SMART CA Prelims 2025 Direct Reflection

Science and technology

SET A	Question Paper Screenshot	Handout Screenshot
1.	41. Consider the following types of vehicles : I. Full battery electric vehicles II. Hydrogen fuel cell vehicles III. Fuel cell-electric hybrid vehicles How many of the above are considered as alternative powertrain vehicles? (a) Only one (b) Only two (c) All the three (d) None	**Electric Vehicles (EVs)** **Recent Context:** Norway is set to become the first country to fully transition to electric vehicles. **About Electric Vehicles:** • A vehicle that uses an electric motor instead of a fuel-powered engine. • **Types:** ○ **Battery EV:** Fully powered by electricity ○ **Hybrid EV:** uses both the IC engine and the battery-powered motor powertrain. ○ **Plug-in Hybrid EV:** Uses both an IC engine and a battery charged from an external socket. ○ **Fuel Cell EV:** Electric energy is produced from **chemical energy,** like **hydrogen FCEV.** • **Market size:** To touch Rs 20 trn by 2030, to create 50 mn jobs. • **Largest adoption in the world:** ○ **Numbers:** China > United States > Germany > France > United Kingdom (can be changed).
2.	43. 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	**Battery** **Recent Context:** A high-performance zinc-air battery **for safe hydrogen production** developed. **About zinc-air battery:** • Also called **"zinc-air fuel cells".** • **Considered a promising alternative to lithium-ion batteries for EVs & other electronics.** • **May or may not be rechargeable.** • Have **high energy densities, low cost, fireproof,** • **Used in hearing aids** as well. **Lithium-ion Battery:** • **Rechargeable** battery. • **Anode:** Graphite • **Cathode:** Lithium Cobalt Oxide • **Electrolyte:** Lithium Salt. • High energy density, fast charge, long cycle life, • Low self-discharge and wide temperature range operation. • **2019 Nobel Prize in Chemistry.**

3.

47 Consider the following statements :

I. It is expected that Majorana 1 chip will enable quantum computing.

II. Majorana 1 chip has been introduced by Amazon Web Services (AWS).

III. Deep learning is a subset of machine learning.

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

Quantum chip - Willow

Google's Next gen Quantum chip

Reduce errors exponentially.

complex math problem < 5 min.

↳ supercomputer - 10^{25} years

Based on superconducting qubit.

What is Willow? Google's quantum computing chip explained in 10 points

Why Microsoft's claims of quantum computing breakthrough matter

The company said it had been successful in creating a new chip that would fast-track the development of a meaningful quantum computer from decades to a few years.

Microsoft chip - Majorana 1

aims to develop million qubit system within few years.

current system - 1000 qubits

Artificial Intelligence

Recent context: US President Donald Trump Announces Stargate, A $500 Billion Artificial Intelligence Initiative.

About Artificial Intelligence (AI):

- AI is the **simulation of human intelligence processes by machines, especially computer systems.**
- Digital assistants, autonomous vehicles, and generative AI tools (like OpenAI's ChatGPT) are just a few examples of AI in our daily lives.
- **Top AI Techniques:**
  - Machine Learning
  - Natural Language Processing
  - Computer Vision
  - Deep Learning
- **AI Initiatives:** IndiaAI Mission, BharatGen, India AI portal, National Strategy for AI,

Machine Learning:

- A subset of AI that **uses statistical methods to enable machines to learn from data.**
- It involves the creation of algorithms that can identify patterns (known as **pattern recognition**), make predictions, and improve their performance over time without explicit programming.

4.

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

I. They are man-made proteins.

II. They stimulate immunological function due to their ability to bind to specific antigens.

III. They are used in treating viral infections like that of Nipah virus.

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

Nipah Virus

Recent context: Scientists at the Institute of Advanced Virology have developed a novel way of generating non-infectious Nipah virus-like particles in the laboratory, which mimic the wild-type Nipah virus.

About Virus-like particles:

- **VLPs carry most of the characteristics of the virus**, except their ability to replicate (because it lacks the viral genome).
- VLPs have long been **recognised as effective quantitative platforms for** studying viral binding and entry kinetics of the virus.
- The **advent of NanoBiT technology and "HiBiT-tagged" VLP** (HiBiT is an 11-amino-acid peptide) makes it far more sophisticated.
- This new method offers an alternate, safe, and effective platform for **developing neutralising antibodies against NiV** in a **biosafety level-2 (BSL) laboratory.**
- **IAV scientists generated** "HiBiT-tagged" Nipah virus-like particles (NiV-VLPs) using **plasmid-based expression systems,** encoding the NiV structural proteins G, F, and M.
- The IAV team has thus come one step closer to its mandate for developing monoclonal antibodies and antivirals against NiV and similar pathogens.
    - **Monoclonal antibodies are a type of protein** that is made in the laboratory and can bind to certain targets in the body, such as antigens on the surface of cancer cells.

