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From

17th Aug *to* **22nd Aug 2026**

INDEX

1. POLITY & GOVERNANCE	1
1.1. Environmental Governance and the Legal Framework	1
1.2. Ex-Agniveers to Get 50% Reservation in CAPFs & Assam Rifles	2
1.3. Namaste Scheme: Mechanising Sanitation Work	3
2. INTERNATIONAL RELATIONS	6
2.1. India–Japan Defence Cooperation: Strategic Partnership in the Indo–Pacific	6
3. ECONOMY	9
3.1. India’s Crude Oil Import Bill Rises Amid West Asia Crisis	9
4. ENVIRONMENT & GEOGRAPHY	11
4.1. Supreme Court: No State Can Block Traditional Elephant Routes	11
4.2. Brics Opposes EU’s Carbon Border Adjustment Mechanism (CBAM)	12
4.3. Ebola Outbreak in Democratic Republic of the Congo: Bundibugyo Virus	14
5. SCIENCE & TECHNOLOGY	16
5.1. Zhuque-3, China’s First Land-Based Rocket Recovery	16
5.2. Rotating Detonation Engines (RDEs): Next-Generation Propulsion	17
5.3. H1N1 Cases Rise Across India	18

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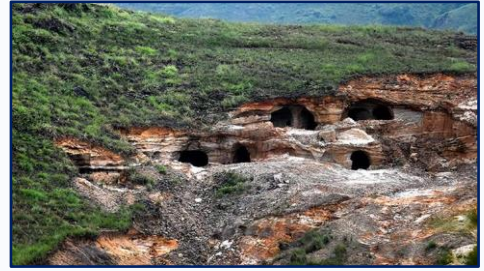
Prelims Test Series

POLITY & GOVERNANCE

1.1. ENVIRONMENTAL GOVERNANCE AND THE LEGAL FRAMEWORK

Context:

- A **High Court-constituted committee headed by retired Justice B.P. Katakey** has criticised the Meghalaya Government for failing to adopt a comprehensive policy for **closing and securing abandoned rat-hole coal mines**.
- The committee has highlighted the risks posed by thousands of abandoned mine openings to **human beings, livestock and the environment**, and has stressed the need for immediate preventive measures.



What is Rat-Hole Mining?

- **Rat-hole mining** is an unscientific and hazardous method of extracting coal through **very narrow horizontal tunnels** dug into coal seams.
- The tunnels are often so narrow that workers have to **crawl through them**.
- It became particularly prevalent in **Meghalaya**, where coal seams are often thin and shallow.
- Mining has traditionally taken place on **privately or community-owned tribal land**, creating a complex relationship between customary land rights and statutory mining regulation.

Why is it called “Rat-Hole”?

- The narrow tunnels resemble the **small burrows of rats**, through which miners enter the coal seams.

Why is Rat-Hole Mining Dangerous?

1. Human Safety

- Narrow and unstable tunnels increase the risk of **collapse, flooding and entrapment**.
- Abandoned shafts remain dangerous even after mining operations stop.

2. Environmental Damage

- Unscientific coal extraction causes **land degradation and soil instability**.
- Acidic mine drainage can contaminate **streams, rivers and groundwater**.
- It can adversely affect **forests, biodiversity and aquatic ecosystems**.

3. Abandoned Mine Openings

- Open mine shafts can become death traps for **people and livestock**.
- Therefore, merely stopping mining is insufficient; **mine closure and land restoration** are also necessary.

NGT Ban – 2014

- The **National Green Tribunal (NGT)** ordered the Meghalaya Government in **April 2014** to stop **rat-hole mining and illegal coal mining throughout the State**.

Supreme Court Judgment – 2019

- In **State of Meghalaya v. All Dimasas Students Union**, the Supreme Court upheld the NGT's action against **unscientific rat-hole mining**.

What is the Katakey Committee Highlighting?

- **Absence of a comprehensive mine-closure policy.**
- Large numbers of **abandoned mine openings** that remain unsecured.
- Need for **fencing and immediate preventive measures.**
- Need for **land restoration and rehabilitation.**
- Delays in implementing proposals for mine closure and restoration.
- The committee has also highlighted restoration projects prepared by the **Central Mine Planning and Design Institute (CMPDI)** for Meghalaya.

Major Laws Relevant to Mining

- Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act)
- Mines Act, 1952
- Environment (Protection) Act, 1986
- Water (Prevention and Control of Pollution) Act, 1974
- Air (Prevention and Control of Pollution) Act, 1981

Q. With reference to **rat-hole mining in Meghalaya**, consider the following statements:

1. The National Green Tribunal banned rat-hole coal mining in Meghalaya in 2014.
2. The Supreme Court upheld the prohibition on unscientific rat-hole mining in 2019.
3. The Sixth Schedule provides an unrestricted constitutional exemption to Meghalaya from central mining and environmental laws.

