delivery)
 - **Research & Conservation:** Wildlife tracking, meteorological data collection

Regulatory Aspects in India (as per Drone Rules, 2021)

- ◆ Classified based on **maximum takeoff weight**:
 - Nano (<250g), Micro (250g–2kg), Small (2–25kg), Medium (25–150kg), Large (>150kg)
- ◆ Unique Identification Number (UIN) required for most drones.
- ◆ No Permission No Takeoff (NPNT) policy enforced digitally.

Source Links:

- ◆ Federal Aviation Administration – Types of Drones: <https://www.faa.gov/uas>
- 3. In the context of electric vehicle batteries, consider the following elements:**
- I. Cobalt
 - II. Graphite
 - III. Lithium
 - IV. Nickel

How many of the above usually make up battery cathodes?

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All the four

Correct Option: (c) Only three

Explanation:

- ◆ **Cobalt** – Used in the cathode of many lithium-ion batteries, especially in lithium cobalt oxide (LCO) and nickel manganese cobalt oxide (NMC) chemistries.
 - **Included in cathode**
- ◆ **Graphite** – Used as the anode, not the cathode, in most lithium-ion batteries.
 - **Not in cathode**
- ◆ **Lithium** – A key component in both the **cathode and the electrolyte** of lithium-ion batteries.
 - **Included in cathode**
- ◆ **Nickel** – Commonly used in the cathode material for high-energy batteries (e.g., NMC, NCA).
 - **Included in cathode**

Supplementary notes:

In lithium-ion batteries:

- ◆ **Cathodes** are typically composed of materials like lithium cobalt oxide (LCO), lithium nickel manganese cobalt oxide (NMC), and lithium iron phosphate (LFP).
- ◆ **Graphite** is the standard anode material due to its excellent ability to intercalate lithium ions.
- ◆ Cathode materials influence energy density, voltage, and lifespan of batteries.

EV Batteries and Their Chemistry

- ◆ Electric vehicle batteries are most commonly **lithium-ion (Li-ion) batteries**, which rely on **electrochemical reactions** between a **cathode** (positive terminal) and an **anode** (negative terminal) to store and release energy.
 - The **cathode** is **crucial** to determining the energy density, lifespan, cost, and performance of the battery.
 - Multiple **metal oxides** are used in cathodes, often in **composite forms**.

Role of Each Element in the Question

- ◆ **Cobalt (Co)**
 - Used in: **Lithium Cobalt Oxide (LCO), Nickel Manganese Cobalt (NMC), Nickel Cobalt Aluminum (NCA)** batteries
 - Improves: **Thermal stability**, energy density
 - Concerns: **Toxicity, human rights issues** in mining (esp. DRC)
- ◆ **Graphite**
 - **Not used in cathodes**
 - **Used in anodes** (negative electrode) as the **primary material** due to its ability to intercalate lithium ions efficiently.
 - Typically synthetic or natural graphite
- ◆ **Lithium (Li)**
 - Used in **all types** of lithium-ion batteries
 - Found in both cathode and electrolyte
 - Forms: **Lithium iron phosphate (LFP), Lithium nickel cobalt manganese oxide (NMC)**, etc.
- ◆ **Nickel (Ni)**
 - Used in high-energy batteries like **NMC and NCA**
 - Enhances: **Energy density** and capacity
 - Drawback: Makes battery more thermally unstable than LFP

Types of Common Cathode Chemistries

Battery Type	Cathode Composition	Application
LCO	LiCoO_2 (Lithium Cobalt Oxide)	Smartphones, laptops
NMC	LiNiMnCoO_2 (Nickel Manganese Cobalt)	EVs (most common)
NCA	LiNiCoAlO_2 (Nickel Cobalt Aluminum)	Tesla (Panasonic cells)
LFP	LiFePO_4 (Lithium Iron Phosphate)	EVs, grid storage
LMO	LiMn_2O_4 (Lithium Manganese Oxide)	Power tools, hybrid EVs

- ◆ Cobalt, Lithium, and Nickel are all **critical cathode materials**
- ◆ Graphite is **not a cathode material**, but a dominant **anode** component
 - **Cobalt**: ~70% sourced from the **Democratic Republic of Congo (DRC)**
 - **Nickel**: Indonesia, Russia, and the Philippines are major suppliers
 - **Lithium**: Extracted from **brine** in Chile, Argentina (Lithium Triangle) and from **spodumene ore** in Australia
 - **Graphite**: China dominates global production of **anode-grade graphite**

Relevance to India

- ◆ India's EV push (FAME II scheme, PLI for ACC battery storage) depends on:
 - **Securing supply chains** for Li, Co, Ni
 - Promoting **LFP chemistries** (safer, cobalt-free)
- ◆ India is investing in **Li-ion recycling** and **local cathode material manufacturing**

Source Links:

- ◆ U.S. Department of Energy – Battery Materials Overview: <https://www.energy.gov/eere/vehicles/battery-materials>

4. Consider the following:

- Cigarette butts
- Eyeglass lenses
- Car tyres

How many of them contain plastic?

- Only one
- Only two
- All the three
- None

Correct Option: (c) All the three

Explanation:

- ◆ **Cigarette butts** – Contain **cellulose acetate**, a type of plastic that does not biodegrade easily. Most cigarette filters are made of this plastic.
 - **Contains plastic**
- ◆ **Eyeglass lenses** – Modern eyeglass lenses are often made from **polycarbonate**, **CR-39**, or other plastic polymers (especially for light weight and shatter resistance).
 - **Contains plastic**
- ◆ **Car tyres** – Made from a mix of **natural rubber**, **synthetic rubber**, and **plastic polymers** like **styrene-butadiene rubber (SBR)**. Additionally, microplastics are released from tyres during use.
 - **Contains plastic**

Supplementary notes:

- ◆ Many common items that are not intuitively seen as plastic contain significant amounts of it. These contribute to **microplastic pollution** through degradation, use, and disposal:

- **Cigarette butts** are among the most littered plastic waste globally.
 - **Eyeglass lenses**, especially those made for children or sports, are rarely glass today.
 - **Tyres** are a major source of urban microplastics.
- ◆ Understanding which everyday items contain **plastic components** is essential in analyzing their **environmental impact, biodegradability**, and implications for **waste management and recycling policies**. Many objects not visibly “plastic” still contain synthetic polymers or microplastics that can persist in ecosystems.
- ◆ **Cigarette Butts – Yes, they contain plastic**
- **Main Component:** The **filter** in cigarette butts is primarily made of **cellulose acetate**, a **bioplastic** (derived from cellulose but processed with acetic acid and plasticizers).
 - Although derived from a natural substance (wood pulp), the final material behaves like **conventional plastic** and is **non-biodegradable**.
 - **Environmental Impact:**
 - Most littered item globally (4.5+ trillion annually).
 - Release **microplastics** and **toxic chemicals** into soil and waterways.
 - **Supporting Studies:**
 - “Tobacco and its environmental impact: an overview” – WHO (2017)
 - National Geographic – Cigarette butts are plastic pollution
- ◆ **Eyeglass Lenses – Yes, they contain plastic**
- **Traditional lenses** were made of **glass**, but most modern lenses are now made from **thermoplastics or polycarbonate** due to their light weight and shatter resistance.
 - Common plastic types used:
 - **CR-39 (Columbia Resin 39):** A **thermosetting plastic polymer**.
 - **Polycarbonate (PC):** Lightweight, durable, impact-resistant.
 - Also used in sunglasses, safety goggles, and sport eyewear.
 - **Supporting Sources:**
 - Optical Laboratories Association: Plastic lenses vs. glass lenses
 - American Academy of Ophthalmology
- ◆ **Car Tyres – Yes, they contain plastic**
- **Tyres** are complex composites made from:
 - **Natural rubber**
 - **Synthetic rubber** (often derived from **petroleum-based polymers** like styrene-butadiene rubber, i.e., **plastic-based**)
 - Fillers like **carbon black** and **silica**
 - They also include:
 - **Nylon, polyester, and rayon** (synthetic textile reinforcements, also plastics)
 - **Tyre wear** is a major source of **microplastic pollution**, especially in urban runoff and marine environments.

Supporting Sources:

- ◆ UNEP – Tyres and microplastics pollution
- ◆ European Chemicals Agency (ECHA) – Microplastics from tyres

All three contain plastic

Item	Contains Plastic?	Key Plastic Component
Cigarette Butts	Yes	Cellulose acetate (plasticized)
Eyeglass Lenses	Yes	Polycarbonate / CR-39
Car Tyres	Yes	Synthetic rubber + polymer textiles

Environmental Impact

- ◆ All three items are sources of **microplastic or persistent waste**.
- ◆ Regulatory focus is increasing on:

- **Ban or redesign** of plastic cigarette filters.
- **Eco-friendly lens materials** or recyclable options.
- **Capturing tyre wear particles** using road runoff filters or design innovations.

Source Links:

- ◆ UNEP – The plastic in cigarette butts: <https://www.unep.org/news-and-stories/story/what-plastic-cigarette-filters>

5. Consider the following substances:

- I. Ethanol
- II. Nitroglycerine
- III. Urea

Coal gasification technology can be used in the production of how many of them?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (c) All the three

Explanation:

- ◆ **Ethanol:** Through **syngas** ($\text{CO} + \text{H}_2$) obtained from coal gasification and subsequent chemical processes (Fischer-Tropsch synthesis, or ethanol synthesis pathways), ethanol can be industrially derived. **Can be produced**
- ◆ **Nitroglycerine:** While nitroglycerine itself is made by nitrating glycerol (not directly from coal), **coal gasification** can provide feedstocks like **glycerol substitutes** or intermediates (via syngas chemistry) that are precursors to nitroglycerine. The key role here is indirect contribution of chemical precursors from coal. **Indirectly feasible via precursors**
- ◆ **Urea:** Coal gasification produces **ammonia** (NH_3) via syngas, and **urea is produced by reacting ammonia with CO_2** — both of which can be derived from coal. **Directly produced**

Supplementary Notes:

- ◆ **Coal gasification** is a process that converts coal into syngas (a mixture of carbon monoxide and hydrogen). This syngas can be further processed to create:
 - **Liquid fuels** (e.g., ethanol, methanol)
 - **Chemicals** (e.g., urea, ammonia)
 - **Explosive precursors** (e.g., nitric acid and nitrated compounds)
- ◆ India's **National Mission on Coal Gasification** encourages using coal to manufacture methanol, fertilizers (urea), and even clean fuels.

What is Coal Gasification?

- ◆ **Coal gasification** is a thermo-chemical process that **converts coal into synthesis gas (syngas)** — a mixture primarily of **hydrogen (H_2)**, **carbon monoxide (CO)**, and **carbon dioxide (CO_2)**. The process occurs under high temperatures (1000°C or more) with a **controlled amount of oxygen and/or steam**, but without complete combustion.
- ◆ This **syngas** serves as a **building block** for multiple downstream products, including:
 - **Fertilizers (urea, ammonia)**
 - **Liquid fuels (via Fischer-Tropsch synthesis, ethanol from syngas)**
 - **Explosives (via intermediate chemicals)**
- ◆ **Ethanol ($\text{C}_2\text{H}_5\text{OH}$) (Can be produced)**
 - **Yes**, ethanol can be produced **indirectly** through coal gasification.
 - Process:
 - **Coal \rightarrow Syngas ($\text{CO} + \text{H}_2$)**
 - **Syngas \rightarrow Ethanol** via **biochemical fermentation** (using engineered microbes) or **thermochemical synthesis**.

- ◆ This method is part of the **second-generation biofuel and synthetic fuel** technologies.
- ◆ **Example:** LanzaTech (USA) and China have operational plants producing **ethanol from industrial syngas**.
- ◆ India also plans to use coal gasification for ethanol production under **National Coal Gasification Mission** (2020 onwards).

Sources:

- ◆ <https://www.energy.gov/eere/bioenergy/ethanol-synthesis-gas>
- ◆ <https://www.downtoearth.org.in/news/energy/coal-gasification-mission-india-s-bid-for-energy-security-76106>

Nitroglycerine ($C_3H_5N_3O_9$) (Can be indirectly produced)

- ◆ Nitroglycerine is **not** a direct product of coal gasification, **but its key inputs can be synthesized from syngas**.
- ◆ Ingredients needed:
 - **Glycerol (from biomass or petrochemicals)**
 - **Nitric acid (HNO_3)**
 - **Sulfuric acid (H_2SO_4)**
- ◆ **Nitric acid** can be derived from **ammonia**, which is itself produced from **coal-derived syngas** via the **Haber-Bosch process**.
- ◆ So, **indirectly**, coal gasification can contribute to nitroglycerine synthesis.
- ◆ While **coal gasification doesn't produce nitroglycerine directly**, it helps synthesize **precursors** like ammonia → nitric acid → explosives.

Sources:

- ◆ <https://www.sciencedirect.com/science/article/abs/pii/S1876610217304523>
- ◆ <https://www.britannica.com/science/nitroglycerin>

Urea ($CO(NH_2)_2$) (Can be directly produced)

- ◆ **Yes**, coal gasification is a major route to produce **urea-based fertilizers**.
- ◆ Process:
 - **Coal → Syngas**
 - **Syngas → Ammonia (NH_3) + CO_2**
 - **Ammonia + CO_2 → Urea**
- ◆ Many Indian fertilizer plants are **shifting to coal-based gasification** to reduce dependence on natural gas.
- ◆ Example: **Talcher Fertilizer Plant (Odisha)** is India's first large-scale coal-to-urea project.

Sources:

- ◆ <https://fert.nic.in/about-us/divisions/coal-gasification>

6. What is the common characteristic of the chemical substances generally known as CL-20, HMX and LLM-105, which are sometimes talked about in media?

- These are alternatives to hydro-fluorocarbon refrigerants
- These are explosives in military weapons
- These are high-energy fuels for cruise missiles
- These are fuels for rocket propulsion

Correct Option: (b) These are explosives in military weapons

Explanation:

- ◆ **CL-20 (Hexanitrohexaazaisowurtzitane):** One of the most powerful non-nuclear explosives ever synthesized. It has higher detonation velocity and pressure than HMX or RDX. **Military explosive**
- ◆ **HMX (High Melting Explosive or Octogen):** A powerful high explosive used in military applications such as missile warheads, mines, and rocket propellants. **Military explosive**

- ♦ **LLM-105 (2,6-diamino-3,5-dinitropyrazine-1-oxide):** A newer insensitive high explosive designed to provide high performance with reduced sensitivity. Used in warhead formulations. **Military explosive**
- ♦ All three are part of the family of **high-energy materials (HEMs)** used in defense, especially in **warheads, bombs, and strategic munitions**.

Supplementary Notes:

- ♦ These substances are **not fuels** or **refrigerants** but **explosives** used for:
 - Increasing explosive power (CL-20 has higher energy than HMX)
 - Creating less sensitive but powerful charges (LLM-105)
 - Strategic missile warheads, shaped charges, and penetration munitions
- ♦ They are under the domain of **energetic materials** research by defense agencies like DRDO and DARPA.

What is Common Among CL-20, HMX, and LLM-105?

- ♦ All three substances are classified as **high-energy explosives** used primarily in **military-grade weaponry** and **defense applications**. They are among the most powerful **insensitive high explosives (IHEs)** developed to date and are used to enhance the **lethality, performance, and safety** of modern munitions.
- ♦ They belong to the class of **nitramine-based explosives**, which are organic compounds containing nitro groups that release large amounts of energy upon detonation.

CL-20 (Hexanitrohexaazaisowurtzitane)

- ♦ **Also known as:** China Lake Compound No. 20
- ♦ **Invented at:** Naval Air Weapons Station China Lake, USA
- ♦ **Energy:** ~20% more powerful than HMX and RDX
- ♦ **Density:** ~2.04 g/cm³ (very high)
- ♦ **Usage:** Warheads, propellants, and thermobaric bombs
- ♦ **Advantage:** Superior detonation pressure and velocity
- ♦ **Challenge:** High cost and complex synthesis limit mass production
- ♦ India has developed **CL-20 indigenously** at **High Energy Materials Research Laboratory (HEMRL), DRDO, Pune**, making it among the few countries with this capability.

HMX (High Melting eXplosive / Octogen)

- ♦ **Chemical Name:** Cyclotetramethylene-tetranitramine
- ♦ **Class:** Nitramine explosive
- ♦ **More powerful than:** RDX (~30% more)
- ♦ **Use Cases:**
 - Solid rocket propellants
 - Plastic bonded explosives
 - Nuclear weapon triggers
- ♦ **Noted for:** High detonation velocity (~9.1 km/s)
- ♦ **Insensitive:** Safer to handle than TNT
- ♦ HMX is commonly blended with other compounds like **polymer binders** to form **PBX (Plastic Bonded Explosives)**.

LLM-105 (2,6-diamino-3,5-dinitropyrazine-1-oxide)

- ♦ **Developed by:** Los Alamos National Laboratory (USA)
- ♦ **Purpose:** To produce a **thermally stable, less sensitive explosive** with high power
- ♦ **Properties:**
 - Less sensitive than RDX and HMX
 - Thermally stable above 280°C
 - Still under evaluation for large-scale military applications
- ♦ **Use Case:** Replaces older explosives where safety and stability are paramount (e.g., **submarine-launched missiles, artillery shells**)

- ◆ LLM-105 represents **next-generation insensitive munitions**, particularly where storage safety is a concern.

Comparison Table

Property	CL-20	HMX	LLM-105
Developed by	China Lake, USA	USA (WWII Era)	Los Alamos Nat'l Lab, USA
Energy Yield	Highest (~20% more than HMX)	High	Comparable to RDX/HMX
Detonation Speed	~9.5 km/s	~9.1 km/s	~8.1 km/s
Sensitivity	High	Moderate	Low
Use Case	Advanced missiles, warheads	Propellants, PBX	Safer military-grade explosives

Importance in India's Defense Context

- ◆ India's **DRDO** and **HEMRL** have been actively working on synthesizing CL-20 and HMX for:
 - **Pinaka rockets**
 - **Agni series of missiles**
 - **Naval warheads**
- ◆ These compounds improve the **range and penetration** of munitions without increasing payload mass.

Environmental & Strategic Aspects

- ◆ **Insensitive munitions** (like LLM-105) are less prone to accidental detonation during storage and handling.
- ◆ **High energy-to-weight ratio** is crucial in modern warfare where compact, potent munitions are needed.
- ◆ Global **export restrictions** (under Wassenaar Arrangement) limit access to such high-energy materials, making **indigenous development** strategically important.

Source Links:

- ◆ Defence Research and Development Organisation (DRDO) – Energetic Materials: <https://www.drdo.gov.in/labs-and-establishments/high-energy-materials-research-laboratory-hemrl>

7. Consider the following statements:

- It is expected that Majorana 1 chip will enable quantum computing.
- Majorana 1 chip has been introduced by Amazon Web Services (AWS).
- Deep learning is a subset of machine learning.

Which of the statements given above are correct?

- I and II only
- II and III only
- I and III only
- I, II and III

Correct Option: (c) I and III only

Explanation:

- ◆ **Statement I is correct:** The **Majorana 1 chip** is designed for **topological quantum computing** using **Majorana zero modes (MZMs)**. These exotic quasiparticles are theorized to be more resistant to decoherence—a major challenge in quantum computing. This makes them highly attractive for **stable qubits**. The chip has been developed in experiments involving Microsoft and Quantinuum—not AWS.

- ◆ **Statement II is incorrect:** The Majorana-based quantum computing research is primarily led by **Microsoft** and **academic institutions** (e.g., Delft University, University of Copenhagen). **Amazon Web Services (AWS)** does have its **Braket** platform for quantum computing, but it is not linked to the Majorana 1 chip.
- ◆ **Statement III is correct:** **Deep learning** is indeed a **subset of machine learning**. It involves multi-layered neural networks that automatically extract features and learn complex patterns from large datasets. Examples: image recognition, language translation, autonomous driving.

Supplementary Notes:

- ◆ **Majorana fermions** are particles that are their own antiparticles. Using them for qubit construction could offer **fault-tolerant quantum computation**.
- ◆ **Quantum chips** using topological qubits may overcome instability found in traditional superconducting or ion-trap qubits.
- ◆ **Deep learning** emerged from advances in computing power and large-scale data, enabling systems like GPT, image classifiers, and deep reinforcement learning.

Source Links:

- ◆ MIT Technology Review – Deep Learning vs Machine Learning: <https://www.technologyreview.com/2017/11/17/148511/what-is-deep-learning-and-how-does-it-work/>

8. With reference to monoclonal antibodies, often mentioned in news, consider the following statements:

- They are man-made proteins.
- They stimulate immunological function due to their ability to bind to specific antigens.
- They are used in treating viral infections like that of Nipah virus.

Which of the statements given above are correct?