5.

70. 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

PM Surya Ghar - Muft Bijli Yojana:

- To increase the share of solar rooftop capacity & empower residential households to generate their own electricity.
- **Outlay & Period:** Rs 75,021 crore till FY 2026-27.
- **Implementation:** By National programme Implementation Agency at the National level & by the State Implementation Agencies at the state level.
- **Subsidy:** 60% of the solar unit cost for systems up to 2kW capacity and
    - 40 percent of additional system cost for systems between 2 to 3kW capacity.
- **Benefits:** Free electricity for households, reduced electricity costs for the government, increased use of renewable energy, reduced carbon emissions, etc.
- **Current penetration:** More than 1.3 crore families applied & installation completed in 3.75 Lakh homes.

6.

83. 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

Gaganyaan Mission

Objective :
- Human spaceflight capability.
- 3-member, 400 km orbit.
- 3 days.

Tests
1. DIADT
2. PAT

Mission
- uncrewed & crewed missions
- Microgravity exp. (Soyuz 1 gene)
- Test Tech for human space mission

Microgravity - impact on human body
1. Muscle/Bone loss
2. Fluid Redistribution
3. cardiovascular changes
4. Immune system alterations
5. Vision impairment - SANS (spaceflight associated Neuro-Ocular Syndrome)

Van Allen Radiation

Axiom-4 Mission

Recent context: India has shortlisted two astronaut-designates for the upcoming Axiom-4 mission to the International Space Station.

About Axiom-4 Mission:

- **Aims to facilitate commercial activities in space,** including scientific research, technological development, and space tourism.
- Private Human spaceflight for **India, Poland, and Hungary** to the International Space Station.
- **Fourth flight of Axiom Space** after Axiom Mission 1, Axiom Mission 2, and Axiom Mission 3.

Gaganyaan Mission

Recent context: **ISRO** and the European Space Agency (**ESA**) signed a **Technical Implementing Plan document** for **Ground Tracking Support** for India's Gaganyaan missions.

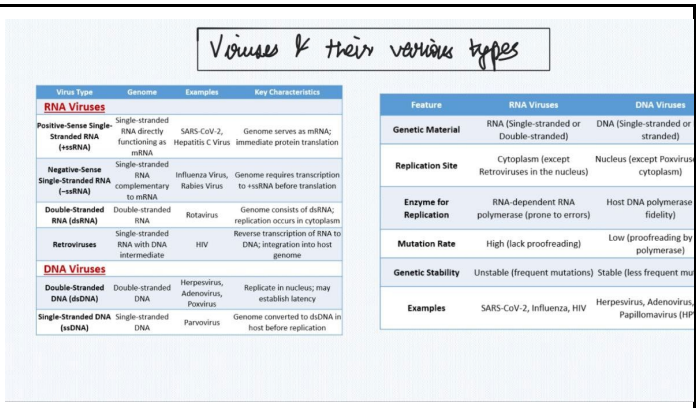
About Gaganyaan:

- **Objective:** Demonstration of **human spaceflight capability** by launching a **crew of three members** to an **orbit of 400 km for a three-day mission.**
- **ISRO intends to carry out** three **un-crewed missions** (2024-25) and **one crewed mission** (2025-27).

Components:

- **Launch vehicle:** Human-rated LVM3 - **HLVM3**
  - HLVM3 **consists of** a **Crew Escape System** powered by a set of quick acting, high burn rate solid motors for the safety of the crew.
- **Orbital Module (OM)** that will be Orbiting Earth **comprises a Crew Module and a Service Module.**

		Space Docking Experiment (SPADEX) **Recent context:** The ISRO on January 16, 2025, successfully executed the SpaDeX docking experiment.  **About Space Docking Experiment:** • Technology demonstrator mission in which ISRO is attempting a docking manoeuvre for the first time. • **Primary objective:** ○ To develop and demonstrate the technology needed for rendezvous, docking, and ○ **undocking of two small spacecraft (SDX01,**
7.	**95.** 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 AI. 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	**Artificial Intelligence Action Summit 2025:** • The third Summit was held in Paris on 10th February 2025. • **Co-chaired by India along with the President of France.** • **Previous summits:** UK (November 2023) and South Korea (May 2024). • The summit featured discussions on critical themes, including, ○ Greater access to AI infrastructure to ensure inclusion, ○ The responsible use of AI, ○ AI for public interest, ○ making AI more diverse and sustainable, and ○ ensuring safe and trusted governance of AI. **Bletchley Declaration** • Adopted at **1st International AI Safety Summit** 2023. • **World's 1st agreement** establishing a shared understanding and risks posed by AI. • **29 countries,** including India and the EU.
8.	**49.** 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.	Discussed in Class - while teaching various types of viruses and the recent Viral diseases.



