MISSION X

INNOVATION IN LEARNING

MISSION X PRESENTS

X TECH

WEEKLY SCIENCE & TECHNOLOGY COMPILATION

9 – 16 July 2026

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SECTION

Space Technology

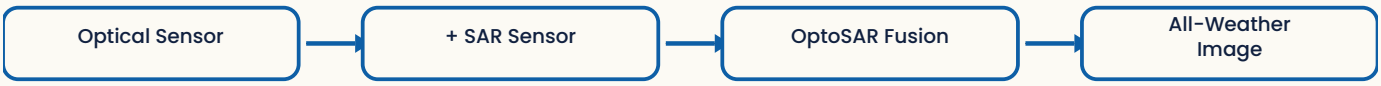
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GS PAPER III · SPACE TECHNOLOGY · PRIVATE SPACE

Mission Drishti — World's First OptoSAR Satellite



NEWS IN BRIEF

- Bengaluru-based startup GalaxEye launched Mission Drishti aboard a SpaceX Falcon 9, becoming the world's first satellite to combine Synthetic Aperture Radar (SAR) and multispectral optical imaging on a single platform, and India's largest privately-built Earth observation satellite (190 kg).
- A proprietary "SyncFusion" imaging stack captures optical and SAR data of the same spot at the same time; when clouds block the optical view, AI regenerates optical-like images from the SAR data.
- Placed in a Sun-synchronous Low Earth Orbit; supports border surveillance, disaster response, agriculture and insurance assessment.
- Early orbit operations were supported by NSIL/ISTRAC, with routine operations now handled by GalaxEye itself.

CONCEPT SIMPLIFIED

Optical imaging works like a camera photograph — sharp and intuitive, but blocked by clouds and darkness. SAR (radar) imaging sends out microwaves and reads their reflection, so it works day or night and through clouds, but the resulting images are harder to interpret. Mission Drishti fuses both data streams instantly instead of stitching together separate satellite passes.

190 kg	Optical+SAR	Sun-Sync LEO
Weight	Sensors	Orbit

STATIC CONNECT

Standard static on Remote Sensing: revise the difference between passive (optical) and active (SAR/radar) sensors, and orbit types (Sun-synchronous vs Geostationary) used for Earth observation.

UNIQUE FACT

Mission Drishti's AI can regenerate optical-like images from SAR data alone when clouds block the camera — effectively reconstructing a clear picture from radar data.

⚠ **EXAM TRAP —** Don't confuse OptoSAR (one satellite fusing two sensor types) with a full 'constellation' — Mission Drishti is the first satellite of a planned Drishti constellation, and GalaxEye is a private company, not ISRO.

REAL-LIFE APPLICATION

- All-weather crop-health and yield monitoring for farmers, even through monsoon cloud cover.
- Rapid flood, cyclone and landslide damage assessment for disaster-response agencies.
- Round-the-clock border and coastal surveillance regardless of weather or daylight.
- Faster, remote verification of crop-damage or infrastructure insurance claims.

📌 PRELIMS MEMORY BANK

- Developer: GalaxEye (Bengaluru start-up)
- Weight: 190 kg — India's largest private EO satellite
- Tech: OptoSAR = Optical + SAR fusion on one platform
- Launch vehicle: SpaceX Falcon 9
- Orbit: Sun-synchronous LEO

PRACTICE MCQ · UPSC PRELIMS STYLE

Mission Drishti — World's First OptoSAR Satellite

With reference to 'Mission Drishti', consider the following statements:

1. It is India's first satellite to be launched by a private Indian company.
2. It combines optical and Synthetic Aperture Radar (SAR) imaging on a single platform.
3. It was launched aboard an ISRO GSLV rocket.

Which of the statements given above is/are correct?

(a) 1 and 2 only

(b) 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

✓ **Correct Answer: (b) 2 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

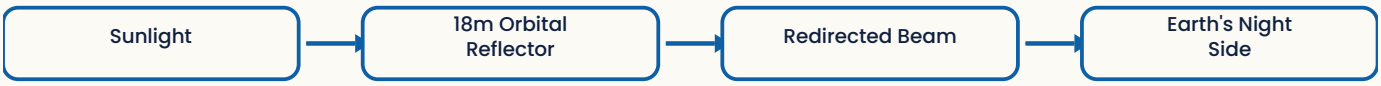
News reports describe Drishti as India's 'largest privately built' satellite — a superlative about size, not a claim of being the first private satellite ever, so an option built on 'first' over-reaches. Since the launch used a foreign private rocket, tying it to ISRO's GSLV is a separate trap.

② THROUGH FACTUAL KNOWLEDGE

Reports confirm GalaxEye's satellite launched on a SpaceX Falcon 9, not an ISRO vehicle; and the 'world's first' claim specifically concerns simultaneous optical+SAR fusion on one satellite, not being India's first private satellite overall.

GS PAPER III · SPACE TECHNOLOGY · ENVIRONMENT

Eärendil-1 — The Orbital 'Space Mirror'



NEWS IN BRIEF

- The US FCC authorised radio operations for Eärendil-1 on 9 July 2026, a demonstration 'space mirror' satellite built by California startup Reflect Orbital — approval covers only this single satellite, not the company's proposed 50,000-satellite constellation.
- The 142 kg satellite will deploy an 18-metre by 18-metre ultra-light thin-film reflector in Sun-synchronous Low Earth Orbit (roughly 600–650 km altitude) to redirect sunlight onto Earth's night side for several minutes at a time.
- The satellite is named after Eärendil the Mariner from J.R.R. Tolkien's legendarium, who carried a shining gem across the sky.
- Astronomers, via the American Astronomical Society, have expressed strong concern: a modelled 50,000-satellite constellation could raise natural night-sky brightness by 200–300%.

CONCEPT SIMPLIFIED

Eärendil-1 acts as an orbital heliostat — a mirror that tracks and redirects sunlight toward a chosen target, similar in principle to ground-based solar heliostats used in concentrated solar power plants, but positioned in space to reflect sunlight down onto Earth's night side.

18m × 18m	142 kg	~600-650 km
Reflector	Weight	Altitude

STATIC CONNECT

Static connect — Space Law & Light Pollution: link to debates around satellite mega-constellations (such as Starlink) and their impact on astronomy, alongside the regulatory role of bodies like the FCC in space licensing.

UNIQUE FACT

Eärendil-1's FCC approval covers only this single demonstration satellite — not Reflect Orbital's much larger proposed constellation of up to 50,000 mirror satellites.

REAL-LIFE APPLICATION

- Could extend the productive hours of ground solar farms by delivering extra sunlight after dusk.
- Potential use in emergency and disaster-relief lighting for night-time search-and-rescue operations.
- Raises genuine environmental trade-offs — brighter night skies could disrupt nocturnal wildlife behaviour and astronomical research.

