MISSION X PRESENTS

X TECH

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SECTION

Space Technology

01 TRISHNA — India-France Thermal Imaging Mission

GS PAPER III · SPACE TECHNOLOGY · EARTH OBSERVATION

TRISHNA — India-France Thermal Imaging Mission

NEWS IN BRIEF

- Joint ISRO-CNES Earth observation satellite; launch planned 2026-27 on a PSLV from Sriharikota.
- Delivers high-resolution thermal infrared imagery of land and coastal regions.
- Tracks crop water stress, irrigation needs, urban heat and glacier changes.
- Sun-synchronous orbit at ~761 km altitude; designed for a 5-year mission life.

KEY CONCEPTS EXPLAINED

Thermal Infrared (TIR) Imaging: Captures a surface's emitted heat rather than reflected light, revealing its actual temperature.

VSWIR Payload: ISRO's Visible/Near-Infrared and Short-Wave Infrared sensor, used to assess vegetation health and land cover.

Sun-Synchronous Orbit: A polar orbit timed so the satellite passes over each location at the same local solar time every visit.

⚡ UNIQUE FACT

TRISHNA's thermal infrared camera can measure something ordinary optical satellites cannot — the actual surface temperature of crops, soil and water bodies — making it possible to detect crop water stress before it becomes visible to the naked eye.

⚠ EXAM TRAP

Don't confuse TRISHNA's TIR (Thermal InfraRed) payload, contributed by France's CNES, with its VSWIR (Visible-Near Infrared/Short-Wave Infrared) payload, contributed by ISRO — the two nations lead different instruments on the same satellite.

📌 PRELIMS MEMORY BANK

- Full form: Thermal infraRed Imaging Satellite for High-resolution Natural resource Assessment
- Partners: ISRO (India) + CNES (France)
- Orbit: Sun-synchronous polar, ~761 km altitude, 8-day repeat cycle
- Payloads: TIR (CNES) + VSWIR (ISRO)
- Predecessors in India-France cooperation: Megha-Tropiques, SARAL

PRACTICE MCQ · UPSC PRELIMS STYLE

TRISHNA — India-France Thermal Imaging Mission

With reference to the TRISHNA mission, consider the following statements:

1. It is a joint Earth observation mission between ISRO and France's CNES.
2. Its Thermal InfraRed payload is contributed by ISRO, while France contributes the optical payload.
3. It is designed to monitor crop water stress, urban heat and glacier changes.

Which of the statements given above is/are correct?

(a) 1 and 3 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

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

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

TRISHNA's payload division is consistently described with France's CNES leading the Thermal InfraRed instrument while ISRO leads the Visible-Near Infrared/Short-Wave Infrared payload — a statement reversing this assignment swaps the two countries' actual contributions.

② THROUGH FACTUAL KNOWLEDGE

TRISHNA is a joint ISRO-CNES mission; CNES contributes the Thermal InfraRed payload while ISRO contributes the VSWIR payload; and its applications include monitoring crop water stress, urban heat and glacier changes.



SECTION

Defence Technology

02 India Weighs Russian RVV-BD Missile for Su-30MKI

03 INS Mysore Takes Part in Exercise Samudra Laksamana

04 Russia Unveils S-71K 'Kovyor' Cruise Missile

GS PAPER III · DEFENCE TECHNOLOGY · AIR-TO-AIR MISSILES

India Weighs Russian RVV-BD Missile for Su-30MKI

NEWS IN BRIEF

- India evaluating integration of Russia's RVV-BD missile onto Su-30MKI jets.
- Part of a ₹1.10 lakh crore defence acquisition cleared in September 2026.
- Export version of the R-37M; range up to ~300 km, speed above Mach 6.
- Designed to threaten high-value aircraft like AEW&C and command planes.

KEY CONCEPTS EXPLAINED

Beyond Visual Range (BVR) Missile: An air-to-air missile that can engage enemy aircraft before a pilot can see them with the naked eye.

AEW&C: Airborne Early Warning and Control aircraft, which use onboard radar to detect threats and coordinate friendly forces.

Weapon Integration: Adapting an aircraft's radar, avionics and software so it can carry and fire a new missile type.

⚡ UNIQUE FACT

RVV-BD's real strategic value isn't measured only by how many enemy aircraft it might shoot down — by simply existing in the IAF's arsenal, it forces adversary AWACS and command aircraft to stay farther back, degrading their surveillance reach without a single missile being fired.

⚠ EXAM TRAP

Don't confuse RVV-BD (an air-to-air missile) with a surface-to-air missile — despite its very long range, it is launched from a fighter aircraft (like the Su-30MKI) to target other aircraft, not from the ground.