Viruses & their various types

Virus Type	Genome	Examples	Key Characteristics
RNA Viruses			
Positive-Sense Single-Stranded RNA (+ssRNA)	Single-stranded RNA directly functioning as mRNA	SARS-CoV-2, Hepatitis C Virus	Genome serves as mRNA; immediate protein translation
Negative-Sense Single-Stranded RNA (−ssRNA)	Single-stranded RNA complementary to mRNA	Influenza Virus, Rabies Virus	Genome requires transcription to +ssRNA before translation
Double-Stranded RNA (dsRNA)	Double-stranded RNA	Rotavirus	Genome consists of dsRNA; replication occurs in cytoplasm
Retroviruses	Single-stranded RNA with DNA intermediate	HIV	Reverse transcription of RNA to DNA; integration into host genome
DNA Viruses			
Double-Stranded DNA (dsDNA)	Double-stranded DNA	Herpesvirus, Adenovirus, Poxvirus	Replicate in nucleus; may establish latency
Single-Stranded DNA (ssDNA)	Single-stranded DNA	Parvovirus	Genome converted to dsDNA in host before replication

Feature	RNA Viruses	DNA Viruses
Genetic Material	RNA (Single-stranded or Double-stranded)	DNA (Single-stranded or stranded)
Replication Site	Cytoplasm (except Retroviruses in the nucleus)	Nucleus (except Poxvirus cytoplasm)
Enzyme for Replication	RNA-dependent RNA polymerase (prone to errors)	Host DNA polymerase fidelity)
Mutation Rate	High (lack proofreading)	Low (proofreading by polymerase)
Genetic Stability	Unstable (frequent mutations)	Stable (less frequent mu
Examples	SARS-CoV-2, Influenza, HIV	Herpesvirus, Adenovirus, Papillomavirus (HP

9.

36. 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

Direct Air Capture With Carbon Storage (DACCS)

Recent Context: Iceland's 'Mammoth' raises potential for carbon capture.

About Direct Air Capture:

- Direct air capture (DAC) technologies **extract CO2 directly from the atmosphere at any location**, unlike carbon capture, which is generally carried out at the point of emissions, such as a steel plant.
- The **CO2 can be permanently stored** in deep geological formations or used for a variety of applications.
- The role of direct air capture with carbon storage (DACCS) remains minor in the various climate models due to its **high price** and its deployment at a large scale depends on the availability of renewable energy.
- **Twenty-seven DAC plants** have been commissioned to date worldwide, capturing almost 0.01 Mt CO2/year.

10.

33. Consider the following statements :

Statement I :

Scientific studies suggest that a 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.

Coronal Mass Ejection:

- Scientists who developed VELC onboard Aditya-L1 precisely **estimated the onset time of a coronal mass ejection** that erupted on the Sun on July 16.
- **Coronal Mass Ejection:** The Sun is a very active object and often spews vast quantities of **plasma in violent eruptions** called coronal mass ejections (CMEs).
  - Usually observed in **visible continuum light** only when they have propagated well away from the Sun's surface.
  - However, unique spectroscopic observations with the VELC, lets us study the CMEs very close to the solar surface itself for the first time
- **Impact of CMEs:** They can damage the electronics in satellites in near-earth space and disrupt radio communication networks on the Earth.
- **Difference with solar flare:** A solar flare is a burst of intense radiation from the Sun, while CME is a large cloud of plasma and magnetic field ejected from the Sun's corona.

11.

94. 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

Discussed for Prelims 2024.

12.

82. Consider the following statements :

I. Indian Railways have prepared a National Rail Plan (NRP) to create a 'future ready' railway system by 2028.

II. 'Kavach' is an Automatic Train Protection system developed in collaboration with Germany.

III. 'Kavach' system consists of RFID tags fitted on track in station section.

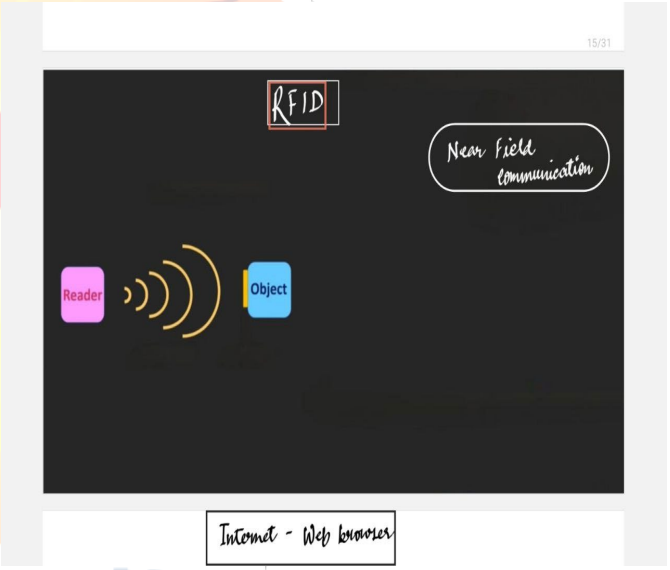
Which of the statements given above are not correct?