- I and II only
- II and III only
- I and III only
- I, II and III

Correct Option: (d) I, II and III

Explanation:

- ◆ **Statement I is correct:** **Monoclonal antibodies (mAbs)** are **man-made proteins** created in laboratories to mimic the immune system's ability to fight pathogens. They are derived by cloning a unique white blood cell and are designed to bind to specific targets (antigens) on pathogens or cells.
- ◆ **Statement II is correct:** These antibodies **bind with high specificity to antigens**, such as viral proteins or cancer cell markers, thereby enhancing immune responses like **neutralization**, **phagocytosis**, or **cytotoxicity**.
- ◆ **Statement III is correct:** **Monoclonal antibodies have been used in treating viral infections**, including **Ebola**, **COVID-19**, and **Nipah virus**. For Nipah, **m102.4**, a human monoclonal antibody, has been shown effective in non-human primate studies and has been used in emergency compassionate use cases.

Supplementary Notes:

- ◆ Monoclonal antibodies are central to **precision medicine**.
- ◆ They are used in:
 - **Cancer therapies** (e.g., Rituximab, Trastuzumab)
 - **Autoimmune diseases** (e.g., Adalimumab)
 - **Infectious diseases** (e.g., REGN-COV2 for COVID-19, m102.4 for Nipah)
- ◆ They work by **blocking receptor-ligand interactions**, **tagging cells for immune destruction**, or **delivering toxins** to specific cells.

Source Links:

- ◆ CDC on monoclonal antibodies for viral infections: <https://www.cdc.gov/coronavirus/2019-ncov/your-health/treatments-for-severe-illness.html>

9. Consider the following statements:

- I. No virus can survive in ocean waters.
- II. No virus can infect bacteria.
- III. No virus can change the cellular transcriptional activity in host cells.

How many of the statements given above are correct?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (d) None

Explanation:

- ◆ **Statement I is incorrect:** Viruses **do survive and are abundant in ocean waters**. In fact, **marine viruses** are one of the most numerous biological entities in the ocean, playing a significant role in regulating microbial populations and ocean ecosystems. For example, **cyanophages** infect marine cyanobacteria.
- ◆ **Statement II is incorrect: Bacteriophages** (also known as phages) are viruses that specifically infect bacteria. They are well-studied for their roles in bacterial ecology, horizontal gene transfer, and even as potential antibiotics.
- ◆ **Statement III is incorrect:** Viruses **change host cellular transcriptional activity** by hijacking the host cell machinery to transcribe and replicate their own genetic material. Many viruses manipulate transcriptional processes to enhance their survival and propagation.

Supplementary Notes:

- ◆ The ocean **contains an estimated 10^{80} viruses**, most of which infect bacteria and other microorganisms.
- ◆ **Bacteriophages** are being explored for phage therapy to combat antibiotic-resistant bacterial infections.
- ◆ Viral manipulation of host cell transcription is fundamental to viral life cycles and pathogenesis—for example, **HIV, influenza, and SARS-CoV-2** alter host gene expression extensively.

Source Links:

- ◆ Science – “Viruses in the ocean”: <https://www.science.org/doi/10.1126/science.1124031>

10. Consider the following statements:

Statements I:

Activated carbon is a good and an attractive tool to remove pollutants from effluent streams and to remediate contaminants from various industries.

Statements II:

Activated carbon exhibits a large surface area and a strong potential for adsorbing heavy metals.

Statements III:

Activated carbon can be easily synthesized from environmental wastes with high carbon content.

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

- (a) Both Statements II and Statement III are correct and both of them explain Statement I
- (b) Both Statement II and Statement III are correct but only one of them explains Statement I
- (c) Only one of the Statements II and III is correct and that explains Statement I
- (d) Neither Statement II nor Statement III is correct

Correct Option: (a) Both Statement II and Statement III are correct and both of them explain Statement I

Explanation:

- ◆ **Statement I is correct:** Activated carbon is widely used in **wastewater treatment, air purification, and industrial filtration** due to its ability to **adsorb a wide range of pollutants**.
- ◆ **Statement II is correct:** Activated carbon has an **extremely high surface area** (500–1500 m²/g), making it ideal for **adsorbing organic pollutants and heavy metals** such as lead, arsenic, and mercury from industrial effluents.
- ◆ **Statement III is correct:** It can be **easily synthesized** from **environmental or agricultural waste materials** like coconut shells, rice husks, sawdust, and other **carbon-rich biomass** by pyrolysis or chemical activation.
- ◆ **Do II and III explain I?** Yes. Statement II explains *why* activated carbon is a powerful adsorbent, and Statement III explains *how* it can be produced easily, making it an attractive and cost-effective option. Together, they justify why activated carbon is a “good and attractive tool” as per Statement I.

Supplementary Notes:

- ◆ Activated carbon is **non-toxic, regenerable**, and works via **adsorption** rather than absorption.
- ◆ It is used in industries like **textiles, dyeing, petroleum refining, and pharmaceuticals**.
- ◆ Its popularity is also due to the **low cost and availability of raw materials** for synthesis.

What is Activated Carbon?

- ◆ **Activated carbon** (also called **activated charcoal**) is a **highly porous form of carbon** with a **very large surface area**, typically derived from carbonaceous materials such as:
 - Coconut shells
 - Wood
 - Coal
 - Agricultural residues (e.g., rice husks, nut shells)
- ◆ It is produced via **activation processes**:
 - **Physical Activation:** Using gases like CO₂ or steam at high temperatures.
 - **Chemical Activation:** Using agents like phosphoric acid or potassium hydroxide.
- ◆ The result is a network of **micropores and mesopores** which provide a surface area of **500–1500 m²/g**, enabling powerful **adsorption** capabilities.

Why Is It Called a “Pollution Sponge”?

- ◆ Activated carbon works through **adsorption**, where pollutants **stick to the surface** of the carbon particles. This makes it especially effective in removing:
 - **Heavy metals** (e.g., lead, mercury, cadmium)
 - **Organic pollutants** (e.g., pesticides, VOCs)
 - **Odors and taste agents**
 - **Dyes and pigments**
 - **Gaseous emissions** (e.g., SO₂, NO_x)

Key Advantages of Activated Carbon

Property	Impact
Large surface area	Enables strong adsorption of contaminants
Porous structure	Facilitates trapping of molecules
Surface functional groups	Enhance binding of metals and organics
Reusability	Can be reactivated and reused (in some cases)
Versatility	Works in gases, liquids, effluent streams

Industrial and Environmental Applications

◆ Effluent Treatment

- Widely used in **industrial wastewater treatment** plants to remove:
 - Dyes
 - Phenols
 - Detergents
 - Pesticides
- Especially effective in **tertiary treatment** stages for polishing and trace removal.

◆ Air Purification

- Used in:
 - **Gas masks**
 - **HVAC filters**
 - **Chimney scrubbers**
- Removes **volatile organic compounds (VOCs)** and toxic gases.

◆ Water Purification

- Municipal drinking water filters, home purifiers, and commercial water treatment facilities use it to remove:
 - **Chlorine**
 - **Taste and odor compounds**
 - **Organic contaminants**

◆ Remediation of Contaminated Soils and Groundwater

- Activated carbon is injected into polluted sites to **immobilize pollutants**.
- Used in **in-situ remediation** of brownfields and industrial sites.

◆ Pharmaceutical and Food Industry

- Used to **decolorize** liquids, **purify drugs**, and in **toxin absorption** (e.g., poisoning treatment via oral activated charcoal).

Why Use Environmental Wastes to Produce It?

- ◆ Biomass materials rich in carbon (e.g., coconut shells, nutshells, sawdust) offer:
 - Low-cost raw materials
 - Renewable and sustainable production
 - Waste-to-value advantage
- ◆ India has seen R&D in converting **agricultural residues** like **sugarcane bagasse** or **peanut shells** into activated carbon, boosting **circular economy** objectives.

Important Scientific Studies & References

- ◆ **Activated carbon from coconut shells** has been shown to be highly effective in treating **textile industry effluents**.
- ◆ **Rice husk-based activated carbon** shows high surface area (~980 m²/g) and is widely used in **arsenic removal** from groundwater in eastern India.
- ◆ **Biochar-based activated carbon** is being explored for heavy metal remediation.

Academic & Policy Angle

- ◆ Featured in **CPCB (Central Pollution Control Board)** guidelines for effluent treatment.
- ◆ Listed as a **Best Available Technique (BAT)** by the **European IPPC Bureau** for industrial pollution control.

Source Links:

- ◆ EPA (United States) – Use of Activated Carbon in Wastewater: <https://www.epa.gov/remedytech/activated-carbon-treatment>

11. Consider the following statements:

Statements I:

Studies indicate that carbon dioxide emissions from cement industry account for more than 5% of global carbon emissions.

Statements II:

Silica-bearing clay is mixed with limestone while manufacturing cement.

Statement III:

Limestone is converted into lime during clinker production for cement manufacturing.

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

- (a) Both Statements II and Statement III are correct and both of them explain Statement I
- (b) Both Statement II and Statement III are correct but only one of them explains Statement I
- (c) Only one of the Statements II and III is correct and that explains Statement I
- (a) Neither Statement II nor Statement III is correct

Correct Option: (a) Both Statement II and Statement III are correct and both of them explain Statement I

Explanation:

- ♦ **Statement I is correct:** Cement production is a **major contributor to global CO₂ emissions**, estimated to be **about 7–8%** globally, largely due to the **decarbonation of limestone** and **fuel combustion** during clinker production.
- ♦ **Statement II is correct:** In cement manufacturing, **silica-bearing clay** (or other sources like shale) is **mixed with limestone** to provide **silica (SiO₂)**, **alumina (Al₂O₃)**, and **iron oxides (Fe₂O₃)** — essential for forming the **clinker**.
- ♦ **Statement III is correct:** **Limestone (CaCO₃)** is **thermally decomposed** into **lime (CaO)** and **CO₂** during the **calcination process** in a kiln — this is the **main source** of process-related CO₂ emissions.
- ♦ **Do II and III explain I?** Yes. Statement II explains the raw materials involved, and Statement III explains **how CO₂ is emitted** from limestone. Together, they explain **why** cement contributes heavily to global carbon emissions.

Supplementary Notes:

- ♦ The **calcination reaction**: $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2 \uparrow$
- ♦ Cement production emits CO₂ in two ways:
 - **Process emissions:** due to chemical conversion (limestone to lime)
 - **Energy emissions:** from burning fossil fuels in kilns
- ♦ Hence, carbon reduction in the **cement industry** is a major climate goal. Approaches include:
 - Clinker substitution (e.g., fly ash, slag)
 - Carbon capture and storage
 - Using alternative fuels (waste biomass)

Cement Industry & CO₂ Emissions

- ♦ The **cement industry** is a **major contributor to global carbon dioxide emissions**, accounting for **approximately 7–8% of total anthropogenic CO₂ emissions worldwide**, according to the International Energy Agency (IEA).
- ♦ This high emission rate is due to two major factors:
 - **Calcination of limestone (CaCO₃)** → CO₂ is released as limestone is converted to lime (CaO)
 - **Combustion of fossil fuels** in kilns to achieve high temperatures (1400–1500°C)
- ♦ Thus, CO₂ emissions in cement production are both:
 - **Process-related** (from chemical reactions)
 - **Energy-related** (from fuel combustion)

Cement Production and Its Environmental Impact

◆ Role of Limestone

- Limestone (CaCO_3) is the **primary raw material** used to make **clinker** — the main ingredient in cement.
- Calcination process:** $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2 \uparrow$
- Nearly **60–65% of the CO_2** emissions from cement come from this **decarbonation reaction** alone.

◆ Role of Silica-bearing Clays

- Clays rich in **silica (SiO_2)**, **alumina (Al_2O_3)**, and **iron oxides (Fe_2O_3)** are mixed with limestone to create a **raw meal**.
- This mix is then heated in kilns to produce **clinker**.
- Silica helps form compounds like **tricalcium silicate (C_3S)** and **dicalcium silicate (C_2S)**, essential for cement strength and setting time.

◆ Clinker Production = Carbon Intensive

- Clinker accounts for the **bulk of cement's carbon footprint**.
- For every **1 tonne of clinker**, **~ 0.9 tonnes of CO_2** is released.
- Hence, reducing clinker content (via fly ash, slag, calcined clay) is a major **decarbonization strategy**.

Climate and Environmental Implications

- Cement's global output was **4.3 billion tonnes in 2023**, and growing.
- If the cement industry were a country, it would be the **third-largest CO_2 emitter**, behind China and the US.
- The IPCC has flagged the **urgent need to decarbonize cement**, especially in fast-urbanizing countries like India.

Innovations and Decarbonization Efforts

- To reduce emissions, several strategies are being pursued:

Strategy	Description
Blended Cement	Use of fly ash, slag, calcined clay to reduce clinker-to-cement ratio. Example: Portland Pozzolana Cement (PPC)
Carbon Capture & Storage (CCS)	Capturing CO_2 at source and storing it underground. Still expensive and under pilot stages
Alternative Fuels	Use of RDF (refuse-derived fuels), biomass, and waste oils instead of coal
Geopolymer Cement	Cement made from industrial by-products (e.g., fly ash + alkaline activators) with very low carbon footprint

India's Context

- India is the **second-largest cement producer** globally after China.
- The **Bureau of Energy Efficiency (BEE)** under PAT Scheme (Perform Achieve Trade) has incentivized cement plants to lower emissions.
- Major Indian cement firms like **UltraTech**, **ACC**, and **Dalmia Cement** are investing in **green cement**, energy efficiency, and carbon capture tech.

Component	Function in Cement	CO_2 Impact
Limestone	Source of CaO	Emits CO_2 during calcination
Silica-bearing clay	Provides SiO_2 for strength phases	Low direct CO_2 impact
Clinker	Key intermediate product	Major source of emissions
Kiln	Reactor for clinker formation	High energy consumption

Source Links:

- ◆ Chatham House – Making Concrete Change: <https://www.chathamhouse.org/2018/06/making-concrete-change-innovation-low-carbon-cement-and-concrete>

12. Consider the following statements:

Statement I:

At the 28th United Nations Climate Change Conference (COP28), India refrained from signing the 'Declaration on Climate and Health'.

Statement II:

The COP28 Declaration on Climate and Health is a binding declaration; and if signed, it becomes mandatory to decarbonize health sector.

Statement III:

If India's health sector is decarbonized, the resilience of its health-care system may be compromised.

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

- (a) Both Statements II and Statement III are correct and both of them explain Statement I
- (b) Both Statement II and Statement III are correct but only one of them explains Statement I
- (c) Only one of the Statements II and III is correct and that explains Statement I
- (d) Neither Statement II nor Statement III is correct

Correct Option: (d) Neither Statement II nor Statement III is correct

Explanation:

- ◆ **Statement I is correct:** India **did not sign** the **COP28 Declaration on Climate and Health**, which was adopted by more than 120 countries at COP28 held in Dubai (December 2023). The declaration highlights the interlinkage between climate and health and calls for action, but India refrained citing national circumstances and prioritization of health infrastructure development.
- ◆ **Statement II is incorrect:** The **COP28 Declaration on Climate and Health is non-binding**. It is a **voluntary political commitment**, not a legal or binding treaty. It encourages countries to reduce emissions from the health sector but does **not impose mandatory decarbonization**.
- ◆ **Statement III is incorrect:** **Decarbonizing the health sector does not compromise its resilience**. In fact, decarbonization (e.g., using solar energy for hospitals, efficient infrastructure, clean transport) often **improves resilience**, reduces dependency on fossil fuels, and enhances service delivery in climate-sensitive regions.

Supplementary Notes:

- ◆ **COP28 Declaration on Climate and Health** aimed to:
 - Integrate health priorities into climate policy.
 - Build climate-resilient and low-carbon health systems.
 - Increase funding for climate-health research.
- ◆ India's position: India supports global health action but did not commit to the declaration possibly due to infrastructure capacity, cost concerns, and preference for nationally determined priorities.

Source Links:

- ◆ UN Climate Change COP28 Summary: <https://unfccc.int/news/landmark-declaration-on-climate-and-health-at-cop28>

13. Consider the following statements:

Statement I:

Scientific studies suggest that shift is taking place in the Earth's rotation and axis.

Statement II:

Solar flares and associated coronal mass ejections bombarded the Earth's outermost atmosphere with tremendous amount of energy.

Statement III:

As the Earth's polar ice melts, the water tends to move towards the equator.

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

- (a) Both Statements II and Statement III are correct and both of them explain Statement I
- (b) Both Statement II and Statement III are correct but only one of them explains Statement I
- (c) Only one of the Statements II and III is correct and that explains Statement I
- (d) Neither Statement II nor Statement III is correct

Correct Option: (c) Only one of the Statements II and III is correct and that explains Statement I

Explanation:

- ♦ **Statement I is correct:** Scientific studies using satellite data (like from GRACE satellites) have confirmed that **the Earth's rotational axis is shifting**. This is known as **polar drift** or **true polar wander**. The **direction and speed** of this drift have changed significantly in recent decades.
- ♦ **Statement II is incorrect:** While solar flares and **coronal mass ejections (CMEs)** do impact Earth's **magnetosphere and ionosphere**, they do **not have any significant effect on Earth's rotation or axis**. These solar events impact satellite communication, GPS systems, and power grids—but **not the geophysical axis** of the Earth.
- ♦ **Statement III is correct:** As **polar ice melts due to global warming**, the meltwater **redistributes** itself, predominantly **toward the equator** because of the Earth's rotation. This **mass redistribution affects Earth's moment of inertia**, contributing to **the shift in the Earth's axis**.
- ♦ **Do the statements explain Statement I? Only Statement III explains Statement I.** The melting of polar ice caps alters the mass distribution on Earth, which in turn leads to a shift in its rotation axis.

Supplementary Notes:

- ♦ The Earth's axis has been drifting at about **10 cm per year**, but post-2000, it shifted dramatically eastward due to **accelerated ice melt and groundwater depletion**.
- ♦ NASA and Chinese researchers published a 2021 study noting **climate-induced axis drift**.
- ♦ These shifts **do not affect seasons** but reflect Earth's response to mass changes.

Source Links:

- ♦ NOAA – Understanding Earth's rotation changes: <https://www.ngdc.noaa.gov/geomag/faqgeom.shtml>

14. Consider the following statements:**Statement I:**

Article 6 of the Paris Agreement on climate change is frequently discussed in the global discussions on sustainable development and climate change.

Statement II:

Article 6 of the Paris Agreement on climate change sets out the principles of carbon markets.

Statement III:

Article 6 of the Paris Agreement on climate change intends to promote inter-country non-market strategies to reach their climate targets.

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

- (a) Both Statements II and Statement III are correct and both of them explain Statement I
- (b) Both Statement II and Statement III are correct but only one of them explains Statement I

- (c) Only one of the Statements II and III is correct and that explains Statement I
- (d) Neither Statement II nor Statement III is correct

Correct Option: (a)

Explanation:

- ◆ Statement 1 is correct. Article 6 of the Paris Agreement, which focuses on international cooperation to achieve climate goals, is frequently in the news due to its role in facilitating carbon markets and enabling countries to meet their emission reduction targets.
- ◆ Statement 2 is correct. Article 6 of the Paris Agreement establishes principles for a carbon market, enabling international cooperation and voluntary cooperation to meet climate targets. It provides a framework for countries to transfer mitigation outcomes, such as emission reductions, to help other countries achieve their nationally determined contributions (NDCs).
- ◆ Statement 3 is correct. Article 6 of the Paris Agreement promotes international cooperation to achieve climate targets through both market and non-market approaches. It enables countries to work together, leveraging carbon markets and non-market mechanisms to reach their nationally determined contributions (NDCs).
- ◆ Link: <https://blogs.worldbank.org/en/climatechange/from-paris-to-baku--article-6-rules-finally-take-flight-after-a-#:~:text=Article%206:%20Almost%20a%20Decade,markets%20and%20enhance%20their%20integrity>

15. Which one of the following launched the 'Nature Solutions Finance Hub for Asia and the Pacific'?

- (a) The Asian Development Bank (ADB)
- (b) The Asian Infrastructure investment Bank (AIIB)
- (c) The New Development Bank (NDB)
- (d) The International Bank for reconstruction and Development (IBRD)

Correct Option: (a)

Explanation:

- ◆ The **Nature Solutions Finance Hub (NSFH)** for Asia and the Pacific is an initiative launched by the Asian Development Bank (ADB) at COP28 in December 2023. Its primary goal is to mobilize at least **\$2 billion** in investments by 2030 to support **nature-based solutions (NbS)** that address climate change, biodiversity loss, and environmental degradation across the region.
- ◆ Link: <https://www.adb.org/news/adb-and-partners-launch-nature-financing-initiative-asia-and-pacific>

16. With reference to 'Direct Air Capture', an emerging technology, which of the following statements is/are correct?

- I. It can be used as a way of carbon sequestration.
- II. It can be a valuable approach for plastic production and in food processing.
- III. In aviation, it can be a source of carbon for combining with hydrogen to create synthetic low-carbon fuel.

Select the correct answer using the code given below.

- (a) I and II only
- (b) III only
- (c) I, II and III
- (d) None of the above statements is correct

Correct Option: (c)

Explanation

- ◆ **Statement 1 is correct.** Direct Air Capture (DAC) is a technology that extracts carbon dioxide (CO₂) directly from the atmosphere at any location.
- ◆ **Statement 2 is correct.** Direct Air Capture (DAC) can be a valuable approach for food processing and the plastic industry by providing a source of carbon dioxide (CO₂) that can be used in various processes,

potentially reducing reliance on fossil fuels and improving sustainability. DAC can also contribute to net-zero emission goals by removing CO₂ from the atmosphere and utilizing it as a feedstock for various products.