Which of the statements given above is/are correct?

- A. 1 and 2 only
B. 1 and 3 only
C. 2 and 3 only
D. 1, 2 and 3

Answer: A. 1 and 2 only

- **Statement 1 – Correct:** The NGT banned rat-hole mining in Meghalaya in **2014**.
- **Statement 2 – Correct:** The Supreme Court upheld the prohibition on **unscientific rat-hole mining** in **2019**.
- **Statement 3 – Incorrect:** Sixth Schedule autonomy does **not provide an unrestricted exemption** from applicable central mining and environmental laws.

1.2. EX-AGNIVEERS TO GET 50% RESERVATION IN CAPFs & ASSAM RIFLES

Context

- The Government has created a separate “**Ex-Agniveer**” **recruitment category** for **Constable (General Duty) in CAPFs** and **Rifleman in Assam Rifles**, with **50% reservation of vacancies**. The move addresses post-service employment opportunities for Agniveers completing their four-year tenure.



Key Provisions

- **Reservation:** 50% of vacancies for Ex-Agniveers in the specified posts.
- **Age Relaxation:** 3 years beyond the prescribed upper age limit; **5 additional years** for the first batch.
- **Recruitment Exemptions:** Ex-Agniveers are exempted from the **written examination, Physical Standards Test (PST) and Physical Efficiency Test (PET)**.
- **Dedicated Wing:** An **Ex-Agniveer Wing** has been established under the Ministry of Home Affairs to coordinate their further progression.

About Agnipath Scheme

- Under **Agnipath**, Agniveers serve in the Armed Forces for **four years**.
- After four years, **up to 25%** of a batch may be retained for regular military service, subject to selection.
- The remaining personnel transition out as **Ex-Agniveers**, for whom post-service employment mechanisms are important.

Q. With reference to the **Agnipath Scheme and Ex-Agniveers**, consider the following statements:

1. Agniveers are recruited for a fixed period of four years under the Agnipath Scheme.
2. Up to 25% of a batch of Agniveers may be retained for regular service in the Armed Forces.
3. Ex-Agniveers are eligible for reservation in recruitment to certain posts in CAPFs and Assam Rifles.

Which of the statements given above is/are correct?

- A. 1 and 2 only
B. 2 and 3 only
C. 1 and 3 only
D. 1, 2 and 3

Answer: (d) 1, 2 and 3

- **Statement 1 – Correct:** Under the **Agnipath Scheme**, Agniveers are recruited into the Armed Forces for a **four-year period**.
- **Statement 2 – Correct:** After four years, **up to 25% of each batch** may be selected for continued regular service in the Armed Forces.
- **Statement 3 – Correct:** **Ex-Agniveers** are provided specified **reservation and recruitment benefits** for certain posts in **CAPFs and Assam Rifles**.

1.3. NAMASTE SCHEME: MECHANISING SANITATION WORK

Context:

- Recently, the Union Government has proposed expanding the **National Action for Mechanised Sanitation Ecosystem (NAMASTE)** scheme from **urban to rural areas**. The proposed expansion will also cover drain cleaners and workers engaged in Sewage Treatment Plants (STPs) and Faecal Sludge Treatment Plants (FSTPs).



About NAMASTE

- **NAMASTE** stands for **National Action for Mechanised Sanitation Ecosystem**.
- **Launched:** 2023–24
- **Objective:** To promote the **mechanisation of sanitation work** and ensure the **safety and dignity of sanitation workers**.
- **Nodal Ministry:** Ministry of Social Justice and Empowerment, in convergence with the **Ministry of Housing and Urban Affairs (MoHUA)**.
- **Initial Focus:** Sewer and Septic Tank Workers (SSWs).
- **Later Expanded to Include:** Waste Pickers.
- To eliminate hazardous and unsafe sanitation practices and move towards zero fatalities in sewer and septic tank cleaning.

Key Components of NAMASTE

1. Identification & Profiling

- Identifies and profiles sanitation workers for welfare and safety support.
- **90,915 SSWs** and **1.3 lakh Waste Pickers** profiled so far.

2. Mechanisation & Safety

- Promotes mechanised cleaning, **PPE**, training and skill development.

3. Emergency Response

- Supports **Emergency Response Sanitation Units (ERSUs)** in **Urban Local Bodies (ULBs)**.

4. Livelihood Support

- Promotes self-employment and sanitation enterprises.
- Provides **capital subsidy of up to 50%** of the project cost.
- Also supports **Private Sanitation Service Organisations (PSSOs)**.