(a) I and II only

(b) II and III only

(c) I and III only

(d) I, II and III



Discussed in Prelims 2024

Environment

1.

9. 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 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

Circular Economy

Recent Context: The 12th Regional 3R and Circular Economy Forum in Asia and the Pacific was held in Jaipur, India, from 3rd to 5th March 2025.

About Circular Economy:

- A model of production and consumption **involves sharing, leasing, reusing, repairing, refurbishing and recycling** existing materials and products as long as possible.
- In this way, **the life cycle of products is extended.**
- It implies **reducing waste to a minimum.**
- It **departs from** the traditional, **linear economic model**, which is based on a take-make-consume-throw-away pattern.
- **Benefits:** Protecting the environment, Reducing raw material dependence, creating jobs and saving consumers money, etc.

Global Initiatives on Circular Economy:

- World Circular Economy Forum,
- Global Alliance on Circular Economy and Resource Efficiency (GACERE) by EU & UNEP,
- The United Nations Environment Programme Finance Initiative,
- Circularity Gap Reporting Initiative,
- Ocean Plastics Leadership Network (OPLN),
- Circularity accelerator by the World Green Building Council, etc.

2.

32. 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.

COP28 Climate Health Pledge

Recent context: The worsening air pollution in Delhi this winter has prompted a senior WHO official to renew the call on India to sign the climate health pledge.

About Climate Health Pledge:

- **Launched at the COP28** to the UNFCCC held in Dubai, United Arab Emirates, in 2023.
- **Global commitment to:**
  - tackle the health impacts of climate change,
  - focusing on actions such as strengthening climate-resilient health systems.
  - addressing the intersection of climate and health.
- **Signatories:** 123 countries, including the United States, China, and several European nations.
  - **India has not signed** the pledge. **(As of Feb 2025)**

3.

34. Consider the following statements :

Statement I :
Article 6 of the Paris Agreement on climate change is frequently discussed in 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 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

Global Carbon Markets

Recent Context: COP29 aims to finalise global carbon market rules under Article 6 of the Paris Agreement.

Global Carbon Markets Mechanisms:

- The concept of a market-based mechanism to reduce emissions was first agreed upon in the 1997 Kyoto Protocol.
  - The Kyoto Protocol established a **Clean Development Mechanism (CDM).**
- **Paris Agreement: Article 6** establishes a framework for international cooperation in achieving Nationally Determined Contributions (NDCs) through both **carbon markets (Article 6.2 and 6.4)** and **non-market approaches (Article 6.8).**
- **International Carbon Action Partnership (ICAP):** It brings together countries and regions with mandatory cap-and-trade systems.
  - It provides a forum for sharing experience,
- **United Nations Special Programme for the Economies of Central Asia (SPECA) Multi-Partner Trust Fund:** A fund to support programmes implemented by participating UN organisations.
- **Paris Agreement Developments:**
  - **Operationalisation of Article 6.4:** This will allow countries **to trade carbon credits** and issue Article **6.4ER units**.
  - **Guidance on Article 6.2, 6.4, and 6.8:** This includes guidance on authorization, first transfers, and registries.
- **Transition from the Clean Development Mechanism (CDM):** This includes allowing afforestation and

4.

38. Consider the following statements :

I. Carbon dioxide (CO_2) emissions in India are less than 0·5 t CO_2/ capita.

II. In terms of CO_2 emissions from fuel combustion, India ranks second in Asia-Pacific region.

III. Electricity and heat producers are the largest sources of CO_2 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

Carbon Dioxide (CO2)

Recent Context: A peer-reviewed report by a scientist has found that carbon emissions are set to rise 0.8% in 2024 since last year.

About CO2:

- **Characteristics:**
  - **Colourless**, **odourless**, and **heavier** than air.
  - **Solubility:** Slightly soluble in water, solubility decreases as temperature increases.
  - Cycles in the ecosystem through respiration, photosynthesis, and combustion.
  - It **remains in the atmosphere for a long time**, thus increasing its greenhouse effect.
  - **Industrial applications:** refrigeration, fire extinguishers, and enhancing oil recovery.
- **Largest absolute contributions to global fossil CO2:** China (31%), the USA (13%), India (8%), the EU-27 (7%).
- **Per-capita fossil CO2 emissions in 2023:** 1.3 tonnes of carbon per person per year.
  - 3.9 in the U.S., 2.3 for China, 1.5 for the EU-27 and 0.6 for India.
- **CO2 reduction strategies:**
  - Carbon capture and storage (CCS),
  - Direct Air Capture (DAC),
  - Decarbonisation with the Thermal Battery,
  - Afforestation, etc.
- **India's CO2 reduction commitments:**
  - Reaching net zero by 2070.

5.