PRELIMS MEMORY BANK

- Developer: Reflect Orbital (California start-up)
- FCC approval: 9 July 2026, single satellite only
- Reflector size: 18m × 18m thin-film mirror
- Weight/Orbit: 142 kg, Sun-synchronous LEO (~600-650 km)
- Concern: could sharply raise night-sky brightness at scale

PRACTICE MCQ · UPSC PRELIMS STYLE

Eärendil-1 — The Orbital 'Space Mirror'

With reference to Eärendil-1, recently in the news, consider the following statements:

1. It is designed to convert sunlight into microwave energy and beam it to Earth.
2. The FCC's approval covers Reflect Orbital's entire proposed 50,000-satellite constellation.
3. It functions as an orbital reflector that redirects sunlight to Earth's night side.

Which of the statements given above is/are correct?

(a) 3 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

✓ **Correct Answer: (a) 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

A 'mirror' or 'reflector', by definition, redirects existing light rather than converting it into another energy form such as microwaves — that description instead matches space-based solar power satellites, a different concept, so statement 1 can be eliminated. Reports explicitly distinguish the single-satellite approval from the larger constellation plan, ruling out statement 2.

② THROUGH FACTUAL KNOWLEDGE

SpaceNews and FCC statements confirm the licence covers only the single Eärendil-1 demonstration satellite, not the proposed 50,000-unit constellation; the satellite's function is a deployable thin-film reflector redirecting sunlight to targeted ground locations.

GS PAPER III · SPACE TECHNOLOGY · INTERNATIONAL COOPERATION

Soyuz MS-29 Docks with the ISS

Launch: Baikonur → 2-Orbit Fast Rendezvous → Dock: Prichal Module → ~8-Month ISS Mission

NEWS IN BRIEF

- Soyuz MS-29 launched from the Baikonur Cosmodrome, Kazakhstan, on 14 July 2026, carrying NASA astronaut Anil Menon and Roscosmos cosmonauts Pyotr Dubrov (commander) and Anna Kikina to the International Space Station.
- The spacecraft docked at the Prichal module just about three hours after liftoff, using a fast-track two-orbit rendezvous profile rather than the longer, standard profiles some launches require.
- The mission is designated Expedition 74/75 (callsign 'Tigris'); the planned duration is about 240 days (roughly eight months), with landing expected around March 2027.
- This was Anil Menon's first spaceflight. The launch brought the ISS crew headcount to 10.

CONCEPT SIMPLIFIED

Soyuz can use a 'fast-track' rendezvous profile by precisely timing launch so the spacecraft's orbital plane closely matches the ISS's at liftoff, letting it catch up and dock within a few orbits instead of the many orbits (and roughly two days) a standard rendezvous profile needs.

3	~3 hrs	~240 days
Crew Size	Dock Time	Duration

STATIC CONNECT

Static connect — Human Spaceflight & the ISS: link to the multi-agency ISS crew-rotation system and compare with India's own upcoming Gaganyaan crewed mission's rendezvous and docking plans.

UNIQUE FACT

Soyuz MS-29 docked with the ISS in about three hours using a fast two-orbit rendezvous profile — far quicker than the roughly two-day journey some earlier Soyuz missions required.

REAL-LIFE APPLICATION

- Sustains continuous human presence aboard the ISS for ongoing microgravity research in medicine, materials science and biology.
- Multinational crew missions like this keep the diplomatic and scientific cooperation framework of the ISS running despite geopolitical tensions.
- The fast-rendezvous techniques refined here feed into planning for future crewed missions, including India's own Gaganyaan programme.

PRELIMS MEMORY BANK

- Launch: 14 July 2026, Baikonur Cosmodrome, Kazakhstan
- Crew: Anil Menon (NASA), Pyotr Dubrov & Anna Kikina (Roscosmos)
- Docking port: Prichal module
- Mission: Expedition 74/75, ~240 days duration
- Rendezvous: fast two-orbit profile (~3 hours)

PRACTICE MCQ · UPSC PRELIMS STYLE

Soyuz MS-29 Docks with the ISS

Consider the following statements regarding the Soyuz MS-29 mission:

1. It was launched from the Vostochny Cosmodrome in Russia.
2. It carried a mixed crew of NASA and Roscosmos astronauts to the ISS.
3. It used a fast rendezvous profile to dock with the ISS within a few hours of launch.

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

✓ **Correct Answer: (b) 2 and 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Crewed Soyuz missions are historically and structurally tied to the Baikonur Cosmodrome in Kazakhstan (leased by Russia) rather than Vostochny (Russia's newer domestic cosmodrome, used mainly for uncrewed launches) — a commonly confused pair, so statement 1 can be eliminated.

② THROUGH FACTUAL KNOWLEDGE

Soyuz MS-29's crew comprised NASA's Anil Menon alongside Roscosmos's Pyotr Dubrov and Anna Kikina; and it docked at the Prichal module roughly three hours after its 14 July 2026 liftoff, using a fast two-orbit rendezvous profile.

SECTION

Defence Technology

04 Pinaka Long Range Guided Rocket — Minimum-Range Trial

05 INS Mahendragiri Commissioned

GS PAPER III · DEFENCE TECHNOLOGY · DRDO

Pinaka Long Range Guided Rocket — Minimum-Range Trial

60 km	120 km	300 km
Min Range	Max Range	Mk4 Target

NEWS IN BRIEF

- DRDO successfully flight-tested the Pinaka Long Range Guided Rocket (LRGR) for a user-defined minimum range of 60 km at the Integrated Test Range (ITR), Chandipur, Odisha on 8 July 2026, striking the target with high precision along the predicted trajectory.
- The rocket was launched from an in-service Pinaka launcher, confirming there is no 'dead zone' in front of the launcher and that the same platform can fire variants across the full 60–120 km range band.
- Designed by the Armament Research & Development Establishment (ARDE) with the High Energy Materials Research Laboratory (HEMRL); supported by DRDL and Research Centre Imarat.
- This follows a December 2025 test of the 120 km maximum-range variant; DRDO is now fast-tracking a Pinaka Mk4 targeting 300 km to anchor India's upcoming Integrated Rocket Force.

CONCEPT SIMPLIFIED

Pinaka is a multi-barrel rocket launcher (MBRL). The guided LRGR variant adds a navigation and guidance kit to what were originally unguided artillery rockets, letting them strike precise coordinates instead of saturating a wide area — the same logic that turns an unguided bomb into a precision-guided one.