Proposed Expansion

The Ministry of Social Justice and Empowerment has proposed expanding NAMASTE to:

- **Rural areas**
- **Drain cleaners**
- Workers engaged in **Sewage Treatment Plants (STPs)**
- Workers engaged in **Faecal Sludge Treatment Plants (FSTPs)**

Proposed Outlay

- **₹498.73 crore**
- Proposed implementation period: **up to 2030–31**

Q. With reference to the NAMASTE Scheme, consider the following statements:

1. NAMASTE aims to promote the mechanisation of sanitation work and improve the safety of sanitation workers.
2. The scheme initially focused on Sewer and Septic Tank Workers and was later expanded to include Waste Pickers.

3. The proposed expansion of the scheme seeks to include workers engaged in Sewage Treatment Plants and Faecal Sludge Treatment Plants.
4. NAMASTE is implemented exclusively by the Ministry of Housing and Urban Affairs.
- Which of the statements given above are correct?

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

Answer: (a)

Explanation

- Statements **1, 2 and 3 are correct**. NAMASTE promotes **mechanisation, safety and livelihood support** for sanitation workers. It initially covered **SSWs**, later expanded to **Waste Pickers**, with the proposed expansion covering **rural areas, drain cleaners and STP/FSTP workers**.
- **Statement 4 is incorrect** as the scheme is under the **Ministry of Social Justice and Empowerment**, with convergence with **MoHUA**.

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INTERNATIONAL RELATIONS

2.1. INDIA–JAPAN DEFENCE COOPERATION: STRATEGIC PARTNERSHIP IN THE INDO-PACIFIC

Context:

- Japanese Defence Minister **Shinjiro Koizumi** is visiting India and is holding talks with Defence Minister **Rajnath Singh** on strengthening bilateral defence and security cooperation, including **defence equipment and technology, maritime security and cooperation in the Indo-Pacific**. The visit comes soon after the **8th India–Japan Defence Policy Dialogue** held in Tokyo in July 2026.



1. India–Japan Strategic Partnership

- India and Japan share a **Special Strategic and Global Partnership**, upgraded to this level in **2014**.
- The partnership is based on convergence over a **free, open and rules-based Indo-Pacific**.
- India's **Act East Policy** and **SAGAR vision** complement Japan's **Free and Open Indo-Pacific (FOIP)** approach.
- Both countries are also partners in the **Quad** along with the **United States and Australia**.

2. Key Areas of Defence Cooperation

A. Defence Equipment & Technology

India and Japan have cooperation in:

- Defence equipment and technology transfer
- Joint research, development and potential co-production
- Maritime technology
- Defence industrial cooperation
- Advanced and emerging technologies

B. Logistics & Interoperability

- The **Acquisition and Cross-Servicing Agreement (ACSA)** was signed in **2020**.
- It facilitates reciprocal provision of: Supplies, Services, Logistical support between the **Indian Armed Forces and Japan's Self-Defense Forces**.

C. Maritime Security

Areas include:

- Maritime domain awareness
- Naval cooperation
- Anti-piracy cooperation
- HADR
- Capacity building
- Freedom of navigation and rules-based maritime order

3. Important Defence Exercises

A. JIMEX

- Bilateral **naval exercise**.
- Focus: maritime cooperation and interoperability.

B. Dharma Guardian

- Bilateral **Army exercise**
- Enhances interoperability and joint operational capabilities.

C. Malabar

- Multilateral **naval exercise**.
- Participants: **India, Japan, USA and Australia**
- Japan's participation strengthens maritime cooperation among the **Quad countries**.

D. Veer Guardian

- Bilateral **Air Force exercise**.
- Conducted between the **Indian Air Force and Japan Air Self-Defense Force**.

4. Institutional Mechanisms

- **2+2 Dialogue**: Foreign Ministers + Defence Ministers
- **Defence Policy Dialogue**: Defence establishments of both countries

Military-to-Military Talks: Armed forces cooperation

- **Coast Guard-to-Coast Guard cooperation**: The **8th Defence Policy Dialogue** in July 2026 reviewed the entire spectrum of bilateral defence engagement.

5. Why Japan Matters for India?

A. Strategic

- Strengthens India's position in the **Indo-Pacific**.
- Supports a **rules-based maritime order**.
- Enhances strategic balance in the wider Indo-Pacific.

B. Defence

- Access to advanced Japanese defence technology.
- Greater interoperability through exercises and logistics cooperation.
- Scope for defence-industrial collaboration.

C. Economic & Technological

- Japan is an important source of investment and technology.
- Cooperation extends to **infrastructure, high technology, connectivity, clean energy and advanced transportation**.

Q. Consider the following pairs regarding India–Japan defence cooperation:

Exercise/Agreement	Nature
1. JIMEX	Naval Exercise
2. Dharma Guardian	Army Exercise
3. Veer Guardian	Air Force Exercise
4. ACSA	Defence Logistics Agreement

Which of the pairs given above are correctly matched?