90. 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

Nature Restoration Plan (NRP)

Recent context: The European Union (EU) on June 17 approved its ambitious Nature Restoration Plan which aims to make continent-wide efforts to restore degraded ecosystems.

About NRP:

- **EU's first continent-wide legislation for** the long-term recovery of nature.
- **Legally binding** restoration targets.
- **Aims to** restore ecosystems, including species and habitats that exist on the EU's land and seas.
- **Target recovery:** At least 20% of the EU's land and sea areas by 2030, and all ecosystems in need of restoration by 2050.
- **Requires EU Member States to** prepare National Restoration Plans by 1 September 2026.
- **Crucial part of the bloc's 2030 biodiversity strategy** which, in turn, forms a core area of the European Green Deal.

6.

29. 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

CLIMATE CHANGE

Causes of Climate Change

Methane

Recent Context: A team of scientists have discovered that Arctic glaciers are leaking significant amounts of methane, **a potent greenhouse gas**, into the atmosphere.

About Methane:

- **Emission sources:** The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
  - Natural processes account for 40% methane emissions (wetlands being the largest).
- **Characteristics:**
  - **Colourless** and **odourless** gas at room temperature and pressure,
  - Lighter than air,
  - Responsible for **30% of the warming since preindustrial times**, second only to CO_2.
  - Slightly soluble in water and completely soluble in organic solvents like ethanol, diethyl ether, benzene, toluene, etc.
  - **Atmospheric lifespan:** around 12 years.

Greenhouse effect

7.

64. 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 reflect(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

(12 meters) per year due to permafrost thaw.

Heat Stress

Recent context: Chennai is facing a growing heat stress crisis, driven by rising temperatures, soaring humidity, and rapid urban expansion, according to a recent analysis by the CSE.

About Heat Stress:

- **Occurs when** the body's natural cooling systems are overwhelmed, causing symptoms ranging from dizziness and headaches to organ failure and death.
- **Brought on by prolonged exposure to heat** and other environmental factors that work together to undermine the body's internal thermostat and its

② Measure: Heat Index: temp + Rel. Humidity

Term: wet bulb globe temp.

= Feel like temp.

① definition ③ Reason for occ: (5-8°C ↑)

8.

44. Consider the following :

I. Cigarette butts

II. Eyeglass lenses

III. Car tyres

How many of them contain plastic?

(a) Only one

(b) Only two

(c) All the three

(d) None

PLASTIC POLLUTION

Polymers

Recent Context: At the global meeting in South Korea's Busan for the plastic pollution treaty, the Indian govt opposed regulating the production of primary plastic polymers as it could impact the development rights of nations.

About Polymers:

- **Substance composed of molecules with** a large molecular mass of repeating structural units or monomers connected by covalent chemical bonds.
- The word polymer comes from the **Greek word for "many parts."** Each of those parts is known as a monomer.
- **Well-known examples of polymers include** plastics, DNA, and proteins.
- **Types of polymers:**
  - **Synthetic polymers are derived from** petroleum oil, and made by scientists and engineers.
    - **Examples:** nylon, polyethylene, polyester, Teflon, and epoxy.
  - **Natural polymers occur in nature** and can be extracted. They are often water-based.
    - **Examples:** silk, wool, DNA, cellulose

Symbol	Polymer	Common Uses	Properties	Recyclable?
1 PETE	Polyethylene terephthalate	Plastic bottles (water, soft drinks, cooking oil)	Clear, strong and lightweight	Yes; widely recycled
2 HDPE	High-density polyethylene	Milk containers, cleaning agents, shampoo bottles, bleach bottles	Stiff and hardwearing; hard to breakdown in sunlight	Yes; widely recycled
3 PVC	Polyvinyl chloride	Plastic piping, vinyl flooring, cabling insulation, roof sheeting	Can be rigid or soft via plasticizers; used in construction, healthcare, electronics	Often not recyclable due to chemical properties; check local recycling
4 LDPE	Low-density polyethylene	Plastic bags, food wrapping (e.g. bread, fruit, vegetables)	Lightweight, low-cost, versatile; fails under mechanical and thermal stress	No; failure under stress makes it hard to recycle
5 PP	Polypropylene	Bottle lids, food tubs, furniture, housewares, medical, rope, automobile parts	Tough and resistant; effective barrier against water and chemicals	Often not recyclable; available in some locations; check local recycling
6 PS	Polystyrene	Food takeway containers, plastic cutlery, egg tray	Lightweight; structurally weak; easily dispersed	No; rarely recycled but check local recycling
7 OTHER	Other plastics (e.g. acrylic, polycarbonate, polyactic fibres)	Water cooler bottles, baby cups, fiberglass	Diverse in nature with various properties	No; diversity of materials risks contamination of recycling

Read & Learn

Microplastics

Recent Context: A first-of-its-kind study commissioned by the Delhi government has detected microplastics in groundwater samples across the Capital.