- ◆ **Statement 3 is correct.** Direct air capture (DAC) technology can be used to produce low-carbon synthetic fuels by capturing atmospheric carbon dioxide (CO₂) and combining it with hydrogen, often produced through renewable energy sources. This process, known as direct air carbon capture and utilization (DACC), creates synthetic fuels like methanol, dimethyl ether, and methane, which can be used as alternatives to fossil fuels.
- ◆ **Link:** <https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage/direct-air-capture>

17. Regarding Peacock tarantula (Gooty tarantula), consider the following statements:

- I. It is an omnivorous crustacean.
- II. Its natural habitat in India is only limited to some forest area.
- III. In its natural habitat, it is an arboreal species.

Which of the statements give above is/are correct?

- (a) I only
- (b) I and III
- (c) II only
- (d) II and III

Correct Option: (d)

Explanation

- ◆ **Statement 1 is incorrect:** It is an arachnid (specifically, a tarantula species), not a crustacean. Its diet is strictly carnivorous, consisting mainly of insects and other invertebrates such as crickets, cockroaches, caterpillars, and beetle larvae, and occasionally scavenging on dead insects or small mammals.
- ◆ **Statement 2 is correct:** Native exclusively to a small area (less than 100 km²) of deciduous forest in Andhra Pradesh, southeast India.
- ◆ **Statement 3 is correct:** Arboreal as adults, living in holes of tall trees and constructing asymmetric funnel webs. Juveniles are more terrestrial, hiding in tree stumps or shallow burrows.

Link:

- ◆ Arkive (via Internet Archive)
- ◆ Animal Diversity Web
- ◆ IUCN Red List – *Poecilotheria metallica*

18. Consider the following statements:

- I. Carbon dioxide (CO₂) emissions in India are less than 0.5 t CO₂/capita.
- II. In terms of CO₂ emissions from fuel combustion, India ranks second in Asia-Pacific region.
- III. Electricity and heat producers are the largest sources of CO₂ emissions in India.

Which of the statements given above is/are correct?

- (a) I and III only
- (b) II only
- (c) II and III only
- (d) I, II and III

Correct Option: (c)

Explanation

- ◆ **Statement 1 is incorrect:** India's per capita CO₂ emissions have increased in recent decades and are currently much higher than 0.5 metric tons per person. As of 2023, India's per capita CO₂ emissions

reached approximately 2.07 metric tons per person. This is still among the lowest in the world for a major economy, but it is well above the 0.5 t CO₂ per capita threshold.

- ◆ **Statement 2 is correct:** in terms of CO₂ emissions from fuel combustion, India ranks second in the Asia-Pacific region, after China. According to the International Energy Agency (IEA), the ranking for CO₂ emissions from fuel combustion in the Asia-Pacific is:
 - China
 - India
 - Japan
 - Indonesia
- ◆ **Statement 3 is correct:** electricity and heat producers are the largest sources of CO₂ emissions in India. In 2022, this sector accounted for 53% of India's total energy-related CO₂ emissions, making it the dominant contributor to the country's carbon footprint

Link:

- ◆ International Energy Agency (IEA) — *CO₂ Emissions from Fuel Combustion*: IEA Emissions by Region Global Carbon Atlas — Global Carbon Project
- ◆ Our World in Data — CO₂ and Greenhouse Gas Emissions
- ◆ International Energy Agency (IEA) — *India Energy Profile and CO₂ Emissions*: IEA India Energy
- ◆ Central Electricity Authority (CEA), Government of India — *Annual Report*: CEA Reports

19. Consider the following pairs:

Plant		Description
I. Cassava	:	Woody shrub
II. Ginger	:	Herb with pseudostem
III. Malabar spinach	:	Herbaceous climber
IV. Mint	:	Annual shrub
V. Papaya	:	Woody shrub

How many of the above pairs are correctly matched?

- (a) Only two
- (b) Only three
- (c) Only four
- (d) All the five

Correct Option: (b)

Explanation:

- ◆ **Pair 1 is correctly matched:** Cassava (*Manihot esculenta*) is a perennial, semi-woody shrub that typically grows between 1 and 5 meters tall, though it can reach up to 7 meters in some cases. It belongs to the Euphorbiaceae family, which includes a wide range of plant types from herbs to trees. The cassava plant has a woody stem that is important for vegetative propagation, and its morphology varies with age and variety
- ◆ **Pair 2 is correctly matched:** ginger (*Zingiber officinale*) is a herbaceous plant that produces pseudostems—false stems made of tightly wrapped leaf bases (leaf sheaths) that grow annually from its underground rhizome. These pseudostems bear narrow leaves and can reach about one meter in height. The rhizome is the thick, branched underground stem from which the pseudostems arise each growing season
- ◆ **Pair 3 is correctly matched:** Malabar spinach (*Basella alba*) is a herbaceous climber. It is a fast-growing, soft-stemmed, semi-succulent vine that can reach lengths of up to 10 meters. It is a perennial vine in tropical regions but often grown as an annual in cooler climates. The plant has twining stems and thick, fleshy leaves, making it a vigorous climbing herbaceous plant rather than a woody climber
- ◆ **Pair 4 is incorrectly matched:** Mint (*Mentha* spp.) is not an annual shrub. It is a perennial herb, meaning it grows back year after year and is not woody like a shrub. Mint plants have soft, green stems rather than woody ones, and they spread vigorously through underground runners. They are hardy, aromatic, and can live for several years, dying back in winter and regrowing in spring

- ◆ **Pair 5 is incorrectly matched:** Papaya (*Carica papaya*) is not a woody shrub. It is classified as a large herbaceous plant or small tree-like plant that typically grows from 5 to 10 meters tall with a single, soft, and sparsely branched stem. The plant lacks secondary growth, meaning it does not develop woody tissue like true trees or shrubs. Its stem is relatively soft and herbaceous, and the large leaves are confined to the top of the trunk

Link:

- ◆ FAO, Cassava Production and Uses — *FAO Cassava*
- ◆ National Horticulture Board, India — *Ginger Production*
- ◆ Indian Council of Agricultural Research (ICAR) — *Basella alba* Crop Profile
- ◆ Missouri Botanical Garden — *Mentha spp.* Missouri Botanical Garden

20. With reference to the planet Earth, consider the following statements:

- Rain forests produce more oxygen than that produced by oceans.
- Marine phytoplankton and photosynthetic bacteria produce about 50% of world's oxygen.
- Well-oxygenated surface water contains several folds higher oxygen than that in atmospheric air.

Which of the statements given above is/are correct?

- I and II
- II only
- I and III
- None of the above statements is correct

Correct Option: (b)

Explanation:

- ◆ **Statement 1 is incorrect** 1. Scientific consensus shows that the oceans, primarily through phytoplankton, produce significantly more oxygen than rainforests. Estimates indicate that 50–80% of the Earth's oxygen is produced by oceanic plankton—microscopic plants, algae, and some bacteria that photosynthesize. In contrast, all the world's forests, including tropical rainforests, contribute a much smaller share, with tropical forests responsible for about one-third of land photosynthesis, and the Amazon itself generating only a fraction of that.
- ◆ **Statement 2 is correct:** it is true that marine phytoplankton and photosynthetic bacteria produce about 50% of the world's oxygen. Multiple scientific sources confirm that oceanic plankton—including phytoplankton, algae, and photosynthetic bacteria such as *Prochlorococcus*—are responsible for roughly half of the Earth's oxygen production through photosynthesis. This contribution is comparable to, or even greater than, the oxygen produced by all terrestrial plants combined.
- ◆ **Statement 3 is incorrect:** Well-oxygenated surface water contains much less oxygen than atmospheric air, not several folds higher. Well-oxygenated surface water typically contains around 8 mg O₂ per liter, while atmospheric air contains about 210 mg O₂ per liter. This means that air has dozens of times more oxygen per unit volume than even the most oxygen-rich surface water. Oxygen is much less soluble in water than in air, so even at 100% saturation, water cannot hold as much oxygen as air does.

Link:

- ◆ National Oceanic and Atmospheric Administration (NOAA), *Phytoplankton and Oxygen Production* — NOAA
- ◆ World Wildlife Fund (WWF) — *Ocean Oxygen* WWF
- ◆ U.S. Geological Survey (USGS) — *Dissolved Oxygen in Water* USGS

21. Consider the following statements about Raja Ram Mohan Roy:

- He possessed great love and respect for the traditional philosophical systems of the East.
- He desired his countrymen to accept the rational and scientific approach and the principle of human dignity and social equality of all men and women.

Which of the statements given above is/are correct?

- I only
- II only

- (c) Both I and II
- (d) Neither I nor II

Correct Answer: (c)

Explanation:

- ◆ Statement 1 is correct. Raja Ram Mohan Roy was indeed known for his love and respect for Eastern cultures, particularly those of India. He was a scholar of Sanskrit, Persian, and Arabic, and he deeply understood Indian philosophy, including Hinduism, Buddhism, and Islam.
- ◆ Statement 2 is correct. Raja Ram Mohan Roy was a strong advocate for rationalism and reason. He actively promoted critical thinking and advocated for a more enlightened society based on logic and evidence.

Link:

- ◆ <https://www.dailypioneer.com/2023/columnists/the-legacy-of-raja-ram-mohan-roy.html#:~:text=Raja%20Ram%20Mohan%20Roy%20emphasized,and%20significance%20of%20such%20teachings.>

22. Consider the following subjects with regard to Non-Cooperation Programme:

- I. Boycott of law-courts and foreign cloth
- II. Observance of strict non-violence
- III. Retention of titles and honours without using them in public
- IV. Establishment of Panchayats for settling disputes

How many of the above were parts of Non-Cooperation Programme?

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All the four

Correct Option: (c)

Explanation:

- ◆ Statement 1 is correct. A key aspect of the Non-Cooperation Movement was the boycott of law courts and foreign clothes, as well as other forms of non-cooperation with the British government. This movement, launched by Mahatma Gandhi, aimed to achieve self-rule (Swaraj) through peaceful resistance.
- ◆ Statement 2 is incorrect. Non-Cooperation Movement (1920-1922) was not characterized by strict adherence to non-violence, a core principle of Mahatma Gandhi's philosophy of Satyagraha.
- ◆ Statement 3 is incorrect. During the Non-Cooperation Movement, individuals were encouraged to renounce titles and honorary positions given by the British government as a form of resistance. This included returning British Raj medals, titles, and honors. Notable examples include Mahatma Gandhi surrendering his title of "Kaiser-i-Hind", and Lala Murlidhar Rai giving up his "Rai Sahib" and "Kaiser-I-Hind" titles.
- ◆ Statement 4 is correct. During the Non-Cooperation Movement of 1920-1922, Mahatma Gandhi encouraged the establishment of panchayats as a way to resolve disputes, particularly in response to the boycott of British courts. Panchayats, which are traditional village councils, were seen as a form of alternative dispute resolution, aiming to provide justice and address local issues outside the British legal system.

Link: <https://newmancollege.ac.in/wp-content/uploads/2022/07/NON-COOPERATION-MOVEMENT.pdf>

23. The irrigation device called 'Araghatta' was

- (a) a water bag made of leather pulled over a pulley
- (b) a large wheel with earthen pots tied to the outer ends of its spokes
- (c) a larger earthen pot driven by bullocks
- (d) a large water bucket pulled up by rope directly by hand

Correct Option: (b)

Explanation:

- ◆ Araghatta is a Persian wheel, a mechanical water-lifting device used for irrigation in medieval India. It's a wheel with buckets or pots attached, rotated by animals like bullocks or camels, raising water from wells to irrigate fields. The name "Araghatta" comes from the Sanskrit words "ara" (spoke) and "ghatta" (pot), referring to the structure of the wheel

Link:

- ◆ https://manikchakcollege.ac.in/pdf/1674564147_Doc.pdf

24. Who among the following rulers in ancient India had assumed the titles 'Mattavilasa', 'Vichitrachitta' and 'Gunabhara'?

- (a) Mahendravarman I
- (b) Simhavishnu
- (c) Narasimhavarman I
- (d) Simhavarman

Correct Option: (a)

Explanation:

- ◆ The titles "Mattavilasa," "Vichitrachitta," and "Gunabhara" were held by Mahendravarman I, a Pallava king. "Mattavilasa" means "addicted to pleasures," "Vichitrachitta" translates to "curious-minded," and "Gunabhara" signifies "virtuous". Mahendravarman I was also known as "Chitrakarapuli" (tiger among painters). He was a prominent ruler of the Pallava dynasty, known for his artistic and literary contributions, as well as his patronage of various artistic activities.

Link: http://protamil.com/india/india-history/pallavas-2.html#google_vignette

25. Fa-hien (Faxian), the Chinese pilgrim, travelled to India during the reign of

- (a) Samudragupta
- (b) Chandragupta II
- (c) Kumaragupta I
- (d) Skandagupta

Correct Option: (b)

Explanation:

- ◆ Fa-Hien travelled to India during the reign of Chandragupta II of the Gupta Empire. He was a Chinese Buddhist pilgrim who came to India in the early 5th century AD.

Link: <https://www.peepultree.world/livehistoryindia/story/people/fa-hien?srsId=AfmBOoruHBmOgtpiPc0aekJc5llw5udLhlybKUZ8hqOGHKCbWpfgoB-l>

26. Who among the following led a successful military campaign against the kingdom of Srivijaya, the powerful maritime State, which ruled the Malay Peninsula, Sumatra, Java and the neighbouring islands?

- (a) Amoghavarsha (rashtrakuta)
- (b) Prataparudra (Kakatiya)
- (c) Rajendra I (Chola)
- (d) Vishnuvardhana (Hoysala)

Correct Option: (c)

Explanation:

- ◆ The Chola king who led a successful campaign against the Kingdom of Srivijaya was Rajendra I Chola. His expedition, which took place in 1025 CE, resulted in a significant weakening of Srivijaya and its influence over Southeast Asia.

Link: <https://swarajyamag.com/ideas/the-wars-that-were-won-rajendra-cholas-naval-conquest-of-south-east-asia#:~:text=At%20the%20end%20of%20the,away%20from%20Srivijayan%20overlord%2Dship>.

27. With reference to ancient India (600-322 BC), consider the following pairs:

Territorial region		River flowing in the region
I. Asamaka	:	Godavari
II. Kamboja	:	Vipas
III. Avanti	:	Mahanadi
IV. Kosala	:	Sarayu

How many of the pairs given above are correctly matched?

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All the four

Correct Option: (b)

Explanation:

- ◆ **Pair 1 is correctly matched:** the Asmaka (or Assaka) territorial region was located on the banks of the Godavari River. Asmaka was one of the sixteen Mahajanapadas in ancient India, situated in the southern part of the subcontinent, covering parts of present-day Telangana, Maharashtra, and Andhra Pradesh. Its capital was variously named Podana, Potali, Paudanyapura, or Potana, identified with modern-day Bodhan in Telangana. The region lay between the Godavari River and neighboring territories such as Mulaka and Kalinga
- ◆ **Pair 2 is incorrectly matched: 2.** The Vipasa River, known in modern times as the Beas River, flows through the states of Himachal Pradesh and Punjab in northwestern India. The ancient Kamboja territorial region, as described in historical and Vedic sources, was generally located further northwest, around what is now eastern Afghanistan and northern Pakistan, not in the direct path of the Beas (Vipasa) River. Therefore, the statement that the Vipasa (Beas) River passes through the Kamboja territorial region is not supported by historical or geographical evidence. The Beas River does not flow through the traditional territory of Kamboja
- ◆ **Pair 3 is incorrectly matched:** the Mahanadi River does not pass through the Avanti kingdom. The ancient Avanti kingdom was located in the region corresponding to present-day Malwa and parts of western Madhya Pradesh. Its main rivers were the Narmada (with Mahishmati as a southern capital) and the Sipra (with Ujjaini as a northern capital). The Mahanadi River, on the other hand, flows much further east, primarily through present-day Chhattisgarh and Odisha, and does not cross the territory historically associated with Avanti.
- ◆ **Pair 4 is correctly matched:** the Kosala kingdom was located on the Saryu River. Ancient sources and historical records confirm that Kosala extended across both banks of the Saryu (modern Ghaghara) River, with its capital Ayodhya situated on its banks. The Saryu was the principal river of the Kosala region and played a central role in its geography and history

Link:

- ◆ **Source 1:** *Romila Thapar, Early India: From the Origins to AD 1300* – mentions Asmaka as the only Mahajanapada located in the southern Deccan and near the Godavari.
- ◆ **Source 1:** *Hemchandra Raychaudhuri, Political History of Ancient India* – places Kamboja in the northwest, around eastern Afghanistan and modern northern Pakistan.
- ◆ **Source 1:** *Historical Geography of Ancient India* by B.C. Law – defines Avanti's borders, centered in Malwa, and its major cities.
- ◆ **Source 2:** *A History of Ancient and Early Medieval India* by Upinder Singh – mentions Ayodhya on the banks of the Saryu and its role in Kosala's geography.

28. The first Gandharva Mahavidyalaya, a music training school, was set up in 1901 by Vishnu Digambar Paluskar in

- (a) Delhi
- (b) Gwalior

- (c) Ujjain
- (d) Lahore

Correct Option: (d)

Explanation:

- ◆ The first Gandharva Mahavidyalaya, a music training school, was set up in Lahore on 5 May 1901 by Vishnu Digambar Paluska
- ◆ There is clear evidence that the original Gandharva Mahavidyalaya was established in Lahore in 1901 by Vishnu Digambar Paluskar.
- ◆ On May 5, 1901, Paluskar set up a music school called Gandharva Mahavidyalaya in Lahore, which included a hostel, an instrument repair section, and a printing press for music publications.
- ◆ This institution is widely recognized as the first Gandharva Mahavidyalaya and the foundation for the later Akhil Bharatiya Gandharva Mahavidyalaya Mandal.
- ◆ The school remained in Lahore until Paluskar moved its headquarters to Bombay in 1908, but its origin in Lahore is well-documented and acknowledged by music historians and the institution's own records

Link:

- ◆ **Vamanrao H. Deshpande**, *Indian Musical Traditions: An Aesthetic Study of the Gharanas in Hindustani Music*
- ◆ **B.R. Deodhar**, *Pillars of Hindustani Music* – includes a detailed biography of Paluskar and the school's founding.
- ◆ Gandharva Mahavidyalaya Official Website (ABGMVM)

29. Ashokan inscriptions suggest that the 'Pradeshika', 'Rajuka' and 'Yukta' were important officers at the

- (a) village-level administration
- (b) district-level administration
- (c) provincial administration
- (d) level of the central administration

Correct Option: (b)

Explanation:

- ◆ Ashokan inscriptions suggest that the pradeshika, rajuka, and yukta were important officers at the district level of the Mauryan administration. These officials played key roles in local governance, revenue collection, land measurement, and the implementation of royal and public welfare measures within their respective districts.
- ◆ Pradeshika, Rajuka, and Yukta were considered key officers in Ashoka's administration because they were responsible for the effective governance and management of the Mauryan Empire at the district level:
 - **Pradeshika:** Served as the head of district administration, overseeing the overall functioning of the district and ensuring the implementation of royal orders and policies.
 - **Rajuka:** Acted as a revenue officer and land surveyor, responsible for land measurement, assessment and collection of taxes, maintaining land records, and also had judicial powers to punish or acquit individuals.
 - **Yukta:** Functioned as an accountant or treasurer, managing revenue collection, land administration, and keeping financial records for the district.
 - Together, these officers ensured efficient administration, revenue management, and justice at the local level, which was crucial for maintaining the vast Mauryan Empire under Ashoka

Link:

- ◆ **R.C. Majumdar**, *The History and Culture of the Indian People*
- ◆ **Romila Thapar**, *Ashoka and the Decline of the Mauryas*

30. Consider the following statements in respect of the Non-Cooperation Movement:

- I. The Congress declared the attainment of 'Swaraj' by all legitimate and peaceful means to be its objective.
- II. It was to be implemented in stages with civil disobedience and non-payment of taxes for the next stage only if 'Swaraj' did not come within a year and the Government resorted to repression.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (c)

Explanation

- ◆ **Statement 1 is correct:** it is true regarding the Non-Cooperation Movement. At the Nagpur session of the Indian National Congress in December 1920, the Congress declared the attainment of Swaraj (self-rule) by all legitimate and peaceful means to be its objective. This marked a significant shift, as the Congress committed itself to achieving self-government through non-violent and extra-constitutional methods, which became the guiding principle of the Non-Cooperation Movement
- ◆ **Statement 2 is correct:** The Non-Cooperation Movement was designed to be implemented in stages:
- ◆ First, peaceful and non-violent actions such as surrendering government titles, resigning from government jobs, boycotting government schools, colleges, courts, and foreign goods were to be carried out.
- ◆ Next, if Swaraj (self-rule) was not achieved within a year and if the government resorted to repression, the movement would escalate to include civil disobedience and non-payment of taxes as the next stage.
- ◆ This stepwise escalation was a key feature of the movement's strategy under Gandhi's leadership

Link:

- ◆ Mahatma Gandhi, *Young India writings* (1920–22)
- ◆ R.C. Majumdar, *History of the Freedom Movement in India*

31. With reference to investments, consider the following:

- I. Bonds
- II. Hedge Funds
- III. Stocks
- IV. Venture Capital

How many of the above are treated as Alternative Investment Funds?