📌 PRELIMS MEMORY BANK

- Full form: Raketa Vozduh-Vozduh Bolshoy Dalnosti ('long-range air-to-air missile')
- Export version of: Russia's R-37M missile
- Range: up to 200-300 km; Speed: Mach 6+
- Integration platform: Su-30MKI (part of ₹1.10 lakh crore deal, Sept 2026)
- Primary targets: AEW&C and airborne command aircraft

PRACTICE MCQ · UPSC PRELIMS STYLE

India Weighs Russian RVV-BD Missile for Su-30MKI

Consider the following statements regarding the RVV-BD missile:

1. It is a surface-to-air missile designed to intercept aircraft from ground-based launchers.
2. It is the export version of Russia's R-37M air-to-air missile.
3. It is primarily designed to threaten high-value aircraft such as AEW&C planes.

Which of the statements given above is/are correct?

(a) 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

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

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

RVV-BD is consistently described as being integrated onto fighter aircraft like the Su-30MKI for air-to-air engagements — a statement describing it as a ground-launched surface-to-air missile misclassifies its fundamental launch platform and target type.

② THROUGH FACTUAL KNOWLEDGE

RVV-BD is confirmed as the export version of Russia's R-37M air-to-air missile; and it is specifically designed to threaten high-value, less-agile aircraft such as AEW&C and airborne command platforms.

GS PAPER III · DEFENCE TECHNOLOGY · NAVAL DIPLOMACY

INS Mysore Takes Part in Exercise Samudra Laksamana

NEWS IN BRIEF

- INS Mysore joined Exercise Samudra Laksamana at Lumut Naval Base, Malaysia.
- Delhi-class guided-missile destroyer, commissioned 1999, built at Mazagon Dock.
- Upgraded with INDRA-LANZA radar and BrahMos missile capability.
- Past operations include Somalia anti-piracy duty and Libya/Iraq evacuations.

KEY CONCEPTS EXPLAINED

Delhi-Class Destroyer: India's first indigenously designed guided-missile destroyers, predecessors to the newer Kolkata-class.

Guided-Missile Destroyer: A warship built to escort larger vessels and engage air, surface and underwater threats using missiles.

Bilateral Naval Exercise: A joint drill between two countries' navies to build interoperability and coordination at sea.

⚡ UNIQUE FACT

INS Mysore's crest features the mythical double-headed eagle Gandaberunda, drawn from the sigil of the erstwhile royal House of Wodeyar of Mysuru — linking a modern guided-missile destroyer to a centuries-old royal emblem.

⚠ EXAM TRAP

Don't confuse the current INS Mysore (D60), a Delhi-class guided-missile destroyer commissioned in 1999, with the earlier INS Mysore (C60), a cruiser that served from 1957 to 1985 — the current ship is actually the second Indian Navy vessel to carry this name.

📌 PRELIMS MEMORY BANK

- Class: Delhi-class guided-missile destroyer (2nd of 3 ships)
- Commissioned: 2 June 1999; Builder: Mazagon Dock Limited, Mumbai
- Displacement: ~6,835 tonnes
- Recent activity: Exercise Samudra Laksamana, Lumut Naval Base, Malaysia
- Upgrades: INDRA-LANZA radar, BrahMos missile integration

PRACTICE MCQ · UPSC PRELIMS STYLE

INS Mysore Takes Part in Exercise Samudra Laksamana

With reference to INS Mysore, consider the following statements:

1. It is the first Indian Navy ship to carry the name 'Mysore'.
2. It belongs to the Delhi-class of guided-missile destroyers.
3. It has been upgraded to carry BrahMos missiles.

Which of the statements given above is/are correct?

(a) 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

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

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

An earlier cruiser named INS Mysore served the Indian Navy from 1957 to 1985, well before the current Delhi-class destroyer was commissioned in 1999 — a statement claiming the current ship is the 'first' to bear this name overlooks this documented predecessor.

② THROUGH FACTUAL KNOWLEDGE

The current INS Mysore is the second Indian Navy ship to carry the name, after an earlier cruiser (1957-1985); it belongs to the Delhi-class of guided-missile destroyers; and it has been upgraded with BrahMos missile capability.

GS PAPER III · DEFENCE TECHNOLOGY · MISSILE SYSTEMS (INTERNATIONAL)

Russia Unveils S-71K 'Kovyor' Cruise Missile

NEWS IN BRIEF

- Russia unveiled the S-71K 'Kovyor' cruise missile at Egypt's El Alamein Airshow.
- Built by United Aircraft Corporation for the Su-57 fighter family.
- Range ~300-350 km; carries a 250 kg warhead; inertial navigation only.
- Reportedly in combat use since late 2025; contains foreign-sourced parts.