India from 2024

About Microplastics:

- Small particles or fragments of plastic less than 5 mm in diameter. (UNEP).
- Like plastic items of any size—they do not readily

ned by the
undwater
than 5 mm
readily

India from 2024

Harmful:

① By themselves

② carry PDP, heavy metal etc

(reach out)

International Relations

1.

21. Consider the following countries :

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

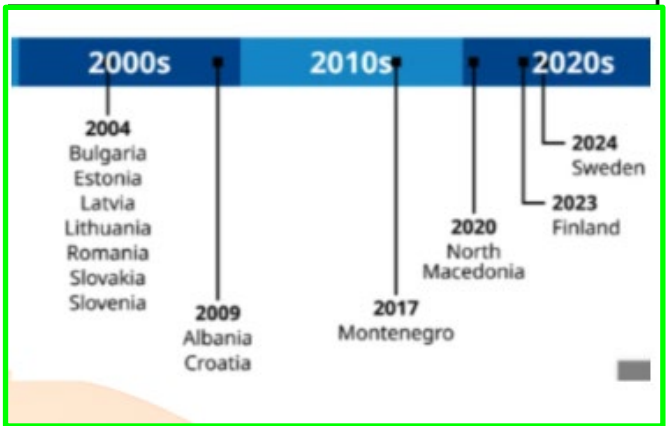
North Atlantic Treaty Organisation_ (NATO)

Recent context: NATO pompously celebrates the anniversary of its establishment on April 4, 75 years ago.

About NATO:

- **Western security alliance**
- **Founded on** April 4, 1949.
- **Headquarters:** Boulevard Leopold III in Brussels, Belgium.
- **12 founding members:** Belgium, Canada, Denmark, France, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, the UK and the US.
- **Secretary-General:** Mark Rutte.
- **Founding treaty: Washington Treaty,** which gets its power from Article 51 of the United Nations Charter.
  - **Article 5 of the Washington Treaty**, on collective security, was added "to counter the risk that the Soviet Union would seek to extend its control of Eastern Europe to other parts of the continent."
- **Concept of "collective security":** an attack on any of the members is seen as an attack on all of them and demands collective action.
- **Current members:** 32 (As of January 2025)
  - **Sweden joined** the alliance as its 32nd member in **March 2024.**
  - **Finland joined** in April **2023.**

NATO Members in the last 25 years:



2.

62. 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

International North-South Transport Corridor (INSTC)

Recent context: For the first time, in June 2024, Russia sent two trains laden with coal to India via INSTC.

About INSTC:

- **First mooted in 2000.**
- **Multi-modal transportation route linking the** Indian Ocean and the Persian Gulf to the Caspian Sea via Iran and onward to northern Europe via St. Petersburg in Russia.
- **Russia, India, and Iran signed preliminary agreements** to develop the 7,200-km-long International NSTC **in 2002.**
- **Now the agreement was eventually ratified by 13 countries:** India, Russia, Iran, Azerbaijan, Belarus, Bulgaria, Armenia, Kazakhstan, Kyrgyzstan, Oman.

3.

92. 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

BIMSTEC

Recent Context: The BIMSTEC will now be open to new members and observers after a historic first charter of the grouping came into force on 20 May 2024.

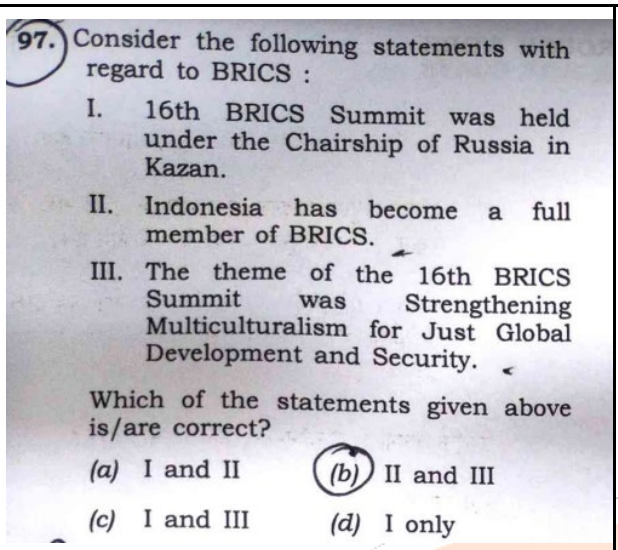
About the Charter:

- Signed and adopted during the Fifth BIMSTEC Summit held in Sri Lanka in 2022.
- Nepal's ratified the charter first.
- Now the BIMSTEC will now be open to new members and observers.

About BIMSTEC:

- **BIMSTEC:** Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation.
- **Established on** 06 June 1997 with the signing of the Bangkok Declaration.
- **Secretariat:** Dhaka, Bangladesh.
- **Secretary General:** Indra Mani Pandey
- **Main aim:** promotion of economic cooperation between countries bordering the Bay of Bengal.
- **Seven member states:** Bangladesh, Bhutan, Sri Lanka, Nepal, Thailand, Myanmar and India.