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All the four

Correct Option: (b)

Explanation

- ◆ Among the four investment options listed—bonds, hedge funds, stocks, and venture capital—two are treated as Alternative Investment Funds (AIFs):
 - Hedge funds are classified as Category III AIFs.
 - Venture capital funds are classified as Category I AIFs.
 - Bonds and stocks are considered traditional investment options and are specifically excluded from the definition of alternative investments.

Link:

- ◆ SEBI (Alternative Investment Funds) Regulations, 2012
- ◆ SEBI FAQs on AIFs: SEBI AIF FAQs
- ◆ NSE India – Investment Products Overview

32. Which of the following are the sources of income for the Reserve Bank of India?

- I. Buying and selling Government bonds
- II. Buying and selling foreign currency
- III. Pension fund management
- IV. Lending to private companies
- V. Printing and distributing currency notes

Select the correct answer using the code given below.

- (a) I and II only
- (b) II, III and IV
- (c) I, III, IV and V
- (d) I, II and V

Correct Option: (d)

- ◆ **Pair 1 is correctly matched:** it is true that buying and selling government funds (more accurately, government securities or bonds) is a source of income for the Reserve Bank of India (RBI). The RBI conducts open market operations by buying and selling government bonds and securities to regulate money supply and maintain financial stability. Through these activities, the RBI earns interest on government bonds it holds, and may also make profits from favorable changes in bond prices during such transactions. These earnings are a significant source of income for the RBI.
- ◆ **Pair 2 is correctly matched:** buying and selling foreign currency is a source of income for the Reserve Bank of India (RBI). The RBI manages India's foreign exchange reserves and conducts operations in the currency markets, including buying and selling foreign currencies. When the RBI sells foreign currency (such as US dollars) during periods of rupee volatility, it can earn profits, especially if the rupee has depreciated. Additionally, the RBI earns interest and commissions from deploying and managing these foreign exchange reserves. These earnings from foreign exchange operations and investments are a significant part of the RBI's total income.
- ◆ **Pair 3 is incorrectly matched:** No, it is not true that pension fund management is a source of income for the Reserve Bank of India (RBI).
- ◆ The RBI's role in the context of pensions is primarily as a facilitator for the disbursement of government pensions through agency banks, not as a pension fund manager or investor. The management of pension funds in India is regulated by the Pension Fund Regulatory and Development Authority (PFRDA), and specific entities such as SBI Pension Fund, LIC Pension Fund, and UTI Retirement Solutions are appointed as pension fund managers.
- ◆ While banks can seek RBI's permission to enter the pension fund management business, the RBI itself does not manage pension funds as a source of income. Its income mainly comes from activities like managing government securities, foreign exchange operations, and lending to banks.
- ◆ **Pair 4 is incorrectly matched:** No, lending to private companies is not a source of income for the Reserve Bank of India (RBI).
- ◆ The RBI primarily lends to banks and financial institutions, not directly to private companies. Its main sources of income include:
 - Interest from lending to banks and financial institutions
 - Income from government securities and bonds
 - Earnings from foreign currency operations
 - Fees and commissions for services provided to the government
- ◆ Direct lending to private companies is not part of the RBI's mandate or a source of its income
- ◆ **Pair 5 is correctly matched:** printing and distributing currency notes is a source of income for the Reserve Bank of India (RBI). This income is known as seigniorage—the difference between the face value of the currency notes and the cost of printing them. The RBI, as the sole authority for printing

currency in India, earns this profit when it issues notes to banks at face value, while the actual production cost is much lower

Link:

- ◆ Handbook of Statistics on Indian Economy, <https://dbie.rbi.org.in>

33. With reference to the Government of India, consider the following information:

	Organization	Some of its functions	It works under
I.	Directorate of Enforcement	Enforcement of the Fugitive Economic Offenders Act, 2018	Internal Security Division-I, Ministry of Home Affairs
II.	Directorate of Revenue Intelligence	Enforces the Provisions of the Customs Act, 1962	Department of Revenue, Ministry of Finance
III.	Directorate General of Systems and Data Management	Carrying out big data analytics to assist tax officers for better policy and nabbing tax evaders	Department of Revenue, Ministry of Finance

In how many of the above rows is the information correctly matched?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (a)

Row 1 is incorrectly matched:

- ◆ The Enforcement Directorate (ED) is empowered to enforce the Fugitive Economic Offenders Act, 2018.
- ◆ However, the ED functions under the Department of Revenue, Ministry of Finance, not the Internal Security Division-I of the Ministry of Home Affairs.
- ◆ The Fugitive Economic Offenders Act, 2018, and its enforcement are matters handled by the Ministry of Finance, as clearly stated in official documents and the Act itself.

Row 2 is correctly matched:

- ◆ The Directorate of Revenue Intelligence (DRI) enforces the provisions of the Customs Act, 1962, and functions under the Department of Revenue, Ministry of Finance.
- ◆ The DRI is the apex intelligence and investigative agency responsible for detecting and curbing smuggling, commercial fraud, and evasion of customs duties in India.
- ◆ Its officers are drawn from the Central Board of Indirect Taxes and Customs (CBIC) and it operates under the administrative control of the Ministry of Finance

Row 3 is incorrectly matched:

- ◆ The Directorate does manage large volumes of data and supports tax administration through technology, the specialized function of carrying out big data analytics to assist tax officers for better policy and nabbing tax evaders is mainly handled by the Directorate General of Analytics and Risk Management (DGARM), not by the Directorate General of Systems and Data Management.
- ◆ DGARM is the apex body for data analytics and risk management, providing actionable intelligence and analytical input for policy formulation and enforcement.
- ◆ However, the Directorate General of Systems and Data Management does support DGARM by organizing, evaluating, and providing data necessary for analytics, but the core responsibility for big data analytics lies with DGARM

Links

- ◆ Ministry of Finance – [Organizational Structure](#)

34. Consider the following statements:

- I. The Reserve Bank of India mandates all the listed companies in India to submit a Business Responsibility and Sustainability Report (BRSR).

- II. In India, a company submitting a BRSR makes disclosures in the report that are largely non-financial in nature.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (b)

- ◆ **Statement 1 is incorrect:** Reserve Bank of India (RBI) mandates all listed companies in India to submit Business Responsibility and Sustainability Reports (BRSR).
 - The BRSR mandate comes from the Securities and Exchange Board of India (SEBI), not the RBI.
 - SEBI requires the top 1,000 listed companies by market capitalization to submit BRSR as part of their annual disclosures, with a view to expanding this to more companies in the future.
 - The RBI, on the other hand, has introduced climate-related disclosure requirements for regulated entities like banks and financial institutions, but not for all listed companies.

Statement 2 is correct:

- ◆ In India, when a company submits a Business Responsibility and Sustainability Report (BRSR), the disclosures made in the report are largely non-financial in nature.
- ◆ The BRSR framework requires companies to report on environmental, social, and governance (ESG) aspects such as environmental protection, human rights, employee well-being, corporate governance, stakeholder engagement, and other sustainability-related factors.
- ◆ These disclosures provide transparency about the company's non-financial performance and sustainability practices, complementing traditional financial reporting.

Link:

- ◆ SEBI Circular: SEBI/HO/CFD/CMD-2/P/CIR/2021/562 dated May 10, 2021
- ◆ RBI: Discussion Paper on Climate Risk and Sustainable Finance, July 2022
- ◆ <https://rbi.org.in>

35. Consider the following statements:

Statements I:

In India, income from allied agricultural activities like poultry farming and wool rearing in rural areas is exempted from any tax.

Statement II:

In India, rural agricultural land is not considered a capital asset under the provisions of the Income-tax Act, 1961.

Which one of the following 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 not correct
- (d) Statement I is not correct but Statement II is correct

Correct Option: (d) (Statement I Is Not Correct but Statement ii IS Correct)

Explanation:

- ◆ **Statement 1 is incorrect:** No, this statement is not true.
 - In India, income from allied agricultural activities like poultry farming and wool rearing is NOT exempt from income tax, even if these activities are carried out in rural areas. According to the Income Tax Act, only income derived directly from agricultural land—such as crop cultivation or horticulture—is considered “agricultural income” and is exempt from tax.

- Income from activities such as poultry farming, dairy, wool rearing, fisheries, and livestock breeding is not classified as agricultural income and is therefore taxable under the Income Tax Act, regardless of whether they are conducted in rural or urban areas
- ◆ **Statement 2 is correct:** Yes, this statement is true.
 - Under the provisions of the Income Tax Act, 1961, rural agricultural land in India is not considered a capital asset. As a result, any gains from the sale or transfer of such land are not taxable under the head 'Capital Gains'. Only urban agricultural land is treated as a capital asset and subject to capital gains tax.

Link:

- ◆ Income Tax Act, 1961, Section 2(1A) – Definition of Agricultural Income_Income Tax Department
- ◆ Circular No. 2/2017 by CBDT clarifying agricultural income: <https://www.incometaxindia.gov.in>
- ◆ Article: "Taxation of Agricultural Income and Allied Activities" – Taxmann: Taxmann.com

36. Consider the following statements:

- India has joined the Minerals Security Partnership as a member.
- India is a resource-rich country in all the 30 critical minerals that it has identified.
- The Parliament in 2023 has amended the Mines and Minerals (Development and Regulation) Act, 1957 empowering the Central Government to exclusively auction mining lease and composite license for certain critical minerals.

Which of the statements given above are correct?

- I and II only
- II and III only
- I and III only
- I, II and III

Correct Option: (c)

Explanation:

- ◆ **Statement 1 is correct:**
 - India has joined the Minerals Security Partnership (MSP) as a member. India was inducted into the MSP in June 2023, becoming its 14th member alongside countries such as the United States, Australia, Canada, and members of the European Union.
 - The MSP is a global initiative aimed at securing and diversifying critical mineral supply chains essential for economic growth and clean energy transitions.
- ◆ **Statement 2 is incorrect:**
 - India has identified 30 critical minerals that are essential for its economic growth, clean energy transition, and national security. However, India is not resource-rich in all of these minerals. In fact, India is heavily import-dependent for more than 80% of its critical mineral requirements, including key minerals like lithium, cobalt, nickel, and rare earth elements. Many of these minerals are either not found in significant quantities within India or are not currently being mined at a scale sufficient to meet domestic demand.
 - India has recently discovered lithium reserves in Jammu & Kashmir, but domestic production is still in its early stages and far from meeting the country's needs.
 - India imports the majority of its rare earth elements and other minerals crucial for batteries, electronics, and renewable energy technologies.
- ◆ **Statement 3 is correct:**
 - In 2023, the Parliament of India amended the Mines and Minerals (Development and Regulation) Act, 1957.
 - The amendment empowers the Central Government to exclusively auction mining leases and composite licenses for certain critical minerals, including rare earth elements, lithium, cobalt, graphite, and others essential for economic development and national security.
 - This change aims to accelerate the exploration and extraction of these minerals, encourage private sector participation, and reduce import dependence

Links:

- ♦ Ministry of Mines, Government of India
- ♦ Reuters, June 2023: “India joins Minerals Security Partnership”
- ♦ Official MSP website and statements

37. Consider the following statements:

Statements I:

As regards returns from an investment in a company, generally, bondholders are considered to be relatively at lower risk than stockholders.

Statement II:

Bondholders are lenders to a company whereas stockholders are its owners.

Statement III:

For repayment purpose, bondholders are prioritized over stockholders by a company.

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

- (a) Both Statement II and Statement III are correct and both of them explain Statement I
- (b) Both Statement I and Statement II are correct and Statement I explains Statement II
- (c) Only one of the Statements II and III is correct and that explains Statement I
- (d) Neither Statement II nor Statement III is correct

Correct Option: (a) Both statement I and II are correct and both of them explain statement I

Explanation:

- ♦ **Statement 1 is correct:** Yes, this statement is true.
 - Generally, bondholders are considered to be at relatively lower risk than stockholders (shareholders) when it comes to returns from an investment in a company.
 - Bondholders are creditors to the company and receive fixed interest payments, with a higher claim on the company's assets in case of bankruptcy.
 - Their returns are more stable and less volatile compared to shareholders, who are partial owners and whose returns depend on company performance and market conditions, making their investment riskier
- ♦ **Statement 2 is correct:** Yes, this statement is true.
 - Bondholders are lenders to a company—they purchase bonds, which are debt instruments, and in doing so, lend money to the company. In return, they receive fixed interest payments and the principal amount upon maturity, but they do not own any part of the company.
 - Stockholders (shareholders) are owners of the company—they buy shares, which represent partial ownership. This ownership entitles them to voting rights in company decisions and a share in the profits through dividends or stock price appreciation
- ♦ **Statement 3 is correct:** Yes, this statement is true.
 - For repayment purposes, bondholders are prioritized over stockholders by a company. Bondholders are creditors and have a contractual right to receive interest payments and the repayment of principal before any distributions are made to shareholders.
 - In the event of liquidation or bankruptcy, bondholders have a higher claim on the company's assets compared to stockholders, who are residual claimants and are paid only after all debts and obligations to creditors (including bondholders) have been settled

Links

- ♦ *Investopedia – Bondholder vs. Shareholder*
- ♦ *Corporate Finance Institute (CFI) – Bondholders and Stockholders*
- ♦ *Securities and Exchange Board of India (SEBI) – Investor education materials*
- ♦ *Financial Accounting and Reporting textbooks (e.g., Kieso, Weygandt)*

38. Consider the following statements:

- I. India accounts for a very large portion of all equity option contracts traded globally thus exhibiting a great boom.
- II. India's stock market has grown rapidly in the recent past even overtaking Hong Kong's at some point of time.
- III. There is no regulatory body either to warn the small investors about the risks of options trading or to act on unregistered financial advisors in this regard.

Which of the statements give above are correct?

- (a) I and II only
- (b) II and III only
- (c) I and III only
- (d) I, II and III

Correct Option: (a)

Explanation:

- ◆ **Statement 1 is correct:** Yes, this statement is true.
 - India accounts for a very large portion of all equity options contracts traded globally and has, in recent years, become the world's largest market for these instruments by contracts traded.
 - The country has experienced a significant boom, with options premiums surging 11-fold in the five years to March 2025, driven largely by a retail investor-led frenzy and increased participation from global high-frequency trading and market-making firms.
 - In 2024, more than 120 billion index options contracts were traded on the National Stock Exchange (NSE), far surpassing volumes on other global exchanges.
 - However, it is worth noting that while the boom has been remarkable, recent regulatory measures have led to a cooling of this explosive growth
- ◆ **Statement 2 is correct:** yes, this statement is true.
 - India's stock market has grown rapidly in the recent past and, at certain points, has even overtaken Hong Kong's in terms of market capitalization. In January 2024, India's stock market capitalization surpassed Hong Kong's, making India the fourth-largest market for public equities globally at that time. This growth was driven by strong investor flows, robust economic outlook, and consistent performance of major indices like the Nifty 50 and Sensex.
 - However, the rankings have seen some fluctuations. For example, in March 2025, Hong Kong overtook India again in share sales, reflecting the dynamic and competitive nature of global equity markets. Nonetheless, India's rapid stock market expansion and its ability to overtake Hong Kong at certain times is a well-documented fact
- ◆ **Statement 3 is incorrect:** No, this statement is not true.
 - India does have a regulatory body—the Securities and Exchange Board of India (SEBI)—that actively works to protect small investors, including those involved in options trading:
 - SEBI regularly issues warnings and advisories to caution investors about the risks of options trading and unregulated platforms.
 - SEBI has implemented new rules and regulatory measures specifically aimed at enhancing investor protection in the derivatives (options and futures) market, such as increasing contract sizes, requiring upfront premium payments, and reducing speculative activity.
 - SEBI also acts against unregistered financial advisors and unregulated entities, including issuing public warnings and taking enforcement action when necessary

Links

- ◆ National Stock Exchange (NSE) Annual Reports and Market Data
- ◆ World Federation of Exchanges (WFE) Market Capitalization Data
- ◆ SEBI Official Circulars and Investor Protection Initiatives

39. Consider the following statements:

Statement I:

Circular economy reduces the emissions of greenhouse gases.

Statement II:

Circular economy reduces the use of raw materials as inputs.

Statement III:

Circular economy reduces wastage in the production process.

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

- (a) Both Statement II and Statement III are correct and both of them explain Statement I
- (b) Both Statement I and Statement II are correct and Statement I explains Statement II
- (c) Only one of the Statements II and III is correct and that explains Statement I
- (d) Neither Statement II nor Statement III is correct

Correct Option: (a) Both statement II and III are corrects and both of them explain statement I

Explanation:

◆ **Statement 1 is correct: Yes, this statement is true.**

- A circular economy reduces the emission of greenhouse gases (GHGs). By designing out waste and pollution, keeping products and materials in use for as long as possible, and regenerating natural systems, the circular economy addresses emissions across the entire value chain—not just from energy use, but also from industry, agriculture, and land use.
- Estimates suggest that circular economy strategies can cut global GHG emissions by up to 39%. Key sectors where these reductions are most significant include the built environment, transport, food systems, and waste management. Circular practices such as recycling, reusing, and efficient product design help retain the embodied energy in materials and reduce the need for new resource extraction, thereby lowering emissions

◆ **Statement 2 is correct: Yes, this statement is true.**

- A circular economy is specifically designed to reduce the use of raw materials by keeping products and materials in use for as long as possible, promoting reuse, repair, refurbishment, and recycling.
- This approach minimizes the need to extract and process new raw materials, thereby conserving natural resources and reducing environmental impact. For example, studies show that a comprehensive circular economy could reduce the consumption of primary raw materials by up to 68% by 2050 compared to traditional linear models

◆ **Statement 3 is correct: Yes, this statement is true.**

- A circular economy reduces wastage in the production process by focusing on designing products and systems that minimize waste from the outset, extending product lifecycles through reuse and repair, and recovering resources through recycling and regeneration.
- In a circular economy, materials are kept in use for as long as possible, and waste is considered a design flaw rather than an inevitable outcome.
- This approach stands in contrast to the traditional linear model, which is based on “take, make, dispose” and leads to significant waste generation. By implementing circular principles, companies can significantly decrease the volume of waste generated during production and promote sustainable resource management

Links

- ◆ Ellen MacArthur Foundation Report (PDF)
- ◆ Global Resources Outlook 2019
- ◆ UNEP Circularity Report

40. Consider the following statements:

- I. Capital receipts create a liability or cause a reduction in the assets of the Government.
- II. Borrowings and disinvestment are capital receipts.
- III. Interest received on loans creates a liability of the Government.

Which of the statements give above are correct?

- (a) I and II only
- (b) II and III only
- (c) I and III only
- (d) I, II and III

Answer: (a) I and II only

Explanation:

- ◆ **Statement I:** Correct. Capital receipts either create a liability (e.g., borrowings increase government debt) or reduce assets (e.g., disinvestment involves selling government assets like shares in PSUs). This is a fundamental concept in government budgeting.
- ◆ **Statement II:** Correct. Borrowings (e.g., issuing bonds) and disinvestment (e.g., selling stakes in public enterprises) are classified as capital receipts in India's budget, as they either add to liabilities or reduce assets.
- ◆ **Statement III:** Incorrect. Interest received on loans (e.g., from states or PSUs) is a **revenue receipt**, as it's income that doesn't create a liability or reduce assets. It's recorded under non-tax revenue in the budget.
- ◆ **Conclusion:** Only statements I and II are correct.

Website Link: Ministry of Finance, Government of India - Budget Basics, Ncert

41. Consider the following statements:

- I. Austria
- II. Bulgaria
- III. Croatia
- IV. Serbia
- V. Sweden
- VI. North Macedonia

How many of the above are members of the North Atlantic Treaty Organization?

- (a) Only three
- (b) Only four
- (c) Only five
- (d) All the six

Correct Option: (b)

- ◆ **NATO Membership:** The North Atlantic Treaty Organization (NATO) includes countries committed to collective defense. Checking the listed countries:
 - **Austria:** Not a NATO member; it maintains neutrality.
 - **Bulgaria:** Joined NATO in 2004.
 - **Croatia:** Joined NATO in 2009.
 - **Serbia:** Not a NATO member; it pursues a neutral stance and cooperates via NATO's Partnership for Peace.
 - **Sweden:** Joined NATO in 2024.
 - **North Macedonia:** Joined NATO in 2020.
- ◆ **Count:** Bulgaria, Croatia, Sweden, and North Macedonia are NATO members, totaling **four**.

Website Link:

- ◆ NATO - Member Countries

42. Consider the following countries:

- I. Bolivia
- II. Brazil

- III. Colombia
- IV. Ecuador
- V. Paraguay
- VI. Venezuela

Andes mountains pass through how many of the above countries?