Dec 2025: Max Range 120 km → Jul 2026: Min Range 60 km → Next: Mk4 Target 300 km

STATIC CONNECT

Static topic — Indigenous Defence Systems: link with DRDO's organisational structure (ARDE, HEMRL, DRDL) and India's shift from unguided artillery rockets to guided precision-strike systems.

UNIQUE FACT

The same Pinaka launcher can fire rockets of different ranges (60–120 km) without modification — confirmed by separately testing its minimum and maximum range across two 2025-26 trials.

⚠ **EXAM TRAP —** Watch out for date-and-range mix-ups: the December 2025 test validated the 120 km maximum range, while the July 2026 test validated the 60 km minimum range — a classic prelims swap.

REAL-LIFE APPLICATION

- Gives artillery units precision strike capability instead of blanket area-saturation, reducing collateral damage.
- Firing rockets of different ranges from the same launcher cuts logistics and training burden for army units.
- Feeds into India's move toward an Integrated Rocket Force capable of deep, precision strikes similar in role to systems like the US ATACMS.

📌 PRELIMS MEMORY BANK

- Full form: Long Range Guided Rocket (LRGR)
- July 2026 test: minimum range 60 km, at ITR Chandipur
- Dec 2025 test: maximum range 120 km
- Developers: ARDE + HEMRL (DRDO)
- Next: Pinaka Mk4 targeting 300 km range

PRACTICE MCQ · UPSC PRELIMS STYLE

Pinaka Long Range Guided Rocket — Minimum-Range Trial

Consider the following statements about the Pinaka Long Range Guided Rocket (LRGR):

1. It was developed jointly by DRDO's ARDE and HEMRL.
2. Its July 2026 flight test evaluated its maximum range capability of 120 km.
3. It can be fired from the same launcher used for other Pinaka variants.

Which of the statements given above is/are correct?

(a) 1 and 3 only

(b) 2 and 3 only

(c) 1 only

(d) 1, 2 and 3

✓ **Correct Answer: (a) 1 and 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

A minimum-range test is explicitly newsworthy because it proves a launcher has no 'dead zone' close by — that specific detail signals the July 2026 trial was about the minimum, not maximum, range, so a statement claiming otherwise is a plant.

② THROUGH FACTUAL KNOWLEDGE

DRDO's official release states the 8 July 2026 test targeted a user-defined MINIMUM range of 60 km; the 120 km maximum-range test had already been conducted separately in December 2025.

GS PAPER III · DEFENCE · INDIGENOUS SHIPBUILDING

INS Mahendragiri Commissioned

Navy's Warship Design Bureau → Built at MDSL, Mumbai → 6th Project 17A Frigate → Commissioned July 2026

NEWS IN BRIEF

- The Indian Navy commissioned INS Mahendragiri (F38) into its Eastern Fleet at Visakhapatnam on 11 July 2026 — the sixth Project 17A (Nilgiri-class) indigenous stealth frigate, inducted just 1.5 years after the class's first ship, INS Nilgiri, joined in January 2025.
- Built by Mazagon Dock Shipbuilders Limited (MDSL), Mumbai — the fourth P17A ship from MDSL, with the remaining ships built at GRSE, Kolkata; it displaces about 6,700 tonnes, roughly 5% larger than the preceding Shivalik-class.
- Features CODOG propulsion (a diesel engine plus a gas turbine), improved stealth shaping with a reduced radar cross-section, advanced surveillance radar and electronic-warfare suites, and supersonic surface-to-surface and surface-to-air missiles.
- Internally designed by the Navy's own Warship Design Bureau, reflecting India's growing indigenous shipbuilding capability and blue-water ambitions in the Indian Ocean Region.

CONCEPT SIMPLIFIED

A 'stealth frigate' is built to reduce its radar cross-section (RCS) through angled hull surfaces, radar-absorbent coatings and minimised external clutter, making it harder for enemy radar to detect at range — alongside reduced acoustic and infrared signatures against sonar and heat-seeking threats.

~6,700 t	6th of 7	MDSL Mumbai
Displacement	Class Rank	Builder

STATIC CONNECT

Static connect — Indian Naval Modernisation: link to the full Project 17A roster (Nilgiri, Udaygiri, Himgiri, Taragiri, Dunagiri, Mahendragiri) and the preceding Project 17 Shivalik-class.

UNIQUE FACT

INS Mahendragiri is the sixth Project 17A frigate commissioned in just 1.5 years since the first ship of the class joined — an unusually fast induction pace for Indian warship building.

REAL-LIFE APPLICATION

- Strengthens India's anti-submarine, anti-air and anti-surface warfare capability on the eastern seaboard.
- Protects sea lanes and counters regional naval build-up in the Indian Ocean Region.
- Supports humanitarian assistance, disaster relief and anti-piracy patrols alongside its combat role.

PRELIMS MEMORY BANK

- Commissioned: 11 July 2026, Visakhapatnam
- Class: Project 17A (Nilgiri-class), 6th ship
- Builder: Mazagon Dock Shipbuilders Ltd, Mumbai
- Displacement: ~6,700 tonnes
- Propulsion: CODOG (diesel + gas turbine)

PRACTICE MCQ · UPSC PRELIMS STYLE

INS Mahendragiri Commissioned

Consider the following statements about INS Mahendragiri:

1. It is the first ship of the Project 17A class to be commissioned into the Indian Navy.
2. It was built at Mazagon Dock Shipbuilders Limited, Mumbai.
3. Project 17A frigates are a follow-on class of the Project 17 Shivalik-class frigates.

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

✓ **Correct Answer: (b) 2 and 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

A ship described in every report as the 'sixth' of its class to be commissioned cannot simultaneously be the 'first' — a straightforward internal-consistency check once you note the sequencing language.

② THROUGH FACTUAL KNOWLEDGE

INS Nilgiri (January 2025) was the first P17A ship commissioned, not Mahendragiri, the sixth (July 2026); Mahendragiri was built at MDSL, Mumbai; and P17A is officially described as a follow-on, improved class of the P17 Shivalik-class.

IX

SECTION

Biotechnology & Health

06 Ebola Outbreak (Bundibugyo Strain) — PHEIC

07 India's First AMR Centre of Excellence

08 Awiqli — First Once-Weekly Basal Insulin

09 Parrot Bornavirus-4 Identified in India

GS PAPER III · BIOTECHNOLOGY · PUBLIC HEALTH

Ebola Outbreak (Bundibugyo Strain) — PHEIC

Contact with Body Fluids → Human-to-Human Spread → Haemorrhagic Fever → Isolation & Supportive Care

NEWS IN BRIEF

- WHO declared a Public Health Emergency of International Concern (PHEIC) on 17 May 2026 for an Ebola outbreak caused by the Bundibugyo virus in DR Congo (Ituri, North Kivu, Haut-Uele) and Uganda — DRC's 17th Ebola outbreak, coming just five months after the previous one ended.
- As of mid-July 2026, DRC has crossed 2,000 confirmed cases and roughly 750 deaths; Uganda has reported a much smaller caseload.
- Unlike the more common Zaire ebolavirus, for which a licensed vaccine and treatment already exist, there is currently no licensed vaccine or specific therapeutic for Bundibugyo virus disease — past outbreaks of this strain have shown a 30–50% case fatality rate.
- The response is complicated by insecurity, population displacement and cross-border mining-related movement; the UK began its first vaccine trial around eight weeks into the emergency.