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

Answer: (d) 1, 2, 3 and 4

- **JIMEX** → India–Japan **Naval** exercise.
- **Dharma Guardian** → India–Japan **Army** exercise.
- **Veer Guardian** → India–Japan **Air Force** exercise.
- **ACSA** → facilitates reciprocal provision of **supplies and services/logistical support** between the armed forces.

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3.1. INDIA'S CRUDE OIL IMPORT BILL RISES AMID WEST ASIA CRISIS

Context

- India's **crude oil import bill** rose sharply in **July 2026**, reflecting the impact of higher international crude prices amid the **West Asia crisis**. This brings into focus India's dependence on imported **crude oil, LPG and natural gas** and the vulnerability of its energy security to global price and supply disruptions.



Why is India's Crude Import Bill Important?

1. High Import Dependence

- India is among the world's major **crude oil consumers and importers**.
- A substantial share of crude processed by Indian refineries is imported.
- This creates vulnerability to **international price fluctuations, geopolitical conflicts and supply disruptions**.

2. Impact on Current Account

- Crude oil is a major component of India's merchandise imports.
- A sharp rise in crude prices can increase the **import bill**, thereby widening the **trade deficit**.
- If higher oil imports are not offset by exports and other inflows, it can put pressure on the **Current Account Balance**.

3. Inflationary Impact

- Higher crude prices → Higher cost of petroleum products → Higher transportation and production costs → **Cost-push inflation**
- The impact can spread across the economy because petroleum products are used in **transport, agriculture, manufacturing and logistics**.

4. Pressure on the Rupee

- Higher oil imports increase India's demand for foreign currency, particularly the **US dollar**.

Higher oil prices → Higher dollar demand → Potential pressure on Rupee

Indian Crude Basket

- The **Indian Crude Basket (ICB)** is a representative basket of crude oil grades imported by India.
- It is used as an important indicator of the **international crude oil price relevant to India**.
- The basket broadly comprises **Oman & Dubai crude and Brent-related crude**.
- It is different from the price of a single crude benchmark such as Brent.

Q. With reference to India's crude oil imports, consider the following statements:

- India meets a substantial proportion of its crude oil requirement through imports.
- An increase in international crude oil prices can widen India's merchandise trade deficit even if the volume of crude imported remains unchanged.

3. The Indian Crude Basket is identical to the Brent crude oil benchmark.
4. LNG is natural gas converted into liquid form primarily to facilitate transportation and storage.
Which of the statements given above are correct?

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

Answer: (b) 1, 2 and 4 only

- **Statement 1 – Correct:** India has a high dependence on imported crude; imported crude accounted for around **89.7% of crude processed in 2023–24**.
- **Statement 2 – Correct:** Higher crude prices increase the value of imports and can worsen the trade balance.
- **Statement 3 – Incorrect:** Brent is an international crude benchmark; the **Indian Crude Basket is a representative basket relevant to India**.
- **Statement 4 – Correct:** LNG is natural gas cooled to a very low temperature and converted into liquid form for easier transportation and storage.

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ENVIRONMENT & GEOGRAPHY

4.1. SUPREME COURT: NO STATE CAN BLOCK TRADITIONAL ELEPHANT ROUTES

Context

- The **Supreme Court** has directed the **Centre to conduct a fresh nationwide survey** of traditional elephant corridors and identify physical barriers obstructing the free movement of wild elephants.



What are Elephant Corridors?

- An **elephant corridor** is a strip of land that facilitates the movement of elephants between **two or more viable habitat patches**.
- Corridors are crucial because elephant populations often require **large, interconnected landscapes** rather than isolated protected areas.
- Maintaining these routes helps reduce **habitat fragmentation** and **human–elephant conflict**.

Major Threats to Elephant Corridors

- Infrastructure development** such as roads, railways and other linear projects can fragment habitats and disrupt elephant movement. **Encroachment and construction**, including buildings, resorts and human settlements, can obstruct traditional routes.
- Other major threats include **agricultural expansion, fencing and walls, trenches, firebreaks, mining and quarrying, and other land-use changes**. The Supreme Court highlighted in particular **physical barriers** that prevent elephants from using their traditional movement routes.