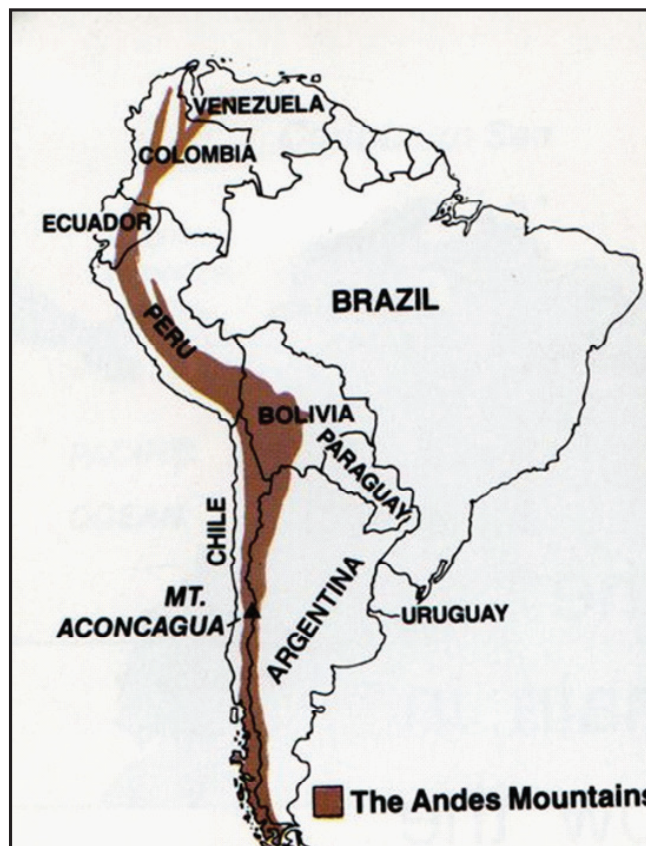
- (a) Only two
- (b) Only three
- (c) Only four
- (d) Only five

Correct Option: (c)

- ◆ **Andes Mountains:** The Andes, the longest continental mountain range, run along South America's western edge. Checking the countries:
 - **Bolivia:** The Andes traverse western Bolivia (e.g., Andes highlands).
 - **Brazil:** The Andes do not pass through Brazil; it's mostly Amazon and Atlantic coast.
 - **Colombia:** The Andes run through western Colombia (e.g., Colombian Andes).
 - **Ecuador:** The Andes cross central Ecuador (e.g., Quito lies in the Andes).
 - **Paraguay:** No Andes; it's mostly lowlands and Chaco region.
 - **Venezuela:** The Andes extend into northern Venezuela (e.g., Mérida Andes).
- ◆ **Count:** Bolivia, Colombia, Ecuador, and Venezuela, totaling **four**.

Website Link:

- ◆ Britannica - Andes Mountains



43. Consider the following water bodies:

- I. Lake Tanganyika
- II. Lake Tonle Sap
- III. Patos Lagoon

Through how many of them does the equator pass?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (d)

- ◆ **Equator's Path:** The equator crosses the Earth at 0° latitude, passing through parts of Africa, Asia, and South America. Checking the water bodies:
 - **Lake Tanganyika:** Located in East Africa (Tanzania, Burundi, DRC, Zambia), it lies between 3°S and 9°S, south of the equator.
 - **Lake Tonlé Sap:** In Cambodia, it's around 12°N to 13°N, north of the equator.
 - **Patos Lagoon:** In southern Brazil, around 30°S to 32°S, far south of the equator.
- ◆ **Conclusion:** None of these water bodies lie on the equator's path.

Website Link:

- ◆ Lake Tanganyika | Size, Map, Facts, Depth, & Wildlife | Britannica. Tonlé Sap Lake: The Heart of Cambodia - Wonders of Cambodia. Patos Lagoon | Saltwater, Migratory Birds, Wetlands | Britannica

44. Consider the following statements about turmeric during the year 2022-23:

- I. India is the largest producer and exporter of turmeric in the world.
- II. More than 30 varieties of turmeric are grown in India.
- III. Maharashtra, Telangana, Karnataka and Tamil Nadu are major turmeric producing States in India.

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

Correct Option: (d)

- ◆ **Statement I:** Correct. India produces ~80% of the world's turmeric and is the largest exporter, shipping to countries like the UAE and the US. In 2022-23, India's turmeric exports were valued at over \$200 million.
- ◆ **Statement II:** Correct. India cultivates over 30 turmeric varieties, including Alleppey Finger, Erode, and Sangli, as documented by agricultural research bodies like the Indian Institute of Spices Research.
- ◆ **Statement III:** Correct. Telangana, Maharashtra, Karnataka, and Tamil Nadu are among India's top turmeric-producing states, alongside Andhra Pradesh and Odisha, per agricultural data for 2022-23.
- ◆ **Conclusion:** All three statements are correct.

Website Link:

- ◆ Turmeric | Spices Board, Turmeric: The Indian Saffron | INDIAN CULTURE. Press Release: Press Information Bureau

45. Which of the following are the evidences of the phenomenon of continental drift?

- I. The belt of ancient rocks from Brazil coast matches with those from Western Africa.
- II. The gold deposits of Ghana are derived from the Brazil plateau when the two continents lay side by side.
- III. The Gondwana system of sediments from India is known to have its counterparts in six different landmasses of the Southern Hemisphere.

Select the correct answer using the code given below.

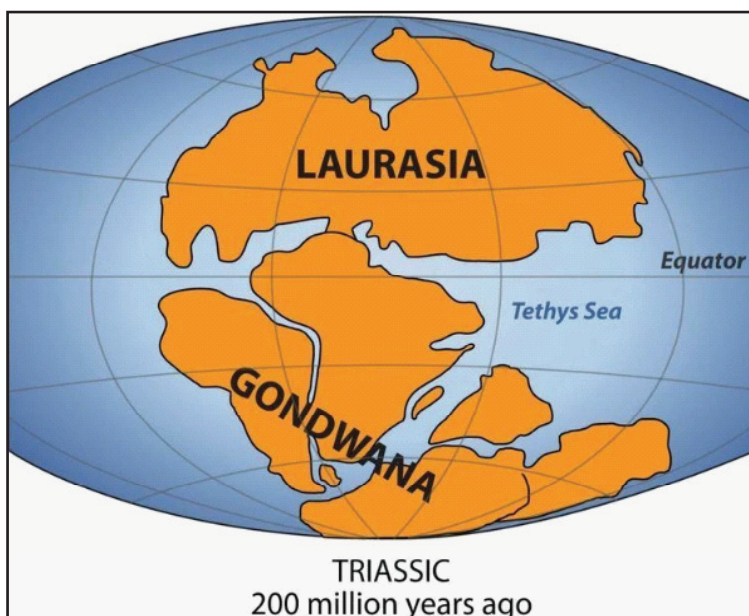
- (a) I and III only
- (b) I and II only
- (c) I, II and III
- (d) II and III only

Correct Option: (c)

- ◆ **Statement I:** Correct. The matching geological formations (e.g., ancient rock belts) between Brazil's eastern coast and Western Africa support continental drift, as these continents were once joined in Pangaea.
- ◆ **Statement II:** Correct. Gold deposits in Ghana and Brazil share geological origins, suggesting they were part of the same landmass before drifting apart, a classic evidence of continental drift.
- ◆ **Statement III:** Correct. The Gondwana system (coal-bearing sediments) in India has counterparts in Australia, Africa, South America, Antarctica, and Madagascar, indicating these landmasses were once connected in the Gondwana supercontinent.
- ◆ **Conclusion:** All three are valid evidences.

Website Link:

- ◆ Continental drift | Definition, Evidence, Diagram, & Facts | Britannica.



46. Consider the following statements:

Statements I:

The amount of dust particles in the atmosphere is more in subtropical and temperate areas than in equatorial and polar regions.

Statement II:

Subtropical and temperate areas have less dry winds.

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 not correct
- (d) Statement I is not correct but Statement II is correct

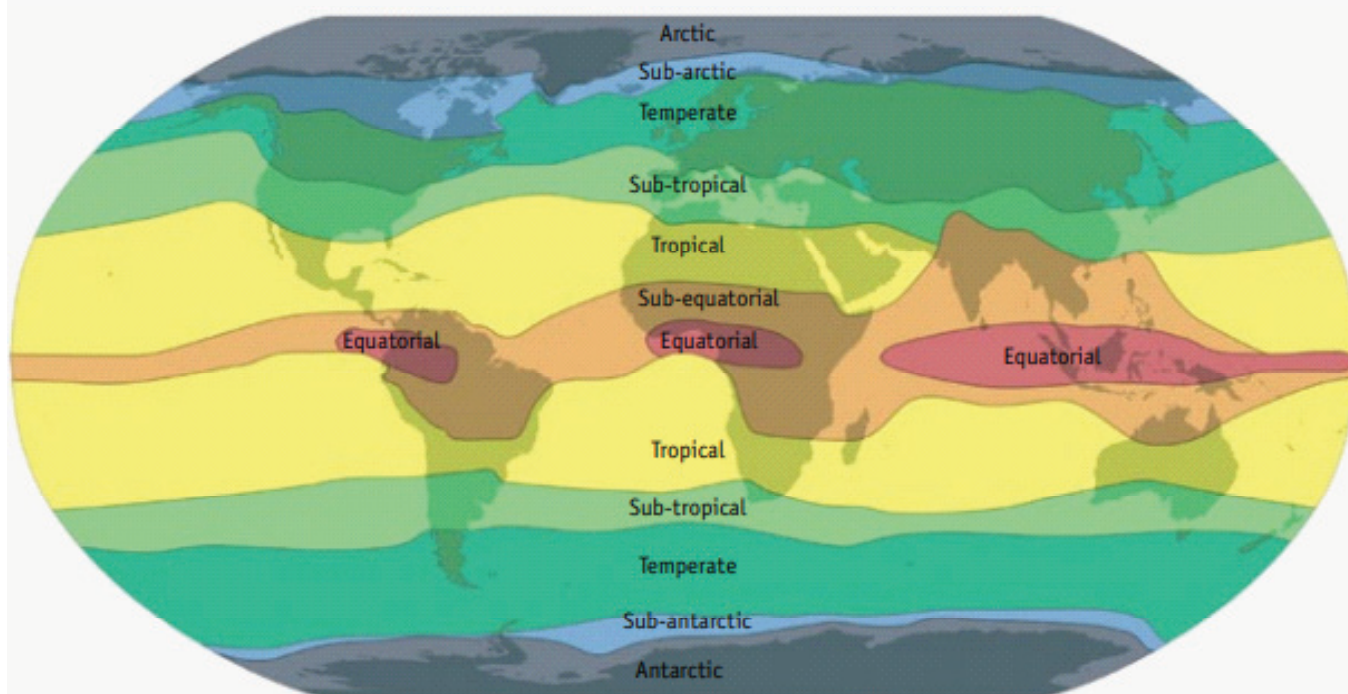
Correct Option: (c)

- **Statement I:** Correct. Subtropical and temperate regions (e.g., Sahara, Middle East) often have more atmospheric dust due to arid conditions and frequent dust storms, unlike wet equatorial or cold polar regions.
- **Statement II:** Incorrect. Subtropical and temperate areas, especially arid zones, have **more dry winds** (e.g., trade winds, sirocco), which lift dust into the atmosphere, not less.
- **Relationship:** Since Statement II is incorrect, it cannot explain Statement I. However, Statement I stands true independently.
- **Conclusion:** Statement I is correct, but Statement II is not.

Website Link:

- ◆ Difference Between Tropical, Subtropical And Temperate Regions - Justagric,

Fig. 1.2.1. The Earth's climates (by B. Alisov).



47. Consider the following statements:

Statement I:

In January, in the Northern Hemisphere, the isotherms bend equatoward while crossing the landmasses, and poleward while crossing the oceans.

Statement II:

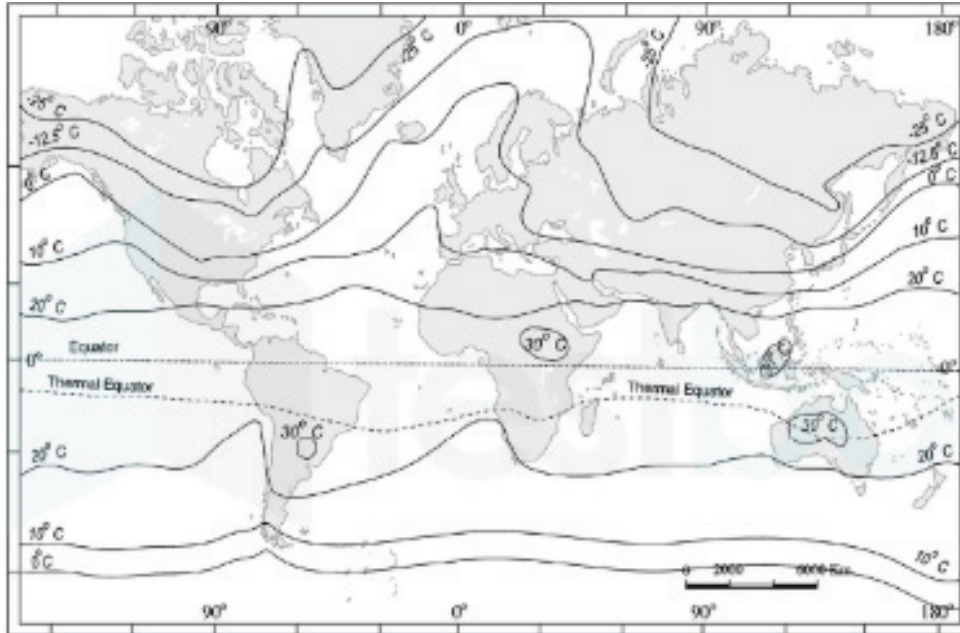
In January, the air over the oceans is warmer than that over the landmasses in the Northern Hemisphere.

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

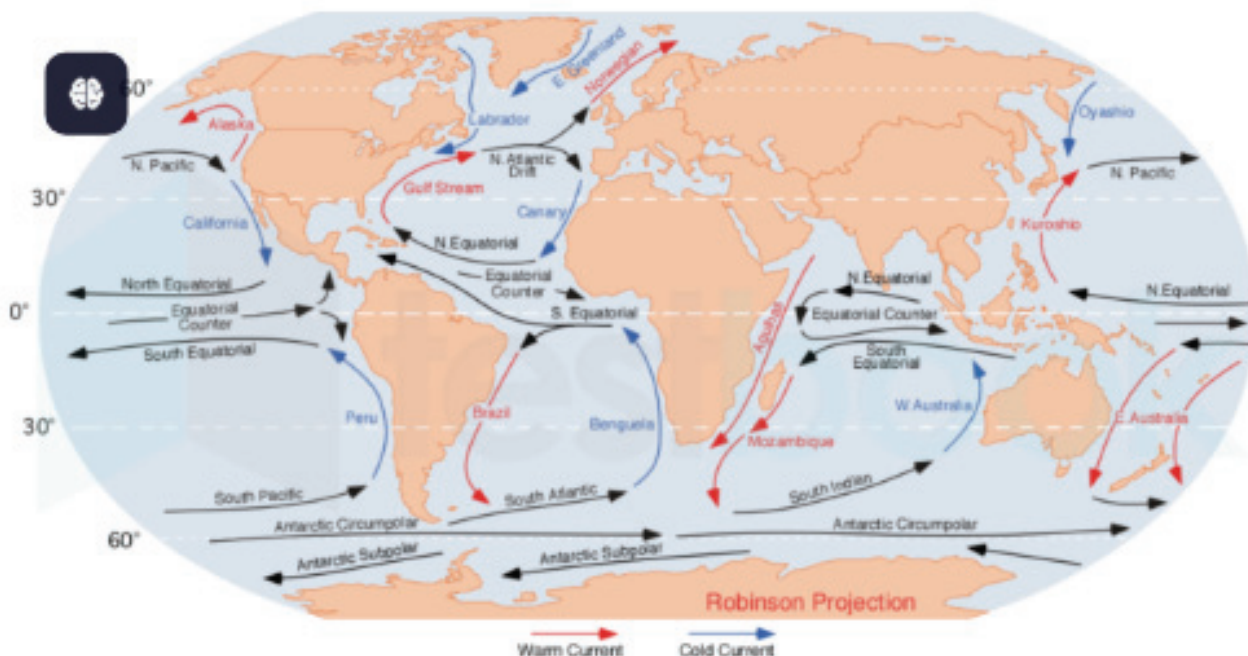
- (a) Both Statement I and Statement II are correct and Statement II explains Statement I
- (b) Both Statement I and Statement II are correct but Statement II does not explain Statement I
- (c) Statement I is correct but Statement II is not correct
- (d) Statement I is not correct but Statement II is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

Correct Option: (a)

- ◆ **Statement I:** Correct. In January (winter in the Northern Hemisphere), isotherms (lines of equal temperature) bend equatorward over landmasses (colder) and poleward over oceans (warmer) due to differential heating.
- ◆ **Statement II:** Correct. Oceans retain heat better than land, so in January, air over Northern Hemisphere oceans (e.g., North Atlantic) is warmer than over landmasses (e.g., Siberia).
- ◆ **Relationship:** Statement II explains Statement I, as the warmer ocean air causes isotherms to bend poleward over oceans, and colder land air pulls them equatorward.
- ◆ **Conclusion:** Both are correct, and Statement II explains Statement I.



The distribution of surface air temperature in the month of January



48. Consider the following statements:

Statement I:

In the context of effect of water on rocks, chalk is known as a very permeable rock whereas clay is known as quite an impermeable or least permeable rock.

Statement II:

Chalk is porous and hence can absorb water.

Statement III:

Clay is not at all porous.

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

- (a) Both Statement II and Statement III are correct and both of them explain Statement I
- (b) Both Statement II and Statement III are correct but only one of them explains Statement I
- (c) Only one of the Statements II and III is correct and that explains Statement I
- (d) Neither Statement II nor Statement III is correct

Answer: (c) Only one of the Statements II and III is correct and that explains Statement I

- ◆ **Statement I:** Correct. Chalk is highly permeable (allows water to pass through due to porosity), while clay is impermeable (blocks water flow due to low porosity).
- ◆ **Statement II:** Correct. Chalk's porosity (tiny pores) allows it to absorb water, explaining its permeability.
- ◆ **Statement III:** Incorrect. Clay is **not entirely non-porous**; it has very fine pores but is impermeable because water can't flow through easily due to tight particle packing.
- ◆ **Relationship:** Statement II explains part of Statement I (chalk's permeability), but Statement III is incorrect and doesn't fully explain clay's impermeability (which is due to low permeability, not zero porosity).
- ◆ **Conclusion:** Only Statement II is correct and explains part of Statement I.

Website Link:

- ◆ Which rocks are permeable to water? – Sage-Advices, Water-induced variations in mechanical properties of clay-bearing rocks - ScienceDirect, <https://geologyscience.com/rocks/sedimentary-rocks/chalk/>

49. Consider the following statements:

- I. Without the atmosphere, temperature would be well below freezing point everywhere on the Earth's surface.
- II. Heat absorbed and trapped by the atmosphere maintains our planet's average temperature.
- III. Atmosphere's gases, like carbon dioxide, are particularly good at absorbing and trapping radiation.

Which of the statements given above are correct?

- (a) I and III only
- (b) I and II only
- (c) I, II and III
- (d) II and III only

Correct Option: (c) I, II, and III

- ◆ **Statement I:** Correct. Without the atmosphere, Earth would lose heat rapidly (like the Moon), with surface temperatures dropping below freezing globally, except perhaps at the equator during peak sunlight.
- ◆ **Statement II:** Correct. The atmosphere's greenhouse effect traps heat, maintaining Earth's average temperature (~15°C) rather than letting it plummet to ~-18°C.
- ◆ **Statement III:** Correct. Gases like CO₂ and methane are efficient at absorbing and trapping infrared radiation, driving the greenhouse effect.
- **Conclusion:** All three statements are correct.

Website Link:

- ◆ What Is the Atmosphere? | Center for Science Education, What Would Earth's Temperature Be Like Without an Atmosphere? | WIRED, Temperature of Earth without Atmosphere | Physics and Universe

50. Consider the following statements about the Rashtriya Gokul Mission:

- I. It is important for the upliftment of rural poor as majority of low producing indigenous animals are with small and marginal farmers and landless labourers.
- II. It was initiated to promote indigenous cattle and buffalo rearing and conservation in a scientific and holistic manner.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (c)

Explanation:

- ◆ **Statement I is Correct:** The majority of indigenous cattle and low milk-yielding animals are reared by small and marginal farmers and landless laborers in rural India. The Rashtriya Gokul Mission (RGM) aims to improve the productivity of these animals, which is directly linked to rural livelihoods and poverty alleviation.
- ◆ **Statement II is Correct:** The Rashtriya Gokul Mission was launched in 2014 under the National Programme for Bovine Breeding and Dairy Development. Its primary objective is the scientific and holistic conservation and development of indigenous breeds of cattle and buffaloes.

Supplementary Notes:

About Rashtriya Gokul Mission (RGM):

- ◆ Launched by: Department of Animal Husbandry & Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India.
- ◆ Launch Year: December 2014 (revamped in 2021 as part of the National Programme for Bovine Breeding and Dairy Development).
- ◆ Aim: Conservation and development of indigenous breeds, genetic upgradation, and production enhancement of cattle and buffaloes.