4.



97. 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 statements given above is/are correct?

(a) I and II (b) II and III

(c) I and III (d) I only

BRICS

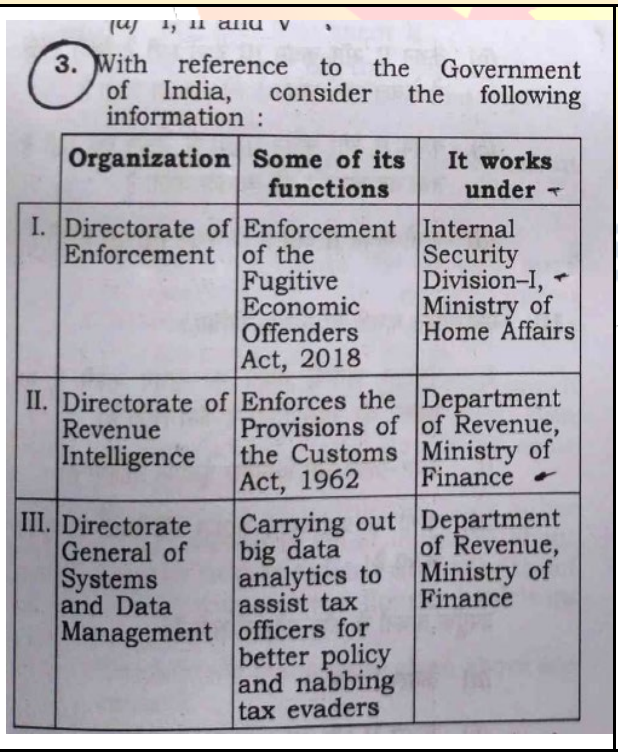
Recent Context: Indonesia joins the BRICS group as a full member.

About BRICS:

- An informal association of countries that aims to coordinate their economic and diplomatic policies.
- **Acronym:** Brazil, Russia, India, China, & South Africa.
- **Formalisation of group:** During the first meeting of BRIC Foreign Ministers on the margins of UNGA in New York in 2006.
- **Recent Summits:**
  - **2024:** Kazan, Russia, from 22-24 October 2024
  - **2025:** To be held in Brazil (hold Presidency).
- **Timelines:**
  - **2009:** The 1st **BRIC** (BRICS minus South Africa) summit, held in **Yekaterinburg**, Russia.
  - **2010:** South Africa joined.
  - **2014: The** Fortaleza Declaration established the **New Development Bank (Shanghai HQ).**
  - **2021:** Summit hosted by India after 2012 & 2016.
  - **2024:** A further expansion of BRICS with five new members - Egypt, Ethiopia, Iran, Saudi Arabia, and the United Arab Emirates. Saudi Arabia Is Still Assessing BRICS Membership.
- **BRICS Countries rejecting China's BRI:** India & Brazil.
- **Contingency Reserve Arrangement:** A financial mechanism established in 2015 to protect against global liquidity pressures.

Polity

1.



(a) I, II and V

3. 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

ED

Recent Context: 1% conviction rate against politicians has left the probe agency ED red-faced.

About Enforcement Directorate (ED):

- Established in the year **1956** with its **Headquarters in New Delhi.**
- Responsible for the enforcement of the,

1. **Foreign Exchange Management Act, 1999 (FEMA).**
2. Provisions of the Prevention of Money Laundering Act, 2002.
3. **Fugitive Economic Offenders Act, 2018 (FEOA),**
4. **Mutual legal assistance** to & from contracting states.

- The Department of Revenue administers FEMA for operational purposes, while the policy aspects of FEMA, its legislation, and its amendments are within the purview of the **Department of Economic Affairs.**
- Policy issues under the PML Act are the responsibility of the **Department of Revenue.**

2.

53. 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

Inter-State Council

Recent context: In November 2024, the Inter-State Council was reconstituted with Prime Minister Narendra Modi as its chairman, all chief ministers and nine Union ministers as members, and 13 Union ministers as permanent invitees.

About Inter-State Council:

- **Recommendatory body,** established under **Article 263.**
- **President can establish such a council** if at any time it appears to him that the public interest would be served by its establishment.
- **Aims at promoting coordination between** inter-state, Centre-state, and Centre-union territories relations.
- **Recommended by the Sarkaria Commission** on Centre-State Relations (1983–88).
- Janata Dal Government headed by V. P. Singh established the Inter-State Council in 1990.
- **Duties:**
  - enquiring into and advising upon disputes which may arise between states;
  - investigating and discussing subjects with common interest;
  - making recommendations upon any such subject.
- Deal with any controversy whether legal or non-legal, but **its function is advisory.**

3.