KEY CONCEPTS EXPLAINED

Air-Launched Cruise Missile: A missile fired from an aircraft that flies within the atmosphere toward its target, unlike a ballistic missile.

Inertial Navigation: A guidance method using onboard motion sensors to track position, without needing GPS or a target-seeking sensor.

Stand-Off Weapon: A weapon launched far enough from a target that the launching aircraft avoids entering hostile air-defence range.

⚡ UNIQUE FACT

Despite being a stealthy, modern cruise missile developed for Russia's most advanced fighter jet, the Kovyor was found to rely on electronic components sourced from the US, China, Switzerland, Japan, Germany, Taiwan and Ireland — a reminder that even sanctioned defence industries often stay dependent on global supply chains.

⚠ EXAM TRAP

Don't assume the Kovyor has a sophisticated guidance system for tracking moving targets — it relies on inertial navigation without an advanced terminal seeker, making it more suited to striking fixed targets than mobile ones.

📌 PRELIMS MEMORY BANK

- Unveiled: El Alamein International Airshow, Egypt, 8-10 September 2026
- Developer: United Aircraft Corporation (UAC), Russia
- Platform: designed for the Su-57 fighter family
- Range: ~300-350 km; Warhead: 250 kg
- In combat use: since late 2025 (per Ukrainian intelligence)

PRACTICE MCQ · UPSC PRELIMS STYLE

Russia Unveils S-71K 'Kovyor' Cruise Missile

With reference to Russia's S-71K 'Kovyor' missile, consider the following statements:

1. It was publicly unveiled at an airshow in Egypt in September 2026.
2. It possesses an advanced terminal seeker optimised for tracking moving targets.
3. It is designed for integration with the Su-57 fighter family.

Which of the statements given above is/are correct?

(a) 1 and 3 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

✓ Correct Answer: (a) 1 and 3 only

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Reports consistently describe the Kovyor as relying on inertial navigation without a sophisticated terminal seeker, making it suited to fixed rather than moving targets — a statement claiming it has an advanced terminal seeker for moving targets contradicts this specific design limitation.

② THROUGH FACTUAL KNOWLEDGE

The Kovyor was unveiled at Egypt's El Alamein Airshow in September 2026; it lacks a sophisticated terminal seeker, relying on inertial navigation; and it is designed for the Su-57 fighter family.

IX

SECTION

Biotechnology & Health

05 Atherosclerosis — The Silent Driver of Heart Attacks

06 Narcolepsy — Lasker Award for Orexin Discovery

07 Foot-and-Mouth Disease — India's Endemic Livestock Challenge

GS PAPER III · BIOTECHNOLOGY · CARDIOVASCULAR HEALTH

Atherosclerosis — The Silent Driver of Heart Attacks

NEWS IN BRIEF

- Atherosclerosis remains a leading cause of heart attacks and strokes worldwide.
- Begins when LDL cholesterol damages an artery's inner lining.
- Plaque rupture can trigger a clot that suddenly blocks blood flow.
- Newer guidelines pair ApoB with LDL testing for sharper risk assessment.

KEY CONCEPTS EXPLAINED

LDL Cholesterol: The 'bad' cholesterol particle that can penetrate artery walls and start plaque formation.

ApoB: A protein marker that directly counts artery-clogging particles, offering a more precise risk measure than LDL alone.

Arterial Plaque: A fatty deposit that builds up inside an artery, narrowing it and risking sudden rupture.

⚡ UNIQUE FACT

Atherosclerosis can silently progress for decades without any symptoms at all — a plaque often only reveals itself the moment it ruptures and triggers a sudden heart attack or stroke, which is why it's sometimes called a 'silent' disease.

⚠ EXAM TRAP

Don't assume atherosclerosis only affects the heart — the same plaque-narrowing process can occur in any artery in the body, including those supplying the brain (causing stroke) and the limbs (causing peripheral artery disease).

📌 PRELIMS MEMORY BANK

- Definition: buildup of fatty plaques inside artery walls
- Trigger: LDL cholesterol penetrating the artery's inner lining
- Complication: plaque rupture leads to a blood clot, causing heart attack or stroke
- Newer risk marker: ApoB (counts atherogenic particles directly)
- Can affect: heart, brain and limb arteries

PRACTICE MCQ · UPSC PRELIMS STYLE

Atherosclerosis — The Silent Driver of Heart Attacks

With reference to atherosclerosis, consider the following statements:

1. It exclusively affects the coronary arteries supplying the heart.
2. It typically begins with LDL cholesterol penetrating the inner lining of an artery.
3. Rupture of an arterial plaque can trigger a blood clot leading to a heart attack or stroke.