Elephant Corridors in India:

Corridor Name	Connected Habitats / State	Key Ecological Significance
1. Kaniyanpura–Moyar	Bandipur NP to Mudumalai TR (<i>Karnataka & Tamil Nadu</i>)	Crucial link in the Nilgiri Biosphere Reserve connecting the Western and Eastern Ghats elephant populations.
2. Thirunelli–Kudrakote	Wayanad Sanctuary to Brahmagiri Sanctuary (<i>Kerala & Karnataka</i>)	Vital passage in the Malnad-Nilgiri landscape, allowing genetic exchange across state borders.
3. Kallhatti–Sigur	Mudumalai Tiger Reserve (<i>Tamil Nadu</i>)	Part of the critical Sigur Plateau corridor network, landmarked by Supreme Court rulings for right-of-passage.
4. Edayarahalli–Doddasampige	MM Hills to BR Hills (<i>Karnataka</i>)	Facilitates movement between Biligirirangan Swamy Temple (BRT) Tiger Reserve and Male Mahadeshwara Hills.
5. Chilla–Motichur	Rajaji Tiger Reserve (<i>Uttarakhand</i>)	Spans across the Ganges river; vital for structural connectivity in the Shivalik-Ganges landscape.
6. Rawasan–Sonanadi	Rajaji TR to Corbett Tiger Reserve (<i>Uttarakhand</i>)	Essential east-west seasonal migration path for elephants in the North-Western landscape.

7. Siju–Rewak	Balpakram NP to Nokrek NP (Meghalaya)	Crucial connectivity bottleneck in the Garo Hills landscape.
8. Kanchanjuri / Haldhibari	Kaziranga NP to Karbi Anglong Hills (Assam)	Enables seasonal refuge movement during annual Brahmaputra floods in Kaziranga.
9. Similipal–Hadagarh–Kuldiha	Similipal TR to Kuldiha Sanctuary (Odisha)	Connects key protected areas in the fragmented East-Central landscape.
10. Titi–Reti	Buxa Tiger Reserve area (North Bengal)	Critical movement path in the high-conflict North Bengal-Dooars region.

Q. With reference to elephant corridors in India, consider the following statements:

1. Elephant corridors facilitate movement between two or more viable habitat patches.
2. Elephant corridors are synonymous with Elephant Reserves notified under Project Elephant.
3. Habitat fragmentation and physical barriers can impair elephant corridors.
4. The Indian Elephant is listed under Schedule I of the Wild Life (Protection) Act, 1972.

Which of the statements given above are correct?

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

Answer: (b) 1, 3 and 4 only

- **Statement 1 – Correct:** Corridors connect two or more viable habitat patches.
- **Statement 2 – Incorrect: Elephant Corridors and Elephant Reserves are distinct concepts;** a corridor is primarily a movement pathway.
- **Statement 3 – Correct:** Infrastructure, construction and other physical barriers can fragment or obstruct corridors.
- **Statement 4 – Correct:** *Elephas maximus* is included in **Schedule I** of the Wildlife (Protection) Act, 1972.

4.2. BRICS OPPOSES EU'S CARBON BORDER ADJUSTMENT MECHANISM (CBAM)

Context

- Recently, **BRICS countries criticised the European Union's Carbon Border Adjustment Mechanism (CBAM)** as unilateral and protectionist, arguing that it could increase the burden on developing countries' exports; they also called for greater and predictable **adaptation finance from developed countries**.



What is Carbon Border Adjustment Mechanism (CBAM)?

- **CBAM is an EU mechanism to impose a carbon-related cost on certain carbon-intensive goods imported into the European Union.**
- It aims to prevent **carbon leakage** and ensure that imported goods face a carbon cost comparable to goods produced within the EU.

How does CBAM Work?

Carbon-intensive goods imported into EU



Embedded emissions are calculated



Importer purchases CBAM certificates



Carbon-related cost is imposed

If a carbon price has already been paid in the exporting country, the corresponding amount can be deducted under the mechanism.

Sectors Covered under CBAM

The current CBAM framework covers **six sectors**:

Sector	Examples/Significance
Iron & Steel	Major carbon-intensive industrial sector
Aluminium	Energy-intensive production
Cement	High process emissions
Fertilisers	Emissions-intensive production
Electricity	Carbon intensity varies by energy source
Hydrogen	Important for industrial decarbonisation

Why are Developing Countries Critical of CBAM?

1. **Trade Competitiveness:** Higher carbon-related costs may make exports from developing countries **less competitive** in the EU market.
2. **Development Concerns:** Developing countries argue that they require greater policy space to balance **economic development with climate action**.
3. **Climate Justice:** Developing countries emphasise their relatively lower historical contribution to cumulative greenhouse-gas emissions while facing significant climate impacts.
4. **Unilateral Climate Measures:** BRICS countries have raised concerns that unilateral trade-related climate measures could undermine **multilateral approaches to climate change**.

Q. With reference to the **European Union's Carbon Border Adjustment Mechanism (CBAM)**, consider the following statements:

1. CBAM seeks to address the problem of carbon leakage.
2. Iron and steel, aluminium, cement, fertilisers, electricity and hydrogen are among the sectors covered under CBAM.
3. CBAM is designed to replace the EU Emissions Trading System (EU ETS) for carbon-intensive industries within the European Union.

Which of the statements given above are correct?