86. 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

Mercy Petitions

Recent Context: The Supreme Court recently laid down a comprehensive set of guidelines to ensure the swift and efficient processing of mercy petitions by death-row convicts.

About Mercy Petitions:

- A mercy petition is a formal plea made by a convicted individual, especially those sentenced to death or long-term imprisonment, seeking clemency or leniency from the President or Governor, as a last resort after exhausting all legal avenues
- A convict can present a mercy petition to the President of India under **Article 72** of the Constitution of India.
- **Article 72 provides:**
  (1) The President shall have the **power to grant pardons, reprieves, respites or remissions** of punishment or to suspend, remit or commute the sentence of any person convicted of any offence—
  (a) in all cases where the punishment or sentence is by a **Court Martial;**
  (b) in all cases where the punishment or sentence is for an offence against any law **relating to a matter to which the executive power of the Union extends;**
  (c) in all cases where the **sentence is a sentence of death.**
- The President's exercise of this power is **not entirely discretionary** but is exercised **on the advice of the Council of Ministers,** as established by Supreme Court rulings like **Maru Ram v. Union of India.**

4.

87. 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, provided 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

Speaker of the Lok Sabha

Recent Context: A Parliamentary Delegation from Madagascar recently met Lok Sabha Speaker Om Birla.

About Speaker of Lok Sabha:

- Each House of Parliament has its own **presiding officer.**
- The Speaker of the Lok Sabha is the **presiding officer of the Lok Sabha,** the lower house of the Parliament of India.

Election and Tenure of the Speaker:

- **Article 93:** The Speaker is **elected by the Lok Sabha from amongst its members** (as soon as may be, after its first sitting).
- When the office of the Speaker falls vacant, the Lok Sabha elects another member to fill the vacancy.
- The **date of election** of the Speaker is **fixed by the President.**
- Usually, the Speaker **remains in office during the life of the Lok Sabha.**
- **Article 94:** The Speaker **vacates the office** earlier in any of the following three cases:

1. If he/she **ceases to be a member** of the Lok Sabha;
2. If he/she **resigns by writing to the Deputy Speaker;**
3. If he/she is **removed by a resolution** passed by a majority of all then members of the Lok Sabha.
   a. Such a resolution can be moved only after giving **14 days' advance notice.**

- **Article 96:** When a resolution for the removal of the Speaker is under consideration of the House, he cannot preside at the sitting of the House, though he may be present.
  - However, he can speak and take part in the proceedings of the House at such a time and vote in the first instance, though not in the case of an equality of votes.
- When the Lok Sabha is dissolved, the Speaker continues in office till the newly elected Lok Sabha meets.

5.

88. 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

3. **Adjourns** the House or **suspends** the meeting in the absence of a quorum.
4. **Does not vote in the first instance** but exercises a **casting vote** in the case of a tie.
5. Presides over a **joint setting** of the two Houses of Parliament.
6. **Allow** a **'secret' sitting** of the House at the request of the Leader of the House.
7. Decides **whether a bill is a money bill or not**, and the Speaker's decision on this question is final.
8. Decides the **questions of disqualification** of a member of the Lok Sabha arising on the ground of **defection** under the provisions of the **Tenth Schedule**, which is subject to **judicial review.**
9. Acts as the ex-officio **chairman of the Indian Parliamentary Group** & the **conference of presiding officers** of legislative bodies in the country.
10. Appoints the **chairman of all the Parliamentary Committees** of the Lok Sabha and supervises their functioning.

Mapping

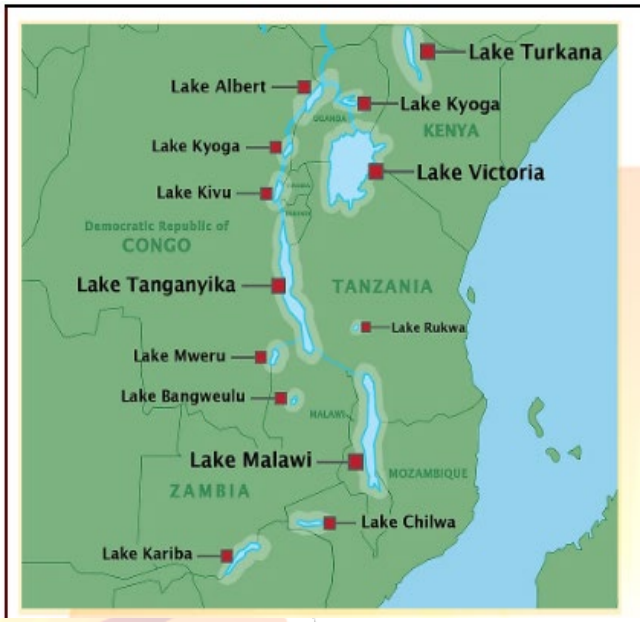
1.

23. Consider the following water bodies :

I. Lake Tanganyika
II. Lake Tonlé 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



2.

80. 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