CONCEPT SIMPLIFIED

Ebola is a filovirus that causes viral haemorrhagic fever and spreads through direct contact with the body fluids of symptomatic or deceased patients — it is not airborne. Different Ebola species (Zaire, Sudan, Bundibugyo, and others) can carry different fatality rates, and existing vaccines were developed and licensed specifically against the Zaire species, not automatically covering the others.

2,000+	~750	DRC & Uganda
Confirmed Cases	Deaths	Countries

STATIC CONNECT

Static connect — Viral Haemorrhagic Fevers: revise WHO's PHEIC mechanism (also used for COVID-19 and mpox) and the Filoviridae virus family, which also includes the Marburg virus.

UNIQUE FACT

This is DR Congo's 17th Ebola outbreak overall, but the first in this cycle caused by the Bundibugyo strain, for which — unlike the Zaire strain — no licensed vaccine yet exists.

REAL-LIFE APPLICATION

- Contact-tracing and isolation protocols refined during Ebola outbreaks now serve as standard playbooks reused for other haemorrhagic-fever emergencies.
- Rapid RT-PCR diagnostic tests deployed at borders and airports help catch cases early and limit cross-border spread.
- Vaccine platforms originally developed for the Zaire strain (such as rVSV-based vaccines) are being adapted and trialled against the Bundibugyo strain.

PRELIMS MEMORY BANK

- Causative agent: Bundibugyo ebolavirus (a Filovirus)
- PHEIC declared: 17 May 2026 by WHO
- Countries: DR Congo (Ituri, N. Kivu, Haut-Uele) & Uganda
- Transmission: body fluids, NOT airborne
- No licensed vaccine/treatment for this strain

PRACTICE MCQ · UPSC PRELIMS STYLE

Ebola Outbreak (Bundibugyo Strain) — PHEIC

Consider the following statements regarding the 2026 Ebola outbreak in Central Africa:

1. It is caused by the Zaire ebolavirus species, for which a licensed vaccine already exists.
2. Ebola virus disease primarily spreads through respiratory droplets.
3. The World Health Organization has declared it a Public Health Emergency of International Concern.

Which of the statements given above is/are correct?

(a) 1 and 3 only

(b) 2 and 3 only

(c) 3 only

(d) 1, 2 and 3

✓ **Correct Answer: (c) 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

The defining feature of this outbreak in every report is precisely that it involves a DIFFERENT species (Bundibugyo) lacking a licensed vaccine, so a statement pairing it with the Zaire/vaccine combination is testing whether you conflate outbreaks — eliminate it. Ebola's textbook transmission route is contact with body fluids, not respiratory droplets, so eliminate that too.

② THROUGH FACTUAL KNOWLEDGE

WHO identifies the causative agent as Bundibugyo virus, for which no licensed vaccine or treatment exists (unlike Zaire ebolavirus); Ebola spreads via blood, secretions and other bodily fluids; and WHO formally declared a PHEIC on 17 May 2026.

GS PAPER III · PUBLIC HEALTH · ONE HEALTH

India's First AMR Centre of Excellence

Human Health → Animal Health → Environment → = One Health Approach

NEWS IN BRIEF

- Sher-e-Kashmir University of Agricultural Sciences and Technology–Kashmir (SKUAST-K) has been selected to host India's first DST-funded Centre of Excellence (CoE) on Antimicrobial Resistance (AMR) research under the One Health framework.
- This builds on India's National Action Plan on AMR, Phase 2.0 (2025–29), which places a One Health approach — spanning human health, veterinary practice, aquaculture and environmental surveillance — at its core.
- The India AMR Innovation Hub (IAIH) continues mobilising resources for rapid diagnostics, new antimicrobials and vaccines.
- AMR is described as a 'silent pandemic', with India carrying a disproportionately high burden due to antibiotic overuse and misuse across human healthcare, animal husbandry and agriculture.

CONCEPT SIMPLIFIED

AMR occurs when microbes — bacteria, viruses, fungi or parasites — evolve to survive the drugs designed to kill them, driven largely by overuse and misuse of antimicrobials, which creates selection pressure favouring resistant strains. The 'One Health' approach recognises that human, animal and environmental health are interconnected, so containing AMR needs coordinated action across all three.

NAP-AMR 2.0	7	2025–29
Plan	Ministries	Period

STATIC CONNECT

Static connect — Public Health Governance: link to India's National Action Plan framework (NAP-AMR, National Health Policy) and the One Health approach also used for zoonotic disease control.

UNIQUE FACT

SKUAST-Kashmir, an agricultural university, is hosting India's first AMR Centre of Excellence — underlining that AMR is being tackled as an animal and agricultural issue as much as a medical one.

REAL-LIFE APPLICATION

- Hospitals run antimicrobial stewardship programmes that restrict inappropriate antibiotic prescriptions to slow resistance.
- Rapid diagnostic tests let doctors prescribe targeted antibiotics instead of broad-spectrum ones, reducing selection pressure.
- One Health surveillance tracks resistant bacteria across farms, water bodies and hospitals to contain spread before it reaches humans.

PRELIMS MEMORY BANK

- CoE host: SKUAST-Kashmir (DST-funded)
- Plan: NAP-AMR Phase 2.0 (2025–29)
- Approach: One Health (human + animal + environment)
- Backed by: 7 ministries (multi-ministerial)
- Also tracked by: India AMR Innovation Hub (IAIH)

PRACTICE MCQ · UPSC PRELIMS STYLE

India's First AMR Centre of Excellence

With reference to Antimicrobial Resistance (AMR) in India, consider the following statements:

1. India's National Action Plan on AMR is implemented solely by the Ministry of Health and Family Welfare.
2. The 'One Health' approach links human, animal and environmental health in tackling AMR.
3. AMR arises when microbes evolve to survive drugs designed to eliminate them.

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

✓ **Correct Answer: (b) 2 and 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

A plan tackling a cross-sectoral problem spanning human, animal and agricultural antibiotic use would logically require several ministries acting together, not one alone — eliminate any 'solely Health Ministry' claim on that basis.