Key Features:

Feature	Description
Gokul Grams	Establishment of integrated indigenous cattle centers for conservation and development of indigenous breeds.
National Bovine Genomic Centre	Aims to increase productivity via genomic selection.
e-Gopala App	Digital platform for farmers to manage livestock efficiently.
IVF/ET Centers	Use of reproductive technologies to breed high-quality indigenous cattle.
Sex-Sorted Semen	For ensuring desired calf production (mostly female).

Why Is It Important?

- ◆ **Livelihood Empowerment:** Small & marginal farmers depend on indigenous breeds, which are climate-resilient and low-maintenance.
- ◆ **Genetic Conservation:** Many Indian breeds are on the verge of extinction; the program revives them.
- ◆ **Climate Resilience:** Indigenous breeds are better suited to Indian agro-climatic conditions and resistant to diseases.
- ◆ **Milk Quality:** A2-type milk from indigenous cows is considered nutritionally superior.

Website Link:

- ◆ Mission Press Release: Press Information Bureau , Press Release: Press Information Bureau, RASHTRIYA GOKUL MISSION | , Department of animal husbandry and dairying

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51. Consider the following statements:

- I. Panchayats at the intermediate level exist in all states.
- II. To be eligible to be a member of a panchayat at the intermediate level, a person should attain the age of thirty years.
- III. The chief minister of a state constitutes a commission to review the financial position of panchayats at the intermediate levels and to make recommendations regarding the distribution of net proceeds of taxes and duties, leviable by the state, between the state and panchayats at the intermediate level.

Which of the statements given above are not correct?

- (a) I and II only
- (b) II and III only
- (c) I and III only
- (d) I, II and III

Correct Option: (d) I, II, and III

- ◆ **Statement I:** Incorrect. Intermediate-level Panchayats (Panchayat Samitis) exist only in states with a population above 20 lakh, as per the 73rd Amendment (Article 243B). Smaller states like Goa or Sikkim may not have them.
- ◆ **Statement II:** Incorrect. The minimum age to be a member of any Panchayat (village, intermediate, or district) is 21 years, as per Article 243F, not 30.
- ◆ **Statement III:** Incorrect. The **State Finance Commission**, constituted by the **Governor** (not the Chief Minister), reviews the financial position of all Panchayats (not just intermediate) and recommends tax distribution (Article 243I).
- ◆ **Conclusion:** All three statements are incorrect.

Website Link:

- ◆ Ministry of Panchayati Raj, laxmikant , Constitutional Law of India - Chapter 22 - The Panchayats

52. Consider the following statements in respect of BIMSTEC:

- I. It is a regional organization consisting of seven member states till January 2025.
- II. It came into existence with the signing of the Dhaka declaration, 1999.
- III. Bangladesh, India, Sri Lanka, Thailand and Nepal are founding member states of BIMSTEC.
- IV. In BIMSTEC, the subsector of 'tourism' is being led by India.

Which of the statements given above is/are correct?

- (a) I and II
- (b) II and III
- (c) I and IV
- (d) I only

Correct Option: (c) I and IV

- **Statement I:** Correct. BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) has seven members: Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka, and Thailand, as of January 2025.
- **Statement II:** Incorrect. BIMSTEC was established with the **Bangkok Declaration** in 1997, not the Dhaka Declaration (no such document exists for BIMSTEC's founding).
- **Statement III:** Incorrect. The founding members (1997) were Bangladesh, India, Sri Lanka, and Thailand. Nepal joined later (2004), so it's not a founding member.
- **Statement IV:** Correct. India leads the tourism sector in BIMSTEC, promoting regional tourism cooperation.
- **Conclusion:** Statements I and IV are correct.

53. Who amongst the following are members of the Jury to select the recipient of 'Gandhi Peace Prize'?

- I. The president of India
- II. The prime minister of India
- III. The chief justice of India
- IV. The leader of opposition in the lok sabha

Select the correct answer using the code given below.

- (a) II and IV only
- (b) I, II and III
- (c) II, III and IV
- (d) I and III only

Correct Option: (c)

- ◆ **Explanation:** The Jury for Gandhi Peace Prize is chaired by Prime Minister, and comprises two ex-officio members, namely the Chief Justice of India and Leader of the single largest Opposition Party in Lok Sabha.

Link:

- ◆ <https://www.mea.gov.in/press-releases.htm?dtl/33693/gandhi+peace+prize+for+the+Year+2019+announced>

54. GPS-Aided Geo augmented navigation (GAGAN) uses a system of ground stations to provide necessary augmentation. Which of the following statements is/are correct in respect of GAGAN?

- I. It is designed to provide additional accuracy and integrity.
- II. It will allow more uniform and high quality air traffic management.
- III. It will provide benefits only in aviation but not in other modes of transportation.

Select the correct answer using the code given below.

- (a) I, II and III
- (b) II and III only
- (c) I only
- (d) I and II only

Correct Option: (d)

- ◆ **Statement 1 and 2 are correct:** This is a Satellite Based Augmentation System (SBAS) implemented jointly with Airport Authority of India (AAI). The main objectives of GAGAN are to provide Satellite-based Navigation services with accuracy and integrity required for civil aviation applications and to provide better Air Traffic Management over Indian Airspace.
- ◆ **Statement 3 is incorrect:** GAGAN has been developed for aviation but it will provide benefits to other sectors as well like transportation, railways, surveying, maritime, highways, telecom industry, and security agencies.

Link: <https://economictimes.indiatimes.com/definition/gagan?from=mdr>

- ◆ <https://www.isro.gov.in/satellitenavign.html>

55. Consider the following statements regarding AI action summit held in grand palais, paris in February 2025:

- I. Co-chaired with India, the event builds on the advances made at the Bletchley park summit held in 2023 and the seoul summit held in 2024.

II. Along with other countries US and UK also signed the declaration on inclusive and sustainable IA.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (a)

Explanation:

- ◆ **Statement 1 is correct:** Co-chaired with India, the event builds on the advances made at the Bletchley Park Summit in November 2023 and the Seoul Summit in May 2024 and will draw on the expertise of a steering committee bringing together some 30 countries and international institutions to ensure inclusive and diverse contributions.
- ◆ **Statement 2 is incorrect:** US and UK refused to sign Paris summit declaration on 'inclusive' AI, however the document was backed by 60 other signatories, including France, China, India, Japan, Australia and Canada.

Link:

- ◆ <https://www.theguardian.com/technology/2025/feb/11/us-uk-paris-ai-summit-artificial-intelligence-declaration>
- ◆ <https://onu.delegfrance.org/ai-action-summit-10-and-11-february-2025>
- ◆ <https://www.downtoearth.org.in/science-technology/ai-action-summit-india-china-over-50-other-countries-sign-declaration-on-inclusive-sustainable-ai>

56. Consider the following pairs:

- | | | |
|--|---|------|
| I. International year of woman farmer | : | 2026 |
| II. International year of sustainable and resilient tourism | : | 2027 |
| III. International year of peace and trust | : | 2025 |
| IV. International year of asteroid awareness and planetary defence | : | 2029 |

How many of the pairs given above are correctly matched?

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All the four

Correct Option: d

Explanation:

- ◆ **Option 1 is correct:** The resolution was adopted by the United Nations (UN) General Assembly In 2024 May to declare 2026 as the International Year of the Woman Farmer. The resolution was proposed by the United States of America and adopted by consensus.
- ◆ **Option 2 is correct:** Proposed by Uzbekistan, the resolution officially declares 2027 as the International Year of Sustainable and Resilient Tourism and underscores the importance of developing sustainable tourism
- ◆ **Option 3 is correct:** In March 2024, The United Nations General Assembly adopted a resolution to declare 2025 as the International Year of Peace and Trust.
- ◆ **Option 4 is correct :** In 2024, the General Assembly declared 2029 the International Year of Asteroid Awareness and Planetary Defence to take advantage on the close approach of 99942 Apophis and raise global awareness about asteroids.

Links:

- ◆ <https://www.fao.org/newsroom/detail/fao-welcomes-the-celebration-of-the-international-year-of-the-woman-farmer-in-2026/en>
- ◆ <https://www.accessibletourism.org/?i=enat.en.news.2376>
- ◆ <https://digitallibrary.un.org/record/4043298?ln=en>
- ◆ <https://www.un.org/en/observances/asteroid-awareness-year>

57. Consider the following statements with regard to BRICS”

- I. 16th BRICS summit was held under the Chairship of Russia in kazan.
- II. Indonesia has become a full member of BRICS.
- III. The theme of the 16th BRICS summit was strengthening multiculturalism for just global development and security.

Which of the statement given above is/are correct?

- (a) I and II
- (b) II and III
- (c) I and III
- (d) I only

Correct Option: (a)

Explanation:

- ◆ **Statement 1 is correct:** Under Russia’s presidency, BRICS (acronym for the founding states – Brazil, Russia, India and China) held its first summit following the group’s expansion on 1 January 2024, from 22 to 24 October in Kazan (Russia).
- ◆ **Statement 2 is correct:** Indonesia’s decision to join BRICS marks a new chapter in its diplomacy. Brazil, as the current BRICS Chair, announced Indonesia’s BRICS membership effective January 2025. This decision was undoubtedly accelerated, with all BRICS member countries agreeing to Indonesia’s inclusion in less than three months.
- ◆ **Statement 3 is incorrect:** 16th BRICS theme is ‘**Strengthening *Multilateralism* for Just Global Development and Security**’. This theme informs Russia’s priorities for 2024 in the areas of policy and security, cooperation in economy and finance, and cooperation in the humanitarian and cultural spheres.

Link:

- ◆ <https://eastasiaforum.org/2025/02/04/indonesias-bold-step-into-brics-and-beyond/>
- ◆ [https://www.europarl.europa.eu/thinktank/en/document/EPRS_ATA\(2024\)766243](https://www.europarl.europa.eu/thinktank/en/document/EPRS_ATA(2024)766243)
- ◆ <https://sdg.iisd.org/events/16th-brics-summit/>

58. Consider the following statements about Lokpal:

- I. The power of Lokpal applies to public servants of India, but not to the Indian public servants posted outside India.
- II. The chairperson or a member shall not be a member of the parliament or a member of the legislature of any the chief justice of India, whether incumbent or retired, has to be its chair person.
- III. The chairperson or a member shall not be a person of less than forty-five years of age on the date of assuming office as the chairperson or member, as the case may be.
- IV. Lokpal cannot inquire into the allegations of corruption against a sitting prime minister of India.

Which of the statements given above is/are correct?

- (a) III only
- (b) II and III
- (c) I and IV
- (d) None of the above statements is correct

Correct Option: (a)

Explanation:

- ◆ **Statement 1 is incorrect:** This Act the Lokpal and Lokayuktas Act, 2013. extends to the whole of India. It shall apply to public servants in and outside India.
- ◆ **Statement 2 is incorrect:** A person who is or has been a Chief Justice of India or is or has been a Judge of the Supreme Court.
- ◆ **Statement 3 is correct:** As per Section 3 of the Lokpal and Lokayuktas Act, 2013, which contains the qualification - The Chairperson or a Member shall not be a person of less than forty-five years of age, on the date of assuming office as the Chairperson or Member, as the case may be.
- ◆ **Statement 4 is incorrect:** In terms of Section 14 of the Act, a complaint can be filed against Any person who is or has been a Prime Minister.

Links:

- ◆ https://documents.doptcirculars.nic.in/D2/D02ser/InvitationOfApplicationForChairpersonAndMembersOfLokpal_English.pdf
- ◆ <https://lokpal.gov.in/pdfs/FreqAQs.pdf>
- ◆ https://dopt.gov.in/sites/default/files/407_06_2013-AVD-IV-09012014_0.pdf

59. Consider the following statements in respect of the first Kho Kho World Cup:

- I. The event was held in Delhi, India.
- II. Indian men beat Nepal with a score of 78-40 in the final to become the world champion in men category.
- III. Indian women beat Nepal with a score of 54-36 in the final to become the world champion in women category.

Which of the statements given above is/are correct?

- (a) I only
- (b) II and III only
- (c) I and III only
- (d) I, II and III

Correct Option: (a)

Explanation:

- ◆ **Statement 1 is correct:** The Kho Kho World Cup 2025 was held at the Indira Gandhi Indoor Stadium in New Delhi from January 13 to 19, 2025.
- ◆ **Statement 2 is incorrect:** The Indian men's kho kho team beat Nepal 54-36 in the final.
- ◆ **Statement 3 is incorrect:** The women's team won 78-40 against the same opponents.

60. Consider the following statements:

- I. In the finals of the 45th chess Olympiad held in 2024, Gukesh Dommaraju became the world's youngest winner after defeating the Russian player Jan Nepomniachtchi.
- II. Abhimanyu Mishra, an American chess player, holds the records of becoming world's youngest ever grandmaster.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (b)

Explanation:

- ◆ **Statement 1 is incorrect:** India's Gukesh Dommaraju became the world's youngest chess champion after defeating China's Ding Liren in the final match of their series in Singapore.

- ◆ **Statement 2 is correct:** Abhimanyu Mishra is the world's youngest chess grandmaster. His home country is the USA. He broke the record that had stood for 19 years.

Link:

- ◆ <https://www.dw.com/en/indias-gukesh-becomes-worlds-youngest-chess-champion/a-71038565>
- ◆ <https://www.chess.com/news/view/abhimanyu-mishra-youngest-grandmaster-in-chess-history>
- ◆ <https://kids.guinnessworldrecords.com/records/young-achievers/abhimanyu-mishra>

61. Consider the following statements:

Statement I:

Some rare earth elements are used in the manufacture of flat television screens and computer monitors.

Statement II:

Some rare earth elements have phosphorescent properties.

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

- Both statement I and statement II are correct and statement II explains statement I
- Both statement I and Statement II are correct but statement II does not explain statement I
- Statement I is correct but statement II is not correct
- Statement I is not correct but statement II is correct.

Correct Option: (a)

Explanation:

- ◆ **Statement I is correct:** Rare-earth elements (REEs) are used as components in high technology devices, including smart phones, digital cameras, computer hard disks, fluorescent and light-emitting-diode (LED) lights, flat screen televisions, computer monitors, and electronic displays. Large quantities of some REEs are used in clean energy and defense technologies.
- ◆ **Statement II is correct :** Some rare-earth metals display unique optical properties, including fluorescence and phosphorescence. These properties are vital in applications such as lighting, display technologies, and medical imaging.
- ◆ Due to unique optical properties, including fluorescence and phosphorescence, these properties are vital in applications such as lighting, display technologies, and medical imaging.

Links:

- ◆ <https://www.xometry.com/resources/materials/rare-earth-metals/>
- ◆ <https://profession.americangeosciences.org/society/intersections/faq/how-do-we-use-rare-earth-elements/>

62. Consider the following statements:

- Indian railways have prepared a national rail plan (NRP) to create a future ready' railway system by 2028.
- 'Kavach' is an automatic train protection system developed in collaboration with Germany.
- 'Kavach' system consists of RFID tags fitted on track in station section.

Which of the statements given above are not correct?

- I and II only
- II and III only
- I and III only
- I, II and III

Correct Option: (a)

Explanation:

- ◆ **Statement 1 is Incorrect:** Indian Railways have prepared a National Rail Plan (NRP) for India – 2030. The Plan is to create a 'future ready' Railway system by 2030.

- ◆ **Statement 2 is Incorrect:** Kavach is an **indigenously developed** Automatic Train Protection (ATP) system. Kavach is a highly technology intensive system, which requires safety certification of highest order (SIL-4).
- ◆ **Statement 3 is correct :** Implementation of Kavach System involves following Key Activities:
 - Installation of Station Kavach at each and every station, block section.
 - Installation of RFID Tags throughout the track length.
 - Installation of telecom Towers throughout the section.

Links:

- ◆ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2112824>
- ◆ <https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1797575#:~:text=Indian%20Railways%20have%20prepared%20a,Railways%20in%20freight%20to%2045%25>.

63. Consider the following space missions:

- I. Axiom-4
- II. SpaDex
- III. Gaganyaan

How many of the space missions given above encourage and support micro-gravity research?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (c)

Explanation:

- ◆ **Statement1 is correct:** As per ISRO's official announcement **seven Indian microgravity experiments** will be conducted on the International Space Station during Axiom-4.
- ◆ **Statement 2 is correct: SpaDeX mission is a cost-effective technology demonstrator mission for the demonstration of in-space docking using two small spacecraft launched by PSLV. It provides an opportunity for the scientific community to carry out certain in-orbit microgravity experiments for an extended duration of up to three months**
- ◆ **Statement 3: ISRO has recently signed a new agreement to boost space medicine research for Gaganyaan Mission. The collaboration is set to bolster Isro's flagship human spaceflight initiative, Gaganyaan, by fostering research and innovation in human health, microgravity, space medicine, and space biology.**

Links:

- ◆ https://www.isro.gov.in/Indian_microgravity_research_Axiom4_mission.html?utm_source=chatgpt.com
- ◆ https://www.indiatoday.in/science/gaganyaan-mission/story/isro-signs-new-agreement-to-boost-space-medicine-research-for-gaganyaan-mission-2715137-2025-04-25?utm_source=chatgpt.com
- ◆ https://www.isro.gov.in/POEM_4_Payloads_spadex.html?utm_source=chatgpt.com

64. With reference to India's defence, consider the following pairs:

Aircraft type		Description
I. Dornier-228	:	Maritime patrol aircraft
II. IL-76	:	Supersonic combat aircraft
III. C-17 Globe-master III	:	Military transport aircraft

How many of the pairs given above are correctly matched?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (b)

Explanation:

- ◆ **Option 1 is correct:** Dornier-228: It has been developed specifically to meet the manifold requirements of utility and commuter transport, third level services and air-taxi operations, coast guard duties and maritime surveillance.
- ◆ **Option 1 is incorrect:** IL-76: This is a tactical airlifter with a fixed wing, four engines, and a turbofan that was created by the Ilyushin Design Bureau in the Soviet Union. Its purpose was to transport large apparatus to places that were hard to reach, including remote regions and war zones. This is not a supersonic aircraft as its maximum speed in level flight was 528 miles per hour (850 km per hour). Typical speeds for supersonic aircraft are greater than 750 mph but less than 1500 mph,
- ◆ **Option 1 is correct:** C-17 Globemaster III: A high-wing, four-engine, T-tailed military transport aircraft, the multi-service C-17 can carry large equipment, supplies and troops directly to small airfields in harsh terrain anywhere in the world.

Links:

- ◆ <https://www.ga-ats.com/en/do228>
- ◆ https://joinindiancoastguard.cdac.in/air_craft
- ◆ <https://www.boeing.com/defense/c-17-globemaster-iii#overview>

65. Artificial way of causing rainfall to reduce air pollution makes use of

- (a) Silver iodide and potassium iodide
- (b) Silver nitrate and potassium iodide
- (c) Silver iodide and potassium nitrate
- (d) Silver nitrated and potassium chloride

Correct Option: (a)

Explanation:

- ◆ Cloud seeding creates artificial rain by injecting substances such as silver iodide, potassium iodide, dry ice (solid carbon dioxide), liquid propane, or salt into clouds to induce precipitation. By dispersing these substances the processes within the cloud are altered and precipitation can be improved.

Links:

- ◆ <https://greenly.earth/en-gb/blog/ecology-news/what-is-cloud-seeding-or-artificial-rain>
- ◆ <https://www.indiatoday.in/science/story/what-is-cloud-seeding-the-science-behind-artificial-rain-that-delhis-air-needs-2635857-2024-11-19>

66. Consider the following statements with regard to pardoning power of the president of India:

- I. The exercise of this power by the president can be subjected to limited judicial review.
- II. The president can exercise this power without the advice of the central government.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (a)

Explanation:

- ◆ **Statement 1 is correct:** Supreme court can put restrictions on the pardoning power of the President and the Governor through its interpretation and activist approach.
- ◆ **Statement 2 is incorrect:** The Supreme Court, in the landmark case of *Maru Ram v. Union of India* has categorically held that the President cannot exercise his personal discretion in this matter; rather, he functions on the aid and advice of Council of Ministers.

67. Consider the following statements:

- I. On the dissolution of the house of the people, the speaker shall not vacate his/her office until immediately before the first meeting of the house of the people after the dissolution.
- II. According to the provisions of the constitution of India, a member of the house of the people on being elected as speaker shall resign from his/her political party immediately.
- III. The speaker of the house of the people may be removed from his/her office by a resolution of the house of the people passed by a majority of all the then members of the house, provide that no resolution shall be moved unless at least fourteen days' notice has been given of the intention to move the resolution.