Which of the statements given above is/are correct?

(a) 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

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

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Atherosclerosis's plaque-forming process can occur in any artery in the body, not just those supplying the heart — a statement restricting it exclusively to coronary arteries ignores its well-documented occurrence in brain- and limb-supplying arteries as well.

② THROUGH FACTUAL KNOWLEDGE

Atherosclerosis begins with LDL cholesterol penetrating the artery's inner lining; and plaque rupture can trigger a blood clot causing a heart attack or stroke, depending on which artery is affected.

GS PAPER III · BIOTECHNOLOGY · NEUROSCIENCE

Narcolepsy — Lasker Award for Orexin Discovery

NEWS IN BRIEF

- Emmanuel Mignot won the 2026 Lasker Award for orexin-narcolepsy research.
- Narcolepsy is caused by a deficiency of orexin (hypocretin) in the brain.
- FDA approved oveporexton (ORZEYFUL) in August 2026 for narcolepsy type 1.
- Affects roughly 1 in 2,000 people; often diagnosed 10-15 years late.

KEY CONCEPTS EXPLAINED

Orexin (Hypocretin): A brain neuropeptide that regulates wakefulness; its deficiency causes narcolepsy type 1.

Cataplexy: Sudden muscle weakness triggered by strong emotion, a hallmark symptom of narcolepsy.

Orexin Receptor Agonist: A drug that mimics orexin's action, restoring wakefulness signals the brain is missing.

⚡ UNIQUE FACT

Oveporexton is the first medicine ever developed to treat the actual underlying cause of narcolepsy type 1 (orexin deficiency) rather than just managing its symptoms with stimulants, as earlier treatments did for decades.

⚠ EXAM TRAP

Don't confuse narcolepsy's underlying cause (a deficiency of orexin/hypocretin, a brain neuropeptide) with a lack of sleep quantity — narcolepsy is a neurological disorder of wakefulness regulation, not simply a consequence of insufficient sleep.

📌 PRELIMS MEMORY BANK

- Key neuropeptide: orexin (also called hypocretin)
- 2026 Lasker Award winner: Emmanuel Mignot (Stanford Medicine)
- New drug: oveporexton (ORZEYFUL) — approved US (Aug 2026), China, Japan
- Prevalence: ~1 in 2,000 people
- Key symptoms: excessive daytime sleepiness, sleep attacks, cataplexy

PRACTICE MCQ · UPSC PRELIMS STYLE

Narcolepsy — Lasker Award for Orexin Discovery

With reference to narcolepsy, consider the following statements:

1. It is caused by excess production of the neuropeptide orexin in the brain.
2. Emmanuel Mignot was awarded the 2026 Lasker Award for research linking narcolepsy to orexin deficiency.
3. Oveporexton is a medicine designed to mimic the effects of orexin in the brain.

Which of the statements given above is/are correct?

(a) 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

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

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Narcolepsy's defining biological mechanism, established through decades of research, is a deficiency of orexin, not an excess — a statement claiming excess orexin production reverses the actual direction of this well-established finding.

② THROUGH FACTUAL KNOWLEDGE

Emmanuel Mignot received the 2026 Lasker Award for discovering narcolepsy's link to orexin deficiency; and oveporexton is designed to mimic orexin's effects in the brain for patients who lack it.

GS PAPER III · BIOTECHNOLOGY · VETERINARY SCIENCE

Foot-and-Mouth Disease — India's Endemic Livestock Challenge

NEWS IN BRIEF

- FMD remains endemic in India, peaking in September and lowest in June.
- Three serotypes circulate — O, A and Asia1; O causes ~80% of outbreaks.
- Affects cattle, buffalo and pigs; rarely fatal but cuts milk yield sharply.
- Immunity to one serotype does not protect an animal against the others.

KEY CONCEPTS EXPLAINED

Serotype: A distinct strain of a virus that the immune system recognises separately, requiring its own targeted immunity.

Cloven-Hoofed Animals: Livestock with a split hoof, such as cattle, buffalo and pigs, that are susceptible to FMD.

Cross-Protection: When immunity to one pathogen strain also protects against another; largely absent between FMD serotypes.

⚡ UNIQUE FACT

Despite causing painful blisters and productivity losses, Foot-and-Mouth Disease is rarely fatal in adult livestock — its true economic damage comes mainly from lost milk yield, reduced draught power and trade restrictions, not animal deaths.