② THROUGH FACTUAL KNOWLEDGE

NAP-AMR is explicitly a multi-ministerial plan backed by seven ministries; its Phase 2.0 foregrounds the One Health approach; and AMR's standard definition matches the evolutionary-resistance mechanism described in statement 3.

GS PAPER III · BIOTECHNOLOGY · HEALTH TECH

Awiqli — First Once-Weekly Basal Insulin

7 shots/week
Daily Insulin

1 shot/week
Awiqli

NEWS IN BRIEF

- The US FDA approved Novo Nordisk's Awiqli (insulin icodec-abae, 700 units/mL) on 27 March 2026 as the first and only once-weekly, long-acting basal insulin for adults with type 2 diabetes.
- It replaces daily basal insulin injections with a single weekly shot — cutting injections from seven to one per week — delivered via a prefilled FlexTouch pen.
- Approval rests on the ONWARDS Phase 3a trial programme; Awiqli is now approved in the US, EU and 13-plus other countries, with a full US launch planned for the second half of 2026.
- Novo Nordisk frames the approval as reaffirming its commitment to insulin innovation even as parts of the industry shift focus toward GLP-1 drugs.

CONCEPT SIMPLIFIED

Basal insulin provides a steady background level of insulin between meals. Insulin icodec is chemically modified with a fatty-acid side chain that binds strongly to albumin in the blood, so it is released slowly over days instead of hours — allowing once-weekly dosing instead of daily injections while still keeping blood sugar stable.

FDA Approval: Mar 2026 → ONWARDS Phase 3a Trials → Weekly Dosing Confirmed

STATIC CONNECT

Static connect — Human Endocrine System: revise insulin's role in blood glucose regulation from NCERT Biology, and the distinction between Type 1 (insulin-dependent) and Type 2 diabetes.

UNIQUE FACT

Awiqli cuts basal insulin dosing from 7 injections a week to just 1 — the first time a once-weekly basal insulin has ever been approved for type 2 diabetes.

REAL-LIFE APPLICATION

- Cuts a type-2 diabetic patient's injection burden from 7 a week to 1, improving treatment adherence, especially among elderly or needle-averse patients.
- Useful in resource-limited settings where daily clinical supervision of injections is hard to arrange.
- Reduces the day-to-day management load of a chronic condition, which can improve quality of life over a lifetime of treatment.

PRELIMS MEMORY BANK

- Drug: insulin icodec-abae (Awiqli), Novo Nordisk
- FDA approval: 27 March 2026
- Indication: adults with Type 2 diabetes (basal insulin)
- Dosing: once weekly (down from once daily)
- Mechanism: strong albumin-binding slows release

PRACTICE MCQ · UPSC PRELIMS STYLE

Awiqli — First Once-Weekly Basal Insulin

With reference to Awiqli, the once-weekly insulin approved in 2026, consider the following statements:

1. It is approved for use in adults with Type 1 diabetes.
2. It reduces basal insulin dosing frequency from daily to weekly.
3. Its prolonged action is achieved through strong binding to blood albumin.

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

✓ **Correct Answer: (b) 2 and 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

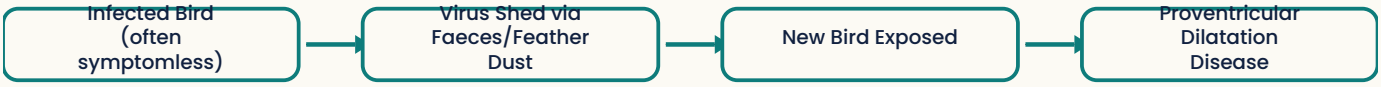
A headline reading 'weekly basal insulin for Type 2 diabetes' signals an indication-specific approval — assuming without evidence that it also extends to Type 1 is an overreach, so eliminate that statement.

② THROUGH FACTUAL KNOWLEDGE

FDA approval explicitly covers adults with type 2 diabetes as an adjunct to diet and exercise; it converts basal dosing from seven injections a week to one; and insulin icodec's design relies on strong, reversible albumin-binding to slow its release — standard chemistry for long-acting insulins.

GS PAPER III · BIOTECHNOLOGY · VETERINARY SCIENCE

Parrot Bornavirus-4 Identified in India



NEWS IN BRIEF

- Indian scientists have, for the first time, identified and genetically characterised Parrot Bornavirus-4 (PaBV-4) in the country — an RNA virus infecting psittacine (parrot-family) birds such as macaws, cockatoos and parakeets.
- PaBV-4 causes Proventricular Dilatation Disease (PDD), which often leads to rapid death in captive birds; infected birds can be asymptomatic carriers, silently shedding and spreading the virus.
- There is currently no specific antiviral treatment or licensed vaccine for PaBV-4; management relies on supportive care, inflammation control, nutrition, biosecurity, quarantine of new birds and routine health screening.
- PaBV belongs to the genus Orthobornavirus; related bornaviruses (such as BoDV-1) are known zoonotic pathogens causing fatal encephalitis in humans, though PaBV-4 itself is not established as zoonotic.

CONCEPT SIMPLIFIED

A bornavirus is a type of RNA virus that can persist for long periods, often in a host's nervous system, sometimes without visible symptoms, before eventually causing neurological or gastrointestinal disease — distinct from viruses that cause rapid, acute illness.

Orthobornavirus	PDD	None yet
Genus	Disease	Vaccine

STATIC CONNECT

Static connect — Zoonotic & Veterinary Disease Surveillance: link to India's One Health genomic surveillance push, also relevant to Nipah virus and avian influenza monitoring.

UNIQUE FACT

PaBV-4 can persist silently in a bird's system for a long time — infected birds may show no symptoms at all while continuously shedding and spreading the virus to others.

REAL-LIFE APPLICATION

- Informs biosecurity protocols for pet-bird breeders, aviaries and zoos to prevent Proventricular Dilatation Disease outbreaks.
- Genetic characterisation helps veterinary diagnostics develop targeted PCR tests for early detection in captive bird populations.
- Adds to India's genomic surveillance capacity for emerging pathogens, useful well beyond this one virus.

PRELIMS MEMORY BANK

- Virus: Parrot Bornavirus-4 (PaBV-4), genus Orthobornavirus
- Hosts: psittacine birds — macaws, cockatoos, parakeets
- Disease caused: Proventricular Dilatation Disease (PDD)
- No licensed vaccine or antiviral treatment
- First genetically characterised in India in 2026

PRACTICE MCQ · UPSC PRELIMS STYLE

Parrot Bornavirus-4 Identified in India

With reference to Parrot Bornavirus-4 (PaBV-4), recently in the news, consider the following statements:

1. It primarily infects poultry birds such as chickens and ducks.
2. Infected birds can act as asymptomatic carriers, spreading the virus without showing symptoms.
3. A licensed vaccine is currently available against it.