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

Answer: (b) 1 and 2 only

Sudan virus (SUDV)	Sudan virus disease (SVD)
Bundibugyo virus (BDBV)	Bundibugyo virus disease (BVD)

Transmission

- Ebola viruses are primarily transmitted through **direct contact with the blood or other body fluids of infected people or deceased persons**.
- **Natural host:** Fruit bats of the **Pteropodidae family** are considered the likely natural hosts of Orthoebolaviruses.

About the Ebola Vaccine?

- **Ervebo®** is a licensed and WHO-prequalified vaccine against **Ebola virus disease caused by EBOV**.
- It is **not currently recommended for the Bundibugyo outbreak**, as there is insufficient evidence that it provides protection against BDBV.

About Bundibugyo Virus (BDBV):

- **Disease:** Bundibugyo virus disease (BVD)
- **Type:** Ebola virus species
- **First identified:** During an outbreak in **Bundibugyo District, Uganda, in 2007**
- **Licensed vaccine:** None specifically approved for BVD
- **Case fatality:** Previous BVD outbreaks have recorded approximately **30–50%** case fatality rates.

Q. With reference to Ebola disease, consider the following statements:

1. Bundibugyo virus belongs to the Orthoebolavirus genus.
2. Ervebo® is a licensed vaccine specifically approved against Bundibugyo virus disease.
3. Fruit bats of the Pteropodidae family are considered likely natural hosts of Orthoebolaviruses.
4. Early intensive supportive care can improve survival in Ebola disease.

Which of the statements given above are correct?

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

Answer: (b) 1, 3 and 4 only

- **Statement 1 – Correct:** Bundibugyo virus is an Orthoebolavirus that causes Bundibugyo virus disease.
- **Statement 2 – Incorrect:** Ervebo® is licensed for **Ebola virus disease caused by EBOV**, not specifically for Bundibugyo virus disease.
- **Statement 3 – Correct:** Pteropodidae fruit bats are considered likely natural hosts.
- **Statement 4 – Correct:** Early intensive supportive care, including rehydration and symptom management, improves survival prospects.

5.1. ZHUQUE-3, CHINA'S FIRST LAND-BASED ROCKET RECOVERY

Context

- Recently, **China** successfully recovered the first stage of its reusable **Zhuque-3** rocket on land for the first time, using deployable landing legs. Developed by private firm **LandSpace**, this was China's second rocket-stage recovery after the **Long March-10B** was recovered at sea on July 10.
- Globally, **LandSpace** became the third entity after **SpaceX** and **Blue Origin** to land an orbital-class rocket booster on legs.



About Zhuque-3

- Developer:** Built by **LandSpace**, a Beijing-based private commercial aerospace company; approved by the **China National Space Administration (CNSA)** as a new-generation reusable launch vehicle.
- Propulsion:** Powered by **liquid oxygen-methane engines** (Tianque-series); the first stage uses nine such engines.
- Configuration:** Single-core, two-stage, stainless-steel launch vehicle with an overall length of **66.1 metres** and a body diameter of **4.5 metres**.
- Purpose:** Designed for **low-cost, high-capacity, high-frequency** satellite launches.

Q. With reference to the recent Zhuque-3 rocket recovery, consider the following statements:

- Zhuque-3 is a rocket developed by the China National Space Administration (CNSA).
- Zhuque-3's first stage was recovered on land using deployable landing legs.
- The first stage of the Long March-10B rocket was recovered on a platform at sea in July.

Which of the statements given above is/are correct?

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

Answer: c. II and III only

Explanation

Statement I is Incorrect: Zhuque-3 is developed by **LandSpace**, a private Chinese commercial aerospace company; it is approved for launch by the **China National Space Administration (CNSA)**, but not developed by it.

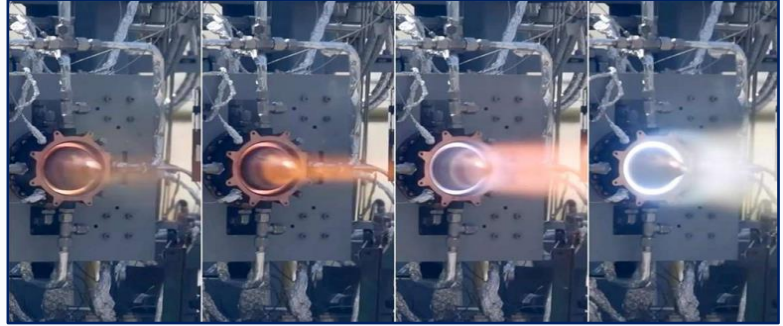
Statement II is Correct: The Zhuque-3 first stage was recovered on land using **deployable landing legs**, the first such recovery for China.

Statement III is Correct: The Long March-10B's first stage was recovered via a **net-capture system on a platform at sea** on **July 10**.