⚠ EXAM TRAP

Don't confuse Foot-and-Mouth Disease (FMD), a viral disease affecting cloven-hoofed livestock like cattle and pigs, with Hand, Foot and Mouth Disease (HFMD), an entirely different viral illness that affects humans, mainly infants and children.

📌 PRELIMS MEMORY BANK

- Affected animals: cloven-hoofed livestock (cattle, buffalo, pigs)
- Serotypes in India: O, A, Asia1 (O causes ~80% of outbreaks)
- Peak season in India: September; lowest: June
- Key feature: immunity to one serotype doesn't protect against others
- Rarely fatal in adults; main damage is economic (milk loss, trade curbs)

PRACTICE MCQ · UPSC PRELIMS STYLE

Foot-and-Mouth Disease — India's Endemic Livestock Challenge

With reference to Foot-and-Mouth Disease (FMD), consider the following statements:

1. It affects only humans, particularly infants and young children.
2. Immunity against one serotype of the FMD virus protects an animal against all other serotypes.
3. Serotype O is responsible for the majority of confirmed FMD outbreaks in India.

Which of the statements given above is/are correct?

(a) 3 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

✓ Correct Answer: (a) 3 only

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

FMD is explicitly a disease of cloven-hoofed livestock, not humans — a statement claiming it affects only humans confuses it with the separately named, unrelated Hand, Foot and Mouth Disease. FMD's defining epidemiological challenge is that immunity to one serotype does NOT protect against others, so a statement claiming universal cross-protection reverses this key feature.

② THROUGH FACTUAL KNOWLEDGE

FMD affects cloven-hoofed animals like cattle and pigs, not humans; immunity to one serotype does not protect against other serotypes; and serotype O is responsible for roughly 80% of confirmed outbreaks in India.

SECTION

ICT & Emerging Tech

08 Claude AI Formalizes Fermat's Last Theorem

GS PAPER III · ICT · AI IN MATHEMATICS

Claude AI Formalizes Fermat's Last Theorem

NEWS IN BRIEF

- Anthropic's Claude formalized Fermat's Last Theorem in Lean, announced 4 Sept 2026.
- Took 11 days, largely autonomously, producing ~13 million lines of proof code.
- Verified about 29,500 supporting intermediate theorems along the way.
- Completed a 20-year-old, 100-theorem formalization benchmark list.

KEY CONCEPTS EXPLAINED

Formalization: Converting a mathematical proof into a form a computer can check automatically, step by step.

Lean: A proof-assistant programming language mathematicians use to write machine-verifiable proofs.

Fermat's Last Theorem: The claim that no positive integers a, b, c satisfy $a^n+b^n=c^n$ for any whole number n greater than 2.

⚡ UNIQUE FACT

Checking a proof of this scale and complexity by hand could take a team of human mathematicians years — Claude's formalization means every one of Wiles's logical steps can now be verified by a computer in minutes, with zero reliance on human judgment.

⚠ EXAM TRAP

Don't confuse 'formalizing' a proof with 'discovering' a new proof — Claude did not create new mathematics or solve Fermat's Last Theorem itself; the theorem was already proven by Andrew Wiles in 1995. Claude's contribution was making that existing proof machine-checkable.

📌 PRELIMS MEMORY BANK

- Announced: 4 September 2026, by Anthropic
- Achievement: first complete, computer-checked (Lean) proof of Fermat's Last Theorem
- Time taken: 11 days; Code produced: ~13 million lines of Lean
- Original proof by: Andrew Wiles, 1995 (350+ years after Fermat's 1637 conjecture)
- Significance: completed a 20-year-old, 100-theorem formalization benchmark list

PRACTICE MCQ · UPSC PRELIMS STYLE

Claude AI Formalizes Fermat's Last Theorem

With reference to the 2026 formalization of Fermat's Last Theorem by Anthropic's Claude, consider the following statements:

1. Claude discovered an entirely new mathematical proof of the theorem.
2. The formalization converts an existing proof into a form that a computer can verify automatically.
3. Fermat's Last Theorem was originally proven by Andrew Wiles in 1995.

Which of the statements given above is/are correct?

(a) 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

✓ Correct Answer: (a) 2 and 3 only

SOLUTION EXPLAINED

① THROUGH LOGICAL ANALYSIS

Every account of this achievement stresses that Claude's contribution was 'formalization', not new mathematical discovery — the underlying proof remains Andrew Wiles's from 1995, so a statement claiming Claude discovered a new proof mischaracterises what formalization actually means.

② THROUGH FACTUAL KNOWLEDGE

Claude's work converted Wiles's existing proof into a computer-checkable Lean formalization, without creating new mathematics; and Fermat's Last Theorem was originally proven by Andrew Wiles in 1995.