Which of the statements given above is/are correct?

(a) 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

✓ **Correct Answer: (a) 2 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

The virus's own name — 'Parrot' bornavirus — is the giveaway against any poultry-infection claim, so statement 1 can be eliminated outright. Every report on it stresses 'no specific antiviral or vaccine', so a statement claiming a licensed vaccine exists directly contradicts the core reported fact.

② THROUGH FACTUAL KNOWLEDGE

PaBV-4 specifically infects psittacine, parrot-family birds, not poultry; it has no antiviral treatment or licensed vaccine; and its defining epidemiological feature is asymptomatic carrier birds that silently shed the virus.



SECTION

ICT & Emerging Tech

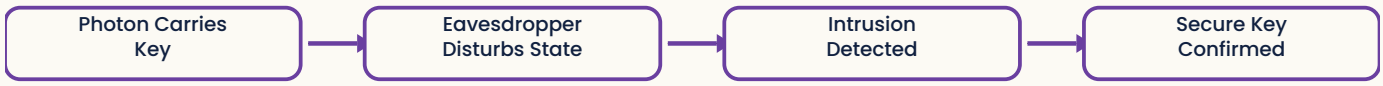
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11 VAR Controversy at the 2026 FIFA World Cup

12 China's Helium Export Ban Rattles Chipmaking

GS PAPER III · EMERGING TECH · QUANTUM

National Quantum Mission — 1,000 km Milestone



NEWS IN BRIEF

- Under the National Quantum Mission (NQM, approved April 2023, ₹6,003.65 crore outlay through 2030-31), India demonstrated a 1,000 km quantum communication network — one of the longest in the world — using indigenous technology from startup QNu Labs, less than two years after the mission's October 2024 launch.
- This builds on a 500 km defence-grade network shown in November 2025; the mission's ultimate target is a 2,000 km pan-India quantum communication backbone within eight years.
- As of June 2026, the government stated NQM has already achieved more than half of its targeted outcomes within three years of launch.
- NQM runs through four Thematic Hubs — Quantum Computing, Communication, Sensing & Metrology, and Materials & Devices — and aims to build quantum computers with 50–1,000 physical qubits within eight years.

CONCEPT SIMPLIFIED

Quantum communication relies on Quantum Key Distribution (QKD) — encoding an encryption key onto single photons whose quantum state is disturbed the moment anyone tries to observe or intercept them, so eavesdropping becomes detectable. This differs from classical encryption, which can, in principle, be broken given enough computing power.

₹6,003 cr	1,000 km	2,000 km
Outlay	Link Achieved	8-yr Target

STATIC CONNECT

Static connect — Cyber Security & Emerging Tech: link with other National Missions under DST (Deep Ocean Mission, National Green Hydrogen Mission) and the broader Digital India cybersecurity framework.

UNIQUE FACT

India's 1,000 km quantum communication link was achieved in under two years of the mission's launch — halfway to its full 2,000 km target, years ahead of the 8-year deadline.

REAL-LIFE APPLICATION

- Secures defence communication networks, banking transaction backbones and critical infrastructure against future quantum-computer-based hacking.
- Could eventually secure everyday digital payment systems like UPI once integrated into telecom infrastructure.
- Creates tamper-evident data links that alert operators the instant eavesdropping is attempted, rather than only after a breach is discovered.

PRELIMS MEMORY BANK

- Approved: April 2023; Operational: October 2024
- Outlay: ₹6,003.65 crore (2023-24 to 2030-31)
- Nodal department: DST
- 4 Thematic Hubs: Computing, Communication, Sensing, Materials
- 8-year target: 2,000 km QKD network; 50–1000 qubit computers

PRACTICE MCQ · UPSC PRELIMS STYLE

National Quantum Mission — 1,000 km Milestone

With reference to India's National Quantum Mission (NQM), consider the following statements:

1. It is administered by the Department of Space.
2. It aims to establish a pan-India quantum communication network spanning 2,000 km.
3. Its Quantum Key Distribution technology relies on the principle that observing a quantum system disturbs its state.

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

✓ **Correct Answer: (b) 2 and 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

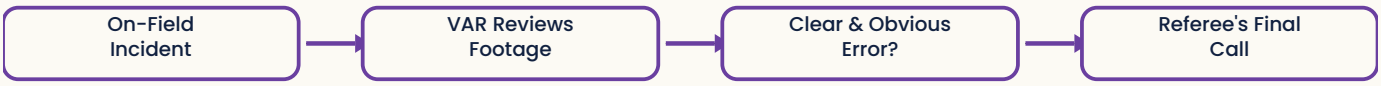
NQM sits alongside missions like the National Green Hydrogen Mission and Deep Ocean Mission under the science ministry's portfolio; the Department of Space instead runs India's satellite and launch-vehicle programme — a different administrative track, so statement 1 can be eliminated.

② THROUGH FACTUAL KNOWLEDGE

DST's official mission page confirms NQM is a DST-run mission approved by the Union Cabinet; its eight-year target is a 2,000 km QKD network; and QKD security fundamentally rests on the fact that any measurement of a quantum system disturbs it, revealing eavesdropping.

GS PAPER II/III · SPORTS GOVERNANCE · TECHNOLOGY

VAR Controversy at the 2026 FIFA World Cup



NEWS IN BRIEF

- VAR became a flashpoint at the 2026 FIFA World Cup (co-hosted by the USA, Canada and Mexico) after Egypt's goal against Argentina was disallowed on VAR review for an earlier foul, reigniting debate over VAR's consistency and fairness.
- Following the controversy, FIFA decided to appoint two in-house VAR officials for every match from the quarter-final stage onward, to tighten review consistency.
- FIFA's Video Assistant Referee system, first written into the Laws of the Game in 2018-19, allows review of a defined set of situations: goals, penalty decisions, direct red cards and cases of mistaken identity.
- India remains without full VAR in domestic football; the All India Football Federation (AIFF) has instead approached IFAB to trial the lighter 'Additional Video Review System' (AVRS), a cheaper VAR alternative.

CONCEPT SIMPLIFIED

VAR is a video-review layer where off-field officials, watching broadcast footage from a Video Operation Room, can flag a 'clear and obvious error' to the on-field referee, who then reviews the incident personally on a pitch-side monitor before making the final call — the on-field referee, not VAR, always makes the final decision.

2018-19	2 VAR/match	AVRS trial
Introduced	2026 WC Fix	India

STATIC CONNECT

Static connect — Sports Governance & Technology: link to other sports-officiating technologies (cricket's DRS, tennis's Hawk-Eye) as examples of technology assisting human judgment.