5.2. ROTATING DETONATION ENGINES (RDEs): NEXT-GENERATION PROPULSION

Context

Recently Hyderabad-based defence start-up **D-Propulse** has successfully demonstrated a **Rotating Detonation Engine (RDE)** at a **DRDO facility**, highlighting India's growing capabilities in advanced propulsion technology.



About Rotating Detonation Engine(RDE)

- **Definition:** An advanced propulsion system that uses **detonation waves** for more efficient fuel-energy conversion, with potential applications in **rockets, missiles and hypersonic systems**. RDE Uses **detonation**, driven by a **supersonic shock wave**, instead of conventional combustion.
- **Working:** The detonation wave continuously rotates through a **ring-shaped (annular) chamber**, producing sustained thrust.

Key Difference: Rotary Detonation Engine (RDE) vs Conventional Internal Combustion Engine

Feature	Rotary Detonation Engine (RDE)	Conventional IC Engine
1. Combustion	Uses detonation —supersonic combustion driven by a shock wave	Uses deflagration —subsonic flame propagation
2. Pressure Generation	Generates pressure through a rotating detonation wave	Pressure builds from relatively gradual fuel combustion
3. Efficiency	Potentially higher thermodynamic efficiency	Comparatively lower efficiency
4. Fuel Consumption	Potential to achieve better fuel efficiency	Generally higher fuel consumption for equivalent output
5. Design & Size	Can potentially be more compact and lightweight due to pressure-gain combustion	Conventional combustion systems are generally more bulky for equivalent performance

Q. With reference to Rotating Detonation Engines (RDEs), consider the following statements:

- An RDE achieves combustion at constant volume, unlike a conventional engine which combusts at constant pressure.
- In an RDE, the detonation wave travels through an annular combustion chamber in a single, non-repeating pulse.
- RDEs are reported to offer around 10% to 25% more thermodynamic efficiency than conventional combustors.

Which of the statements given above is/are correct?

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

Answer: (c). I and III only

Explanation

Statement I is Correct: In a regular engine, combustion occurs at constant pressure (deflagration). In a detonation engine, the shock wave compresses the mixture before combustion, and the detonation itself happens at constant volume, converting more chemical energy into pressure.

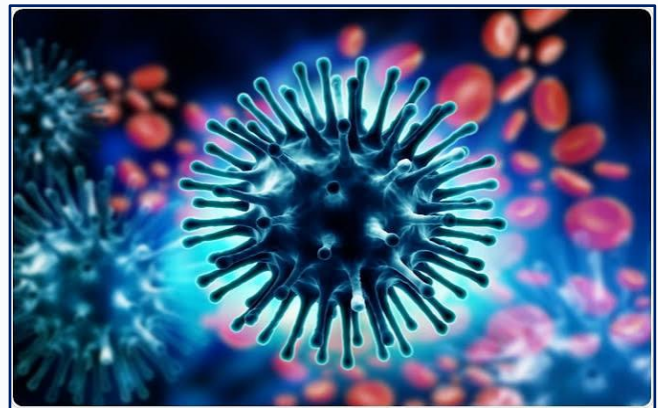
Statement II is Incorrect: An RDE makes detonation a continuous, circulating process — the detonation wave races repeatedly around the annular chamber rather than passing through once. A single, non-repeating pulse through a long tube describes a Pulsed Detonation Engine (PDE), not an RDE.

Statement III is Correct: RDEs are reported to offer around 10% to 25% more thermodynamic efficiency than conventional combustors, which could theoretically translate into significant fuel savings for the same output.

5.3. H1N1 CASES RISE ACROSS INDIA

Context

- Recently, H1N1 (swine flu) cases have increased in several parts of India, mainly during the monsoon season when flu infections usually rise, with Kerala reporting the highest number of cases and deaths.
- Experts say there is no major cause for concern as most patients recover with timely treatment, and health authorities have not declared it an outbreak, advising early testing and quick treatment for suspected cases.



State-wise Trends

- Delhi and Mumbai** saw a rise in H1N1 cases and set up special isolation/wards, while **Bengaluru** reported heavy respiratory illness among children, with testing mainly for severe or long-lasting cases.
- Telangana** has not seen a major rise in H1N1 despite more viral-fever cases, while **Kerala** has seen influenza cases and deaths steadily increase from **May to July** (526 to 2,899 cases; 6 to 31 deaths).

About the H1N1 Virus

- H1N1 is an **Influenza A subtype** causing **swine flu**.
- Its Symptoms include **Fever, chills, cough, sore throat, runny/blocked nose, headache, tiredness, muscle or body aches; sometimes vomiting and diarrhoea**.
- Children and older adults, especially those with asthma or other chronic conditions are most Vulnerable to this virus.

- **The Virus was** first reported in **North America (April 2009)**; WHO declared a pandemic in **June 2009** after spread to **74 countries/territories**. It originated from **animal influenza viruses** and differed from earlier human H1N1 strains.
- India reported its first case in **May 2009**; it spreads mainly through **cough/sneeze droplets**, but also through contaminated surfaces. Symptoms usually appear in **1–4 days (about 2 days)**, and spread can occur before clear symptoms.

H1N1: Prevention & Treatment Measures

- **Diagnosis:** Most cases are identified clinically; **RT-PCR of respiratory samples** confirms infection and is generally more sensitive than rapid tests.
- **Vaccination:** Take the flu vaccine every year for protection.
- **Hygiene:** Wash hands, cover coughs/sneezes and avoid close contact with infected people.
- **Isolation:** Keep infected people away from others to prevent spread.
- **Antivirals:** High-risk and severe patients should get antiviral medicines early, preferably within **48 hours**.
- **Public Health:** Ensure vaccination, testing, monitoring and awareness, especially for **pregnant women, children, elderly and people with chronic diseases**.

Additional Scientific & Conceptual Insights

- **Antigenic Drift vs. Antigenic Shift:**
 - **Antigenic Drift:** Small, continuous genetic mutations occurring over time, causing minor updates in seasonal flu vaccines.
 - **Antigenic Shift:** A sudden, major genetic change resulting in a new influenza A strain (e.g., 2009 H1N1 pandemic) that has not previously circulated in humans, creating potential for a pandemic.

Influenza Subtypes (H1N1 vs. H3N2 vs. H5N1)

All three strains belong to the **Orthomyxoviridae** family (Influenza A genus) and are classified by their surface glycoproteins: **Hemagglutinin (H)**, which enables host cell entry, and **Neuraminidase (N)**, which facilitates viral release.

Parameter	Influenza A (H1N1)	Influenza A (H3N2)	Influenza A (H5N1)
Common Name	Swine Flu / Seasonal Flu	Seasonal Flu	Highly Pathogenic Avian Influenza (HPAI / Bird Flu)
Primary Host Reservoir	Pigs (swine), Humans	Swine, Birds, Humans	Wild aquatic birds (ducks, geese), Domestic poultry
Transmission to Humans	Human-to-human transmission is high via droplets/fomites.	Human-to-human transmission is high via droplets/fomites.	Zoonotic spillover from direct contact with infected birds; human-to-human spread remains extremely rare/limited.

Clinical Severity	Moderate; causes upper/lower respiratory tract illness. High risk for vulnerable groups.	Moderate; often presents with higher fever, severe body aches, and prolonged cough compared to H1N1.	Very High; leads to rapid primary viral pneumonia, Acute Respiratory Distress Syndrome (ARDS), and multi-organ failure.
Vaccine Inclusion	Included in standard annual Quadrivalent Seasonal Flu Vaccines.	Included in standard annual Quadrivalent Seasonal Flu Vaccines.	Not part of seasonal flu shots; stockpiled as candidate pandemic vaccines by global agencies.

Q. With reference to H1N1 (swine flu), consider the following statements:

I. H1N1 is a subtype of the Influenza A virus.

II. Routine H1N1 testing is conducted at all government hospitals in India.

III. Anti-flu drugs are more effective when administered within the first few days of fever onset.

Which of the statements given above is/are correct?

(a) I and II only

(b) II and III only

(c) I and III only

(d) I, II and III

Answer: (c). I and III only

Explanation

Statement I is Correct: H1N1, commonly known as **swine flu**, is a subtype of the **Influenza A** virus.

Statement II is Incorrect: Routine H1N1 testing is **not** conducted at government hospitals, which makes it difficult to classify flu-like cases; testing is largely restricted to symptomatic cases in select facilities.

Statement III is Correct: Anti-flu drugs are more effective when started within the **first few days of fever**, and suspected cases should ideally be tested within **24 to 48 hours** of developing symptoms.

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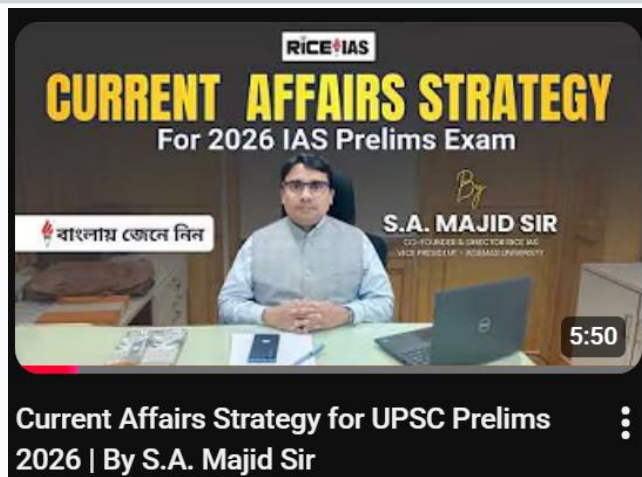
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