MISSION X PRESENTS

X TECH

WEEKLY SCIENCE & TECHNOLOGY COMPILATION

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Space Technology

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GS PAPER III · SPACE TECHNOLOGY · HUMAN SPACEFLIGHT

AstroRad Vest Could Cut Astronaut Radiation Exposure by 60%

NEWS IN BRIEF

- New peer-reviewed findings, published in Science Advances in August 2026, show the AstroRad radiation-shielding vest could cut astronaut radiation exposure by up to 60% during a severe solar particle event, based on data from NASA's uncrewed Artemis I mission.
- The vest was developed by Israeli startup StemRad, with support from the Israel Space Agency and Lockheed Martin, made of dense, hydrogen-rich plastic shaped to protect the body's most radiation-sensitive organs.
- During Artemis I