UNIQUE FACT

FIFA's decision to appoint two in-house VAR officials per match from the quarter-finals onward at the 2026 World Cup was a direct response to the Egypt–Argentina controversy.

REAL-LIFE APPLICATION

- Reduces referee error in high-stakes matches, protecting fair outcomes and cutting down player and fan disputes.
- Has inspired similar video-review adoption in other sports, such as cricket's Decision Review System and tennis's Hawk-Eye.
- AIFF's interest in the lighter AVRS system is a real-world example of appropriate, frugal technology adoption for resource-constrained sporting infrastructure.

PRELIMS MEMORY BANK

- Introduced in Laws of the Game: 2018-19
- Reviews: goals, penalties, red cards, mistaken identity
- Principle: intervenes only for 'clear and obvious' errors
- Final decision: always the on-field referee's
- India: no full VAR yet; AIFF exploring lighter AVRS

PRACTICE MCQ · UPSC PRELIMS STYLE

VAR Controversy at the 2026 FIFA World Cup

Consider the following statements regarding the Video Assistant Referee (VAR) system in football:

1. The on-field referee is bound to accept the VAR's recommendation without independent review.
2. VAR was first incorporated into the Laws of the Game in 2018-19.
3. India's domestic football leagues currently use full VAR technology.

Which of the statements given above is/are correct?

(a) 2 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

✓ **Correct Answer: (a) 2 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

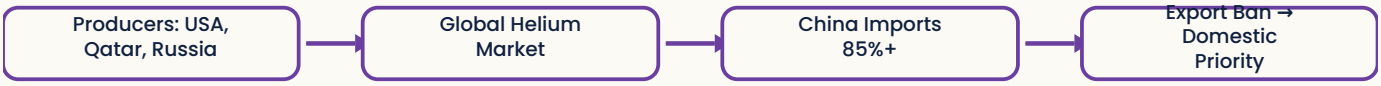
IFAB's protocol explicitly preserves referee authority — a review system meant only to flag 'clear and obvious' errors would be undermined if the referee had no independent check, so a claim of automatic binding can be eliminated. Since AIFF is still only exploring the lighter AVRS system, a claim that India's leagues already run full VAR contradicts that gradual-adoption narrative.

② THROUGH FACTUAL KNOWLEDGE

VAR entered the Laws of the Game in 2018-19; IFAB protocol requires the referee to personally view the replay before changing a decision; and India's ISL and I-League have not implemented full VAR, with AIFF instead pursuing an AVRS trial.

GS PAPER III · CRITICAL MINERALS · SEMICONDUCTORS

China's Helium Export Ban Rattles Chipmaking



NEWS IN BRIEF

- China's Ministry of Commerce and General Administration of Customs imposed an immediate, open-ended 'temporary' export ban on helium on 10 July 2026, citing supply risks from renewed conflict in West Asia affecting Qatar's helium-linked output.
- Helium is essential in semiconductor manufacturing — wafer cooling, plasma etching, chemical vapour deposition and leak detection — as well as MRI machines and quantum-computing devices.
- China itself produces only about 1.6% of global helium supply, yet imports over 85% of what it needs, making the ban a defensive, domestic-allocation move rather than a supply-leverage tool like its earlier rare-earth curbs.
- It follows a pattern of China placing critical materials — rare earths, gallium, germanium, graphite, and now helium — under export control, amid an already-tight global market.

CONCEPT SIMPLIFIED

Helium is used as a cryogenic coolant because it stays liquid or gaseous at extremely low temperatures without reacting chemically — it is an inert noble gas — making it critical for keeping sensitive equipment such as semiconductor tools and MRI superconducting magnets at stable, ultra-low operating temperatures.

~1.6%	85%+	USA
China Produces	China Imports	Top Producer

STATIC CONNECT

Static connect — Critical Minerals & Strategic Resources: link to India's Critical Mineral Mission and the broader pattern of critical-resource export controls (rare earths, gallium, germanium).

UNIQUE FACT

China itself produces barely 1.6% of the world's helium yet imports over 85% of what it needs — making its export ban a defensive move to protect its own chip industry, not a supply-leverage tool.

REAL-LIFE APPLICATION

- Helium shortages or price spikes directly affect MRI machine availability in hospitals, since liquid helium cools their superconducting magnets.
- Drives semiconductor fabs and countries to diversify sourcing and invest in helium-recycling systems to reduce dependence on any single supplier.
- Affects everyday uses too, from party-balloon suppliers to scientific research relying on cryogenic cooling.

PRELIMS MEMORY BANK

- Ban date: 10 July 2026, effective immediately
- Reason cited: West Asia conflict disrupting Qatari supply
- Largest producer: USA (~81 million m³/year)
- China's global share: ~1.6% (produces), 85%+ (imports)
- Uses: semiconductor cooling, MRI magnets, quantum devices

PRACTICE MCQ · UPSC PRELIMS STYLE

China's Helium Export Ban Rattles Chipmaking

With reference to the global helium market and China's July 2026 export ban, consider the following statements:

1. China is the world's largest producer of helium.
2. Helium is primarily used as a coolant in semiconductor manufacturing due to its inert and cryogenic properties.
3. The United States is currently the world's largest producer of helium.

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

✓ **Correct Answer: (b) 2 and 3 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

A country that must import over 85% of a resource to meet its own demand cannot, by definition, be that resource's dominant global producer — this import-dependence detail directly rules out a 'China is largest producer' claim.

② THROUGH FACTUAL KNOWLEDGE

USGS data (as of March 2026) confirms the USA as the largest helium producer at roughly 81 million cubic metres a year, with China ranking around sixth at about 1.6% of global supply; helium's inertness and cryogenic properties make it standard for cooling semiconductor tools.



SECTION

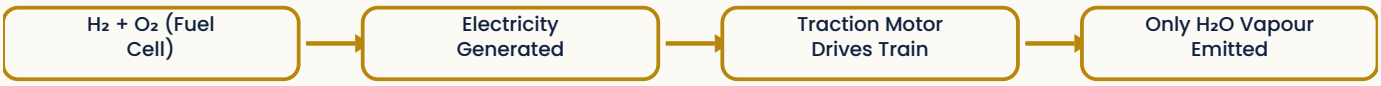
Energy & Environment

13 India's Swadeshi Hydrogen Train

14 E20 Ethanol-Blended Fuel — Mileage Clarification

GS PAPER III · GREEN TRANSPORT · SCIENCE & TECH

India's Swadeshi Hydrogen Train



NEWS IN BRIEF

- Indian Railways' first indigenous hydrogen fuel-cell train was flagged off by PM Modi from Jind, Haryana on 17 July 2026, running the Jind–Sonipat stretch of Northern Railway (about 90 km).
- Built by ICF as a pilot project under the National Green Hydrogen Mission; part of a wider "Hydrogen for Heritage" plan for future heritage and hill routes.
- Powered by a 1,200 kW hydrogen fuel-cell propulsion system paired with lithium-ferro-phosphate batteries; approved for 75 km/h service (110 km/h design speed) in a 10-coach, ~2,600-passenger configuration.
- A dedicated hydrogen storage and refuelling facility has been set up at Jind; the only by-product is water vapour, giving zero tailpipe emissions.