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

Correct Option: (c)

Explanation:

- ◆ **Article 94. Vacation and resignation of, and removal from, the offices of Speaker and Deputy Speaker**
- ◆ **Statement 1 is correct:** Whenever the House of the People is dissolved, the Speaker shall not vacate his office until immediately before the first meeting of the House of the People after the dissolution.
- ◆ **Statement 2 is incorrect:** Vacation and resignation of, and removal from, the offices of Speaker and Deputy Speaker.— A member holding office as Speaker or Deputy Speaker of the House of the People— **(a)** shall vacate his office if he ceases to be a member of the House of the People; **(b)** may at any time, by writing under his hand addressed, if such member is the Speaker, to the Deputy Speaker, and if such member is the Deputy Speaker, to the Speaker, resign his office; and **(c)** may be removed from his office by a resolution of the House of the People passed by a majority of all the then members of the House. There is no mention of resignation from political parties.
- ◆ **Statement 3 is correct:** Provided that no resolution for the purpose of clause (c) shall be moved unless at least fourteen days' notice has been given of the intention to move the resolution.

Links: <https://www.constitutionofindia.net/articles/article-94-vacation-and-resignation-of-and-removal-from-the-offices-of-speaker-and-deputy-speaker/>

68. Consider the following statements:

- I. If any question arises as to whether a member of the house of the people has become subject to disqualification under the 10th schedule, the president's decision in accordance with the opinion of the council of union ministers shall be final.
- II. There is no mention of the word 'political party' in the constitution of India.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (b)

Explanation:

- ◆ **Statement 1 is incorrect:** If any question arises as to whether a member of a House has become subject to disqualification under this Schedule, the question shall be referred for the decision of the Chairman or, as the case may be, the Speaker of such House and his decision shall be final.

- ◆ **Statement 2 is correct:** There is no mention of the word 'political party' in the Constitution of India.

Links: <https://www.mea.gov.in/Images/pdf1/S10.pdf>

69. Consider the following statements:

Statements I:

In India, state governments have no power for making rules for grant of concessions in respect of extraction of minor minerals even though such minerals are located in their territories.

Statements II:

In India the central government has the power to notify minor minerals under the relevant law.

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 not correct
- (d) Statement I is not correct but statement II is correct

Correct Option: (d)

Explanation:

- ◆ **Statement 1 is incorrect:** As per Section 15 of the MMDR Act, 1957 State Governments have complete powers for making Rules for grant of concessions in respect of extraction of minor minerals and levy and collection of royalty on minor minerals.
- ◆ **Statement 2 is correct:** The central government has the power to notify "minor minerals" under section 3 (e) of the MMDR Act, 1957.

Links: http://arthapedia.in/index.php/Minor_Minerals#:~:text=The%20central%20government%20has%20the,following%20minerals%20as%20minor%20minerals

70. Which organization has enacted the Nature restoration law (NRL) to tackle climate change and biodiversity loss?

- (a) The European union
- (b) The world bank
- (c) The organization for economic cooperation and development
- (d) The food and agriculture organization

Correct Option: (a)

Explanation:

- ◆ The Nature Restoration Regulation is the first continent-wide, comprehensive law of its kind. It is a key element of **the EU Biodiversity Strategy**, which sets binding targets to restore degraded ecosystems, in particular those with the most potential to capture and store carbon and to prevent and reduce the impact of natural disasters.

Links: https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-regulation_en

71. Suppose the revenue expenditure is Rs. 80,000 crores and the revenue receipts of the government are Rs. 60,000 crores. The government budget also shows borrowings of Rs. 10,000 crores and interest payments of Rs. 6,000 crores. Which of the following statement are correct?

- I. Revenue deficit is Rs. 20,000 crores.
- II. Fiscal deficit is Rs. 10,000 crores.
- III. Primary deficit is Rs. 4,000 crores.

Select the correct answer using the code given below.

- (a) I and II only
- (b) II and III only
- (c) I and III only
- (d) I, II and III

Correct Option: (d)

Explanation:

- ◆ **Statement 1 is correct:** Revenue Deficit = Revenue Expenditure – Revenue Receipts (80,000 crore – 60,000 crore = 20,000)
- ◆ **Statement 2 is correct:** Fiscal Deficit; The Government budget shows borrowing of Rs 10,000 crore
- ◆ **Statement 3 is correct:** Primary Deficit: Fiscal Deficit – Interest Payment (10,000 crore – 6,000 crore = 4,000 crore)

72. India is one of the founding members of the International North-South Transport corridor (INSTC), a multimodal transportation corridor, which will connect

- (a) India to central asia to Europe via iran
- (b) India to central asia via china
- (c) India to south-east asia through Bangladesh and Myanmar
- (d) India to Europe through Azerbaijan

Correct Option: (a)

Explanation:

- ◆ The INSTC envisages the movement of goods from Mumbai (India) to Shahid Beheshti Port – Chabahar (Iran) by sea, from Chabahar to Bandar-e- Anzali (an Iranian port on the Caspian Sea) by road, and then from Bandar-e- Anzali to Astrakhan (a Caspian port in the Russian Federation) by ship across the Caspian Sea, and after that from Astrakhan to other regions of the Russian Federation and further into Europe by Russian railways were highlighted by the speakers during the workshop.

Links: <https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1892221#:~:text=Ministry%20of%20Ports%2C%20Shipping%20and%20Waterways%2C%20GoI%2C%20in%20association,Petersburg%20in%20Russia>

73. Consider the following statements:

Statement I:

Of the two major ethanol producers in the world, i.e., Brazil and the United States of America, the former produces more ethanol than the latter.

Statement II:

Unlike in the united states of America where corn is the principal sugarcane is the principal feedstock for ethanol production in Brazil.

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 statements 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 not correct
- (d) Statement I is not correct but statement II is correct.

Correct Option: (d)

Explanation:

- ◆ **Statement 1 is incorrect:** The United States is the leading producer of fuel ethanol in the world. In 2024, the U.S. produced an estimated 16.1 billion gallons of the biofuel. Of the two major ethanol

producers in the world, i.e., Brazil and the United States of America, the former produces more ethanol than the latter.

- ◆ **Statement 2 is correct:** Sugarcane is the primary raw material used for ethanol production. This makes Brazil a leading producer of ethanol, with sugarcane being the main feedstock for fuel, unlike the United States, which uses corn. In USA Corn serves as the primary feedstock for ethanol production, creating E10, E15 and E85.

Links:

- ◆ <https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1892221#:~:text=Ministry%20of%20Ports%2C%20Shipping%20and%20Waterways%2C%20GoI%2C%20in%20association,Petersburg%20in%20Russia.>
- ◆ <https://www.sciencedirect.com/science/article/pii/S1517838216310346>
- ◆ <https://afdc.energy.gov/data>

74. The World Bank warned that India could become one of the first places where wet-bulb temperatures routinely exceed 35°C. Which of the following statements best reflects(s) the implication of the above-said report?

- I. Peninsular India will most likely suffer from flooding, tropical cyclones and droughts.
- II. The survival of animals including humans will be affected as shedding of their body heat through perspiration becomes difficult.

Select the correct answer using the code given below.

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (c)

Explanation:

- ◆ **Statement 1 is correct:** According to world bank, Peninsular India will most likely suffer from flooding, tropical cyclones and droughts.
- ◆ **Statement 2 is correct:** A wet-bulb temperature of 35°C is considered a critical threshold, as it essentially means the human body can no longer effectively cool itself through sweating under such conditions, leading to heatstroke and potentially death. This scenario would significantly impact the survival of animals and humans in affected areas.

Links: https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15503-WB_India%20Country%20Profile-WEB.pdf

75. A country's fiscal deficit stands at Rs. 50,000 crores. It is receiving Rs. 10,000 crores through non-debt creating capital receipts. The country's interest liabilities are Rs. 1,500 crores. What is the gross primary deficit?

- (a) Rs. 48,500 crores
- (b) Rs. 51,500 crores
- (c) Rs. 58,500 crores
- (d) None of the above

Correct Option: (a)

Explanation:

- ◆ Gross Primary Deficit = Fiscal Deficit (Rs 50,000 crore) – Interest Payments (Rs 1,500 crore) = Rs 48,500 crore

Supplementary Notes

- ◆ A primary deficit is the difference between what a government earns (not counting interest payments) and what it spends on non-interest items. It shows how well a government is managing its finances,

indicating how much it borrows to pay for daily operations instead of using its own money. A primary deficit can point to poor financial practices, as it means the government is using debt for everyday costs instead of focusing on long-term growth or paying off existing debts.

76. Which of the following statements with regard to recommendations of the 15th Finance Commission of India are correct?

- I. It has recommended grants of Rs. 4,800 crores from the year 2022-23 to the year 2025-26 for incentivizing states to enhance educational outcomes.
- II. 45% of the net proceeds of union taxes are to be shared with states.
- III. Rs. 45,000 crores are to be kept as performance-based incentive for all states for carrying out agricultural reforms.

Select the correct answer using the code given below.

- (a) I, II and III
- (b) I, II and IV
- (c) I, III and IV
- (d) II, III and IV

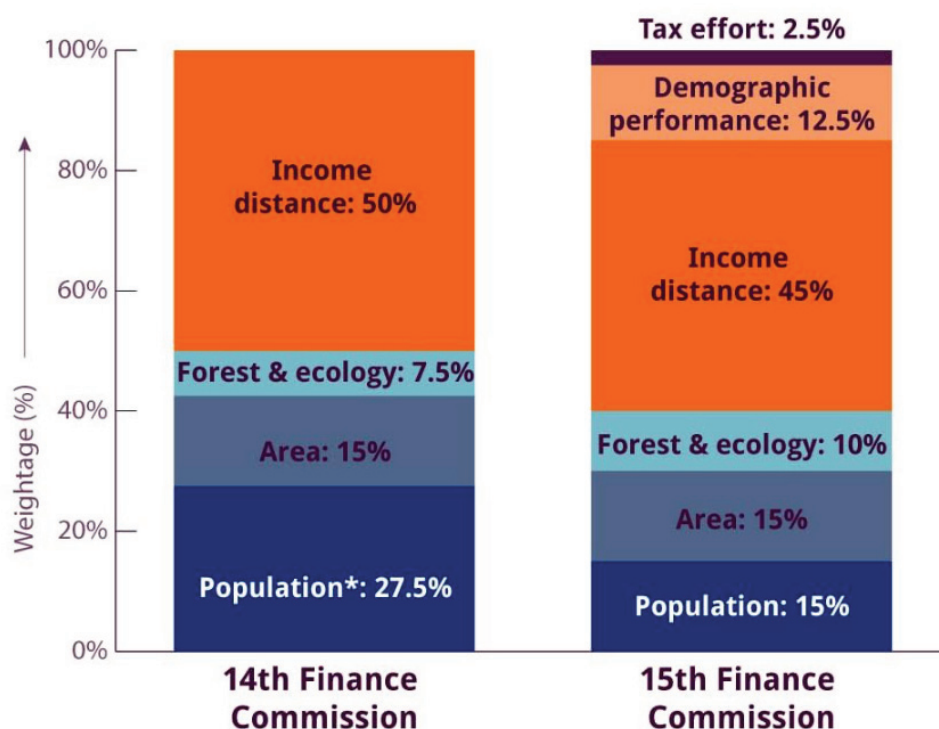
Correct Option: (c)

Explanation:

- ◆ **Statement 1 is correct:** Finance Commission has recommended grants of Rs.4,800 crore (Rs.1,200 crore each year) from 2022-23 to 2025-26 for incentivising the States to enhance educational outcomes.
- ◆ **Statement 2 is incorrect:** The Commission has recommended that **41 per cent of the net proceeds** of Union taxes should be shared with the States.
- ◆ **Statement 3 is correct:** The Commission has recommended that Rs.45,000 crore be kept as performance-based incentive for all the States for carrying out agricultural reforms during the award period
- ◆ **Statement 4 is correct:** The Commission reintroduced tax effort criteria to reward fiscal performance.

Links: https://tnbudget.tn.gov.in/tnweb_files/CFC/15th_FinanceCom_ENG_2021.pdf

Revenue-sharing formulas in the 14th and 15th Finance Commissions



77. Consider the following statements in respect of the international bank for reconstruction and development (IBRD):

- I. It provides loans and guarantees to middle income countries.
- II. It works single-handedly to help developing countries to reduce poverty.
- III. It was established to help Europe rebuild after the world war II.

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

Correct Option: (c)

Explanation:

- ◆ **Statement 1 is correct:** The International Bank for Reconstruction and Development (IBRD) is a global development cooperative owned by 189 member countries. As the largest development bank in the world, it supports the World Bank Group's mission by providing loans, guarantees, risk management products, and advisory services to middle-income and creditworthy low-income countries, as well as by coordinating responses to regional and global challenges.
- ◆ **Statement 2 is incorrect:** IBRD joins with IDA, our fund for the poorest countries, to form the World Bank. They work closely with all institutions of the World Bank Group and the public and private sectors in developing countries to reduce poverty and build shared prosperity.
- ◆ **Statement 3 is correct:** It is Created in 1944 to help Europe rebuild after World War II

Links: <https://www.worldbank.org/en/who-we-are/ibrd>

78. Consider the following statements in respect of RTGS and NEFT:

- I. In RTGS, the settlement time is instantaneous while in case of NEFT, it takes some time to settle payments.
- II. In RTGS, the customer is charged for inward transactions while that is not the case for NEFT.
- III. Operating hours for RTGS are restricted on certain days while this is not true for NEFT.

Which of the statements given above is/are correct?

- (a) I only
- (b) I and II
- (c) I and III
- (d) III only

Correct Option: (c)

Explanation:

- ◆ **Statement 1 is correct:** NEFT processes transactions in batches at designated intervals throughout the day, which means the settlement can occur within a few hours but may vary depending on the timing of the transaction. RTGS offers real-time settlement, ensuring that funds are transferred and settled instantly once the transaction is processed.
- ◆ **Statement 2 is incorrect:** With effect from July 01, 2019, RBI has waived the processing charges levied by it for RTGS transactions. Banks may pass on the benefit to its customers.
- ◆ NEFT does not levy charges for inward transactions, i.e., when funds are credited to the beneficiary's account. This makes it cost-effective for receiving money while
- ◆ **Statement 3 is correct:** The NEFT system operates 24x7, including on weekends and holidays while RTGS transfers initiated through online banking platforms (like internet banking or mobile apps) are generally available 24/7, including Sundays but Some banks may have cut-off times for RTGS transactions, particularly for branch-based transactions, meaning transactions initiated after a certain time may not be processed until the next business day.

Links:

- ◆ <https://www.bankbazaar.com/ifsc/difference-neft-rtgs-imps.html>
- ◆ <https://www.rbi.org.in/commonman/english/Scripts/FAQs.aspx?Id=275#:~:text=With%20a%20view%20to%20rationalise,no%20charge%20to%20be%20levied.&text=Banks%20may%20decide%20to%20charge,the%20rates%20prescribed%20by%20RBI>

79. Consider the following countries:

- I. United arab emirates
- II. France
- III. Germany
- IV. Singapore
- V. Bangladesh

How many countries amongst the above are there other than India where international merchant payments are accepted under UPI?

- (a) Only two
- (b) Only three
- (c) Only four
- (d) All the five

Correct Option: (b) Only 3

Explanation:

- ◆ India's digital payments movement is gaining global attention, with UPI and RuPay expanding across borders. UPI is now operational in seven countries: UAE, Singapore, Bhutan, Nepal, Sri Lanka, France, and Mauritius.

Links: Advancing Cashless India

80. Consider the following statements about 'PM Surya Ghar Muft Bijli Yojana':

- I. It targets installation of one crore solar rooftop panels in the residential sector.
- II. The ministry of New and Renewable Energy aims to impart training on installation, operation, maintenance and repairs of solar rooftop systems at grassroot levels.
- III. It aims to create more than three lakhs skilled manpower through fresh skilling, and up-skilling, under scheme component of capacity building.

Which of the statements given above are correct?

- (a) I and II only
- (b) I and III only
- (c) II and III only
- (d) I, II and III

Correct Option: (d) I, II and III

Explanation:

- ◆ The PM Surya Ghar: Muft Bijli Yojana, the world's largest domestic rooftop solar initiative, is transforming India's energy landscape with a bold vision to supply solar power to one crore households by March 2027.
- ◆ The Ministry of New and Renewable Energy (MNRE) intends to impart training on installation, operation, maintenance and repairing of solar roof top systems at grass root level.
- ◆ To create more than 3 lakh skilled manpower, through fresh skilling, and up-skilling, under scheme component of capacity building, out of which at least 1,00,000 will be Solar PV Technicians.

Links:

- ◆ Guidelines for PM-Surya Ghar: Muft Bijli Yojana
- ◆ PM Surya Ghar: Muft Bijli Yojana

81. With reference to the Indian polity, consider the following statements:

- I. An ordinance can amend any central act.
- II. An ordinance can abridge a fundamental right.
- III. An ordinance can come into effect from a back date.

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

Correct Option: (c) I and III Only

Explanation:

- ◆ An ordinance, issued by the President or a Governor when the legislature is not in session, has the same force as a law and can amend any Central Act. It can also be made retrospective, meaning it can take effect from an earlier date. However, an ordinance cannot abridge or take away Fundamental Rights, as such actions are restricted under Article 13(2) of the Constitution.

82. Consider the following pairs:

State	Description
I. Arunachal Pradesh	: The capital is named after a fort, and the State has two national parks
II. Nagaland	: The state came into existence on the basis of a constitutional amendment act
III. Tripura	: Initially a part 'C' State, it became a centrally administered territory with the reorganization of states in 1956 and later attained the status of a full-fledged state

How many of the above pairs are correctly matched?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Answer: (c) All the three

Explanation:

- ◆ **The Governor of Arunachal Pradesh :: History**
 - Itanagar is named after Ita fort meaning fort of bricks, built in the 14th century AD.
- ◆ **Wildlife | Department of Environment, Forest & Climate Change | Govt. of Arunachal Pradesh**
 - There are 13 Wildlife Sanctuaries, 2 National Parks, 3 Tiger Elephant Reserves, 2 Elephant Reserves, 9 Community Reserves and 1 Biosphere Reserve in the State of Arunachal Pradesh.
- ◆ **Nagaland**
 - THE CONSTITUTION (THIRTEENTH AMENDMENT) ACT, 1962
- ◆ **Tripura**
 - After merger Tripura became a Part 'C' State. On reorganization of the states, effected in November, 1956, Tripura became a Union Territory with an Advisory Committee to aid and advise the Chief Commissioner. Thereafter in place of the Advisory Committee, a Territorial Council was formed through the adult franchise on 15th August, 1957. On July 1, 1963, the Tripura Territorial Council was dissolved and the Legislative Assembly with the existing members of the Territorial Council was formed. On January 21, 1972 Tripura became full-fledged State by the Act of Parliament called the North Eastern Areas (Reorganization) Act, 1971.

83. With reference to India consider the following:

- I. The inter-state council
- II. The national security council
- III. Zonal councils

How many of the above were established as per the provisions of the constitution of India?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (a) Only one

Explanation:

The Inter-State Council

- ◆ The Inter-State Council was established under Article 263 of the Constitution of India through a Presidential Order dated 28th May 1990

Zonal Council

- ◆ Five Zonal Councils were set up vide Part-III of the States Re-organisation Act, 1956.
- ◆ India's National Security Council: Stuck in the Cradle?

84. Consider the following statements:

- I. The constitution of India explicitly mentions that in certain spheres the governor of a state acts in his/her own, discretion.
- II. The president of India can, of his/her own, reserve a bill passed by a state legislature for his/her consideration without it being forwarded by the governor of the state concerned.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (c)

Explanation:

- ◆ **Article 163: Council of Ministers to aid and advise Governor - Constitution of India**
- ◆ If any question arises whether any matter is or is not a matter as respects which the Governor is by or under this Constitution required to act in his discretion, the decision of the Governor in his discretion shall be final, and the validity of anything done by the Governor shall not be called in question on the ground that he ought or ought not to have acted in his discretion.

85. Consider the following pairs:

Provision in the Constitution of India		Stated under
I. Separation of Judiciary from the Executive in the public services of the State	:	The Directive Principles of the State Policy
II. Valuing and preserving of the rich heritage of our composite culture	:	The Fundamental Duties
3. Prohibition of employment of children below the age of 14 years in factories	:	The Fundamental Rights

How many of the above pairs are correctly matched?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (c) All the three

Explanation:

Article 50: Separation of judiciary from executive - Constitution of India

- ♦ The State shall take steps to separate the judiciary from the executive in the public services of the State.

Fundamental Duties

- ♦ India has a rich heritage of composite culture. This is summarily recited in Article 51A(f) of the Constitution of India which makes it every citizen's fundamental duty to value and preserve our composite culture.

Article 24 in Constitution of India

- ♦ 24. Prohibition of employment of children in factories, etc.
- ♦ No child below the age of fourteen years shall be employed to work in any factory or mine or engaged in any other hazardous employment.

86. Consider the following statements:

- I. With reference to the Constitution of India, if an area in a State is declared as Scheduled Area under the Fifth Schedule
- II. The state government loses its executive power in such areas and a local body assumes total administration
- III. The union government can take over the total administration of such areas under certain circumstances on the recommendations of the governor

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I and II

Correct Option: (d) Neither I nor II

Explanation:

FIFTH SCHEDULE

Fifth Schedule Areas | Social welfare

87. With reference of India, consider the following pairs:

Organization	Union Ministry
I. The National Automotive Board	: Ministry of Commerce and Industry
II. The Coir Board	: Ministry of Heavy Industries
III. The National Centre for Trade Information	: Ministry of Micro, Small and Medium Enterprises

How many of the above pairs are correctly matched?

- (a) Only one
- (b) Only two

- (c) All the three
- (d) None

Correct Option: (d) None

Explanation:

Selection for the post of Chairman, National Automotive Board(NAB).

- ◆ National Automotive Board (NAB) is an autonomous society under Department of Heavy Industry, Ministry of Heavy Industry & Public Enterprises. Govt. of India.

Shri Bhanu Pratap Singh Verma lays the foundation stone for Coir Showroom at Konch, Jalaun District, Uttar Pradesh.

- ◆ Coir Board comes under the Ministry of MSME, Govt. of India.

Information of National Centre for Trade Information

- ◆ The National Centre for Trade Information (NCTI) has been setup by Ministry of Commerce and Industry to create institutional mechanism for collection and dissemination of trade data and for improvement of business information services.

88. Consider the following subjects under the Constitution of India:

- I. List I-Union List, in the Seventh Schedule
- II. Extent of the executive power of a State
- III. Conditions of the Governor's office

For a constitutional amendment with respect to which of the above, ratification by the Legislatures or not less than one-half of the States is required before presenting the bill to the president of India for assent?

- (a) I and II only
- (b) II and III only
- (c) I and III only
- (d) I, II and III

Correct Option: (a) I and II only

Explanation:

- ◆ The Union List (List I) in the Seventh Schedule of the Indian Constitution can be amended, along with other provisions related to the federal structure, through a special majority of Parliament and the consent of half of the state legislatures.
- ◆ The Conditions of the Governor's office can be amended through the Indian Parliament by enacting a law under Article 158 of the Constitution.
- ◆ The extent of the executive power of a state can be amended by a special majority of the Parliament, along with the consent of half of the state legislatures by a simple majority
- ◆ Powers & Functions of the Governor Under Constitution of India

89. With reference to the India polity, consider the following statements:

- I. The governor of a state is not answerable to any court for the exercise and performance of the powers and duties of his/her office.
- II. No criminal proceedings shall be instituted or continued against the governor during his/her term of office.
- III. Members of a state legislature are not liable to any proceedings in any court in respect of anything said within the house.

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

Correct Option: (d) I, II and III

Explanation:

Article 361 in Constitution of India

Article 194 in Constitution of India

- ◆ The President, or the Governor or Rajpramukh of a State, shall not be answerable to any court for the exercise and performance of the powers and duties of his office or for any act done or purporting to be done by him in the exercise and performance of those powers and duties.
- ◆ No criminal proceedings whatsoever shall be instituted or continued against the President, or the Governor of a State, in any court during his term of office.
- ◆ No member of the Legislature of a State shall be liable to any proceedings in any court in respect of anything said or any vote given by him in the Legislature or any committee thereof, and no person shall be so liable in respect of the publication by or under the authority of a House of such a Legislature of any report, paper, votes or proceedings.

90. Consider the following activities:

- I. Production of crude oil
- II. Refining, storage and distribution of petroleum
- III. Marketing and sale of petroleum products
- IV. Production of natural gas

How many of the above activities are regulated by the petroleum and natural gas regulatory board in our country?

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All the four

Correct Option: (b) Only two

Explanation:

Petroleum and Natural Gas Regulatory Board (PNGRB)

<https://www.pngrb.gov.in/eng-web/function.html>

- ◆ Petroleum and Natural Gas Regulatory Board (PNGRB) regulates storage, distribution, and marketing of petroleum products (II & III), but not production of crude oil or natural gas (I & IV), which are upstream activities.

91. "Sedition has become my religion" was the famous statement given by Gandhiji at the time of

- (a) The Champaran Satyagraha
- (b) Publicly violating salt law at Dandi
- (c) Attending the second round table conference in London
- (d) The launch of the Quit India movement

Correct Option: (b) publicly violating Salt Law at Dandi

92. The famous female figurine known as 'Dancing Girl', found at Mohenjo-daro, is made of

- (a) Carnelian
- (b) Clay

- (c) Bronze
- (d) Gold

Correct Option: (c)

Explanation:

- ◆ This mesmerizing sculpture, famously known as 'The Dancing Girl,' is one of the highest achievements of the artists of Mohenjodaro. The 'Dancing Girl' is a sculpture made of bronze. It belongs to the Indus Valley Civilization and dates back to circa 2500 BCE. It is 10.5 cm in height, 5 cm in width and 2.5 cm in depth. Presently, it is on display in the Indus Valley Civilization gallery in the National Museum, New Delhi.

Supplementary Notes:

- ◆ The 'Dancing Girl' is a sculpture made of bronze. It belongs to the Indus Valley Civilization and dates back to circa 2500 BCE.
- ◆ This small bronze statuette (only 4 inches in height), depicts a nude young woman, with a coiled hairstyle and bangles adorning her arms.
- ◆ The figure stands with her feet apart and her weight distributed unevenly (often referred to by art historians as contrapposto). She props one arm at her waist and her other arm hangs by her side.
- ◆ The title of the sculpture, Dancing Girl, comes from the archaeologist who unearthed it in 1926 who thought the ancient figure recalled images of dancing nautch girls (female dancers who often performed at royal courts and in salons, especially in colonial India).
- ◆ This free-standing nude female figure is dated to c. 2500 B.C.E. Its site of origin, Mohenjodaro, was an important prehistoric city from the Indus Valley civilization (sometimes referred to as the Harappan civilization), and was known for its well-planned cities, large-scale architecture, and one of the earliest urban sanitation systems in the world. Named after the Indus River, the Indus Valley civilization encompassed a vast swath of present-day Pakistan and northwestern India.

Link: <https://indianculture.gov.in/artefacts-museums/dancing-girl#:~:text=The%20'Dancing%20Girl'%20is%20a,the%20National%20Museum%2C%20New%20Delhi>

93. Who provided legal defence to the people arrested in the aftermath of Chauri Chaura INCIDENT?

- (a) C.R. Das
- (b) Madan Mohan Malaviya and Krishna Kant
- (c) Dr. Saifuddin Kitchlew and Khwaja Hasan Nizami
- (d) M.A. Jinnah

Correct Option: (b)

Explanation:

- ◆ The Chauri Chaura incident occurred on February 4, 1922, in the Gorakhpur district of the United Provinces (now Uttar Pradesh). During a protest, a group of satyagrahis clashed with police, which escalated into violence. A police station was set on fire, resulting in the death of 22 policemen.
- ◆ Following the incident, 172 people were arrested, and 151 of them were put on trial for murder under Section 302 of the Indian Penal Code.
- ◆ Pandit Madan Mohan Malaviya, a prominent lawyer and freedom fighter, volunteered to defend the accused in the Gorakhpur Sessions Court, along with Krishna Kant Malaviya (his son and also a legal professional).
- ◆ Due to their legal efforts, the sentences of many were commuted, and a significant number were acquitted. Malaviya's arguments in court are considered one of his most celebrated legal interventions in the freedom movement.
- ◆ Other options are incorrect:
 - C.R. Das was active in Bengal and was not involved in this case.
 - Dr. Saifuddin Kitchlew and Khwaja Hasan Nizami were involved in anti-Rowlatt Act protests and the Khilafat movement, not this trial.
 - M.A. Jinnah was not associated with the Chauri Chaura incident or its aftermath.

Supplementary Notes

- ◆ The historical Chauri Chaura incident occurred on February 4, 1922 at Gorakhpur (Uttar Pradesh).
- ◆ The incident occurred in Chauri Chaura town of Gorakhpur district of the United Province (Uttar Pradesh) in British India.
- ◆ A large group of protesters, participating in the Non-cooperation Movement, clashed with police, who opened fire.
- ◆ In retaliation the demonstrators attacked and set fire to a police station, killing all of its occupants.
 - The incident led to the deaths of three civilians and 23 policemen.

Background of the Incident

- ◆ Non-Cooperation Movement: On August 1, 1920, Gandhi had launched the Non-Cooperation (Asahayog) Movement against the government.
 - The movement involved a boycott of foreign goods, especially machine-made cloth, and legal, educational and administrative institutions, “refusing to assist a ruler who misrules”.
- ◆ As the movement gathered momentum over the next year and a half, large numbers of volunteers became active across the country.
- ◆ In the winter of 1921-22, volunteers of the Congress and the Khilafat movement were organised into a national volunteer corps.
- ◆ In mid-January 1922, after a meeting addressed by a functionary of the Gorakhpur Congress and Khilafat Committees, peasant “officers” were appointed to fill out pledges of non-cooperation, collect subscriptions, and lead the picketing of shops selling foreign items.
- ◆ A few days before the February 4 incident, police cracked down on volunteers who were trying to stop trade in foreign cloth, and enforce a just price for meat and fish, and severely beat up one Bhagwan Ahir, a demobilised soldier from the British Indian Army.

Link: <https://www.gandhiheritageportal.org>

94. Subsequent to which one of the following events, Gandhiji, who consistently opposed untouchability and appealed for its eradication from all spheres, decided to include the upliftment of ‘Harijans’ in his political and social programme?

- (a) The Poona Pact
- (b) The Gandhi-Irwin Agreement (Delhi Pact)
- (c) Arrest of Congress leadership at the time of the Quit India movement
- (d) Promulgation of the Government of India Act, 1935

Correct Option: (a)

Explanation:

- ◆ The Poona Pact was signed on the 24th September, 1932. On the 25th September a public meeting of the Hindus was held to accord their support. Mr. Gandhi felt it necessary for an organization to be there, that would devote themselves exclusively to the **Untouchables**. On 28th September, 1932, All India Anti-Untouchability League was established. Afterwards he changed it and renamed it as **Harijan Sevak Sangh**. Untouchables were now called Harijans. The Untouchables simply rejected the name. It did nothing to rescue them from the curse of the untouchability. Secondly, the name ‘**Harijan**’ or ‘**the children of the god**’ was indicative of pity and their helplessness.

Supplementary Notes:

- ◆ Poona Pact was signed by Dr. Babasaheb Ambedkar and Mahatma Gandhi on September 24, 1932, in the Yerwada Central Jail in Pune.
- ◆ The pact is a result of the fusion of two diametrically opposed ideas (Gandhi’s Social Approach and Ambedkar’s Political Approach), with the aim of attaining a shared objective for the upliftment of one of India’s most vulnerable groups of society.
- ◆ Key agreements:
 - As part of a deal he reached with Mahatma Gandhi, Bhimrao Ambedkar agreed to have candidates from the underprivileged class chosen by a joint electorate.
 - In addition, 147 legislative seats—nearly twice as many as the community award—were reserved for the oppressed classes.

- The Poona Pact also guaranteed that underprivileged groups received fair representation in public services while providing a portion of subsidies for their education to continue their advancement. Higher-class Hindus publicly acknowledged with the Poona Pact that the underprivileged class was the most unfairly treated group in India.
- Additionally, it was decided that quick, severe action was required to help politically the underprivileged segment of society.
- The treaty made the entire country ethically answerable for the moral uplift of the lower classes.

Link: <https://www.allaboutambedkaronline.com/post/a-note-on-gandhi-and-his-fast>

95. Consider the following fruits:

- I. Papaya
- II. Pineapple
- III. Guava

How many of the above were introduced in India by the Portuguese in the sixteenth and seventeenth centuries?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (c)

Explanation:

- ◆ The Portuguese introduced many 'New World' fruits like the pineapple, Papaya, Sapodilla, and the Guava which found acceptance and became part of Indian food culture.

Supplementary Notes:

- ◆ The Portuguese first arrived in India in 1498 with Vasco da Gama, establishing a colonial presence from 1505 to 1961.
- ◆ They established trading posts and forts, particularly in Goa, Daman, Diu, and Dadra and Nagar Haveli, and their influence was mainly limited to these colonies.
- ◆ The Portuguese India era ended in 1961 when Goa, Daman, Diu, and Dadra and Nagar Haveli were annexed by India.
- ◆ The Portuguese also introduced many 'New World' fruits like the pineapple, Papaya, Sapodilla, and the Guava which found acceptance and became part of Indian food culture.

Link: https://www.ripublication.com/ijhss/ijhssv5n3_07.pdf

96. Consider the following countries:

- I. United Kingdom
- II. Denmark
- III. New Zealand
- IV. Australia
- V. Brazil

How many of the above countries have more than four time zones?

- (a) All the five
- (b) Only four
- (c) Only three
- (d) Only two

Correct Option: (b)

Explanation:

Country	No. of time zones
Australia	9
United Kingdom	9
New Zealand	5
Brazil	4
Denmark	5

Supplementary Notes:

- ◆ Time zones are determined by variations from Coordinated Universal Time (UTC), with specific dates marking these shifts. Daylight saving time (DST) can lead certain regions to alternate between these offsets throughout the year.
- ◆ UTC offsets range from UTC-12:00 to UTC+14:00, usually in full-hour increments, although some, like India, South Australia, and Nepal, deviate by 30 or 45 minutes.
- ◆ Areas with extreme latitudes are more likely to adopt DST, often lasting about half of the year. This period involves adjusting local time by one hour during spring and summer months.

Link: <https://www.worldatlas.com/time-zones/10-countries-with-the-most-time-zones.html>

97. Consider the following statements:

- I. Anadyr in Siberia and Nome in Alaska are a few kilometers from each other, but when people are waking up and getting set for breakfast in these cities, it would be different days.
- II. When it is Monday in Anadyr, it is Tuesday in Nome.

Which of the statements given above is/are correct?

- (a) I only
- (b) II only
- (c) Both I and II
- (d) Neither I nor II

Correct Option: (a)

Explanation:

- ◆ **Statement 1 is correct:** Anadyr and Nome are geographically close, separated by the Bering Strait. However, they lie **on opposite sides of the IDL**, which causes them to be **almost a day apart**, even though their clock times may be similar.
- ◆ **Statement 2 is incorrect:** When it is Monday in Anadyr (Russia), it is still Sunday in Nome (USA), not Tuesday. Anadyr is ahead of Nome by 20-21 hours. So technically, Nome lags behind.

Supplementary Notes:

- ◆ Anadyr and Nome are indeed geographically close and are separated by the Bering Strait, a narrow stretch of water that connects the easternmost part of Russia (Chukotka Autonomous Okrug, where Anadyr is located) with the westernmost part of Alaska, USA (where Nome is situated).
 - The straight-line distance between Anadyr and Nome is approximately 850 kilometers (about 530 miles), although the closest points between Russia and Alaska across the Bering Strait (Cape Dezhnev in Russia and Cape Prince of Wales in Alaska) are only about 85 kilometers (53 miles) apart.
 - **Geographic Context:**
 - **Anadyr** is a port town and administrative center of Chukotka in Russia's Far East. It lies near the mouth of the Anadyr River, close to the Bering Sea.
 - **Nome** is a coastal city on the southern Seward Peninsula of Alaska, along the Bering Sea.

- **Bering Strait:** This narrow passage of water is not only a physical separator but also a symbolic boundary between Asia and North America, and between Russia and the United States. In winter, parts of the strait may freeze, historically making temporary crossings possible.

Link: <https://www.geographyrealm.com/separated-by-2-4-miles-and-21-hours/>

98. Who among the following was the founder of the 'Self-Respect Movement'?

- (a) 'Periyar' E.V. Ramaswamy Naicker
- (b) Dr. B.R. Ambedkar
- (c) Bhaskarrao Jadhav
- (d) Dinkarrao Javalkar

Correct Option: (a)

Explanation:

- ◆ The Self-Respect Movement was launched in 1925 by EV Ramasamy (Periyar) in Tamil Nadu, the movement fundamentally altered the political and social fabric of southern India.

Supplementary Notes:

- ◆ The Self-Respect Movement was an emancipatory movement unlike any other. Its aim was to empower individuals and communities to challenge and overthrow the hierarchical structures that oppressed them.
- ◆ But the movement traversed farther to nurture rational thinking, inspire subaltern politics, advocate women's rights and promote social justice.
- ◆ Though the Self-Respect Movement is synonymously associated with the Dravidian Movement, there are key but subtle differences.
- ◆ Together, both movements continue to guide the political outlook of Tamil Nadu and provide an undisputable counter-balance to the emergence of the majoritarian onslaughts across Indian society.

Why in news?

- ◆ 2024 marked the start of the hundredth year of the Self-Respect Movement.

Link: <https://www.thehindu.com/opinion/lead/keep-the-fire-of-the-self-respect-movement-going/article68687061.ece>

99. Consider the following pairs:

Country		Resource-rich in
I. Botswana	:	Diamond
II. Chile	:	Lithium
III. Indonesia	:	Nickel

In how many of the above rows is the given information correctly matched?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (c)

Explanation:

- ◆ **Pair 1 is correctly matched:** Botswana's mining industry continues to be a global mining stalwart, especially diamond mining – Botswana is the world's leading producer of diamonds by value.
- ◆ **Pair 2 is correctly matched:** Chile holds the largest lithium reserves in the world at 9.3 million metric tons.
- ◆ **Pair 3 is correctly matched:** Indonesia is home to the world's largest nickel reserves, accounting for nearly 30 per cent of the global supply

Supplementary Notes:

- ◆ Botswana – Diamond Mining (Correctly Matched)
 - Botswana has long been recognized as one of the world's leading producers of diamonds by value. The country's mining industry, especially diamond mining, plays a central role in its economy.
 - Botswana ranks first globally in diamond production by value, even though Russia (particularly Alrosa) may exceed it in volume. This is because Botswana's diamonds are of higher quality.
 - The industry is dominated by Debswana, a joint venture between the Government of Botswana and De Beers.
 - Diamond revenues account for a significant portion of Botswana's GDP, exports, and government revenues, helping to fund infrastructure, health, and education.
- ◆ Chile – Lithium Reserves
 - Chile is a global powerhouse in the lithium industry, holding some of the **largest proven lithium reserves** in the world.
 - As of the latest estimates, Chile holds **around 9.3 million metric tons** of lithium reserves, the **largest** globally.
 - The lithium is primarily found in the **Salar de Atacama**, a salt flat in northern Chile.
 - Chile is part of the "**Lithium Triangle**" along with Bolivia and Argentina – a region that contains over **50% of the world's lithium resources**.
- ◆ Indonesia – Nickel Reserves
 - **Overview:** Indonesia has emerged as a **nickel superpower**, holding the **largest nickel reserves** globally and accounting for a substantial share of global production.
 - Indonesia possesses **around 30% of global nickel reserves**, particularly in the Sulawesi and Maluku islands.
 - The country is also the **largest producer of nickel**, having strategically banned the export of raw nickel ore in 2020 to **boost domestic refining and industrialization**.
 - It is investing heavily in **downstream industries**, including **battery-grade nickel processing and EV battery production**, in collaboration with global companies.
 - ◆ **Strategic Importance:** Nickel is a crucial component in **lithium-ion batteries**, especially for higher energy density types used in EVs. Indonesia's resource policy has made it a pivotal player in the EV and battery supply chain.

Link:

- ◆ Botswana: <https://www.trade.gov/country-commercial-guides/botswana-mining-minerals#:~:text=Botswana's%20mining%20industry%20continues%20to,during%20the%20COVID%2D19%20pandemic.>
- ◆ Chile: <https://globalcenters.columbia.edu/news/journey-through-chiles-lithium-landscape>
- ◆ Indonesia: <https://www.downtoearth.org.in/mining/booming-indonesian-nickel-industry-faces-challenges-ahead>

100. Consider the following pairs:

Region	Country
I. Mallorca	: Italy
II. Normandy	: Spain
III. Sardinia	: France

In how many of the above rows is the given information correctly matched?

- (a) Only one
- (b) Only two
- (c) All the three
- (d) None

Correct Option: (d)

Explanation:

- ◆ **Pair 1 is incorrectly matched:** Mallorca, or Majorca, is the largest of the Balearic Islands, which are part of Spain, and the seventh largest island in the Mediterranean Sea.
- ◆ **Pair 2 is incorrectly matched:** Normandy is situated in north-west France, in Europe, close to the French capital Paris.
- ◆ **Pair 1 is incorrectly matched:** Sardinia is an island country in the western Mediterranean, located between Corsica, the Italian peninsula, Sicily, North Africa, and the Balearic Islands.

Supplementary Notes:

- ◆ **Mallorca (or Majorca) is** indeed the largest of the Balearic Islands, which are autonomous islands of Spain, located in the western Mediterranean Sea.
 - It is part of Spain, not a separate country or entity.
 - It ranks seventh in size among Mediterranean islands (after islands like Sicily, Sardinia, Cyprus, etc.).
- ◆ **Normandy**
 - Normandy is a region in northwestern France, situated along the English Channel.
 - It is close to Paris, though not immediately adjacent.
 - It is in Europe and well-known historically for the D-Day landings during World War II.
- ◆ **Sardinia**
 - Sardinia is not an island country.
 - It is the second-largest island in the Mediterranean Sea (after Sicily) and is an autonomous region of Italy, with its own regional government.
 - It lies between Corsica (north), the Italian peninsula (east), Sicily (south), and the Balearic Islands (west).

Link: <https://www.smithsonianjourneys.org/tours/cruising-the-mediterranean-sicily-sardinia-and-mallorca/itinerary/>