CONCEPT SIMPLIFIED

A hydrogen fuel cell works almost like electrolysis in reverse: hydrogen gas combines with oxygen from the air across a membrane (a Proton Exchange Membrane Fuel Cell, or PEMFC) to generate electricity directly, releasing only water vapour. This electricity drives the train's traction motors — unlike a diesel engine (which burns fuel) or an electric train (which draws power from overhead wires).

1,200 kW	75 km/h	~90 km
Power	Speed	Route

STATIC CONNECT

NCERT Class XI Chemistry — Electrochemistry/Fuel Cells: revise how a hydrogen-oxygen fuel cell converts chemical energy directly into electrical energy, and compare it with the reverse process, electrolysis.

UNIQUE FACT

This is touted as the most powerful hydrogen fuel-cell train in the world at 1,200 kW — surpassing existing hydrogen train fleets in Germany, Japan and China in propulsion power.

⚠ **EXAM TRAP —** Don't confuse a hydrogen fuel-cell train (generates its own electricity onboard, no overhead wires needed) with a conventional electric train running on overhead traction — a frequent prelims distractor on delivery mechanism.

REAL-LIFE APPLICATION

- Enables zero-emission rail travel on non-electrified regional and heritage routes, cutting diesel consumption.
- The same PEMFC technology already powers hydrogen buses, trucks and forklifts for cleaner logistics elsewhere.
- Well suited to remote or hilly routes where laying overhead electric wires is costly or terrain makes it impractical.

📌 PRELIMS MEMORY BANK

- Route: Jind–Sonipat, Northern Railway (~90 km), Haryana
- Power: 1,200 kW PEMFC + lithium-ferro-phosphate battery
- Speed: 75 km/h service (110 km/h design)
- Mission link: National Green Hydrogen Mission
- By-product: only water vapour

PRACTICE MCQ · UPSC PRELIMS STYLE

India's Swadeshi Hydrogen Train

Consider the following statements regarding India's first hydrogen fuel-cell train:

1. It generates electricity onboard through a chemical reaction between hydrogen and oxygen, releasing water vapour as the only by-product.
2. It draws its traction power from overhead electric lines, similar to conventional EMU trains.
3. It has been introduced as part of the National Green Hydrogen Mission.

How many of the statements given above are correct?

(a) Only one

(b) Only two

(c) All three

(d) None

✓ **Correct Answer: (b) Only two**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Statement 2 contradicts the very premise of a 'fuel-cell' train — fuel cells generate power onboard through a chemical reaction; needing overhead wires as well would defeat that purpose, so it can be eliminated on logic alone. Statements 1 and 3 are consistent with what is known about fuel-cell operation and the mission driving the project.

② THROUGH FACTUAL KNOWLEDGE

Indian Railways' own release confirms the train's PEMFC system produces electricity via a hydrogen–oxygen reaction with water vapour as the only by-product, draws no power from overhead lines, and has been rolled out explicitly under the National Green Hydrogen Mission.

GS PAPER III · ENERGY · BIOFUELS

E20 Ethanol-Blended Fuel — Mileage Clarification



NEWS IN BRIEF

- India achieved its 20% ethanol-blending (E20) target in petrol nationwide by 2025, five years ahead of the original 2030 deadline (advanced by a Cabinet decision in May 2022).
- Ethanol supply has grown from 38 crore litres (2013-14) to over 661 crore litres (by June 2025); the government credits blending with forex savings exceeding ₹1.44 lakh crore and higher farmer incomes over the past decade.
- In a July 2026 clarification, the government acknowledged E20 fuel 'may reduce' mileage by roughly 3–5%, but maintained that scientific studies show no evidence it damages vehicle engines; older E5/E10 blends have now been phased out from nearly all pumps.
- The rollout has triggered public debate over mileage loss and vehicle compatibility, especially in older vehicles, even as officials continue to call E20 safe to use.

CONCEPT SIMPLIFIED

Ethanol, a biofuel derived from sugarcane or grain, is blended with petrol to cut crude-oil imports and vehicular emissions. Because ethanol carries less energy per litre than petrol, higher-percentage blends like E20 tend to deliver marginally lower mileage even though they burn cleaner and reduce net carbon emissions.



STATIC CONNECT

Static connect — Biofuels Policy: revise the National Policy on Biofuels (2018) classification of 1G/2G/3G biofuels and India's ethanol-blending roadmap from E10 to E20.

UNIQUE FACT

India achieved the 20% ethanol-blending target five full years ahead of its original 2030 deadline — one of the fastest biofuel transitions among major economies.

⚠ **EXAM TRAP —** Don't equate the government's admitted mileage dip with engine damage — official statements explicitly deny the latter while conceding the former; conflating the two is a common careful-reading trap.

REAL-LIFE APPLICATION

- Reduces India's crude oil import bill and the resulting foreign-exchange outflow.
- Provides an additional income stream for sugarcane and grain farmers who supply ethanol.
- Cuts vehicular carbon emissions compared with pure petrol, supporting India's climate commitments.

📌 PRELIMS MEMORY BANK

- Blend: 20% ethanol + 80% petrol
- Target achieved: 2025 (advanced from 2030)
- Mileage impact: ~3–5% reduction (government-acknowledged)
- No evidence of engine damage per official studies
- Ethanol supply: 38 crore litres (2013-14) → 661+ crore litres (2025)

PRACTICE MCQ · UPSC PRELIMS STYLE

E20 Ethanol-Blended Fuel — Mileage Clarification

Consider the following statements regarding India's E20 ethanol-blending programme:

1. It mandates a blend of 20% ethanol with 80% petrol.
2. India achieved the E20 target five years ahead of the original 2030 deadline.
3. Government studies have found that ethanol-blended petrol causes engine damage in vehicles.

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

✓ **Correct Answer: (a) 1 and 2 only**

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Official messaging deliberately separates 'reduced mileage' (conceded) from 'engine damage' (explicitly denied) — a statement collapsing the two into a single 'damage' claim is testing exactly this distinction.

② THROUGH FACTUAL KNOWLEDGE

E20 is officially defined as a 20% ethanol / 80% petrol blend; the target was advanced from 2030 to 2025; and government and scientific studies cited in July 2026 found no evidence of engine damage, only a mileage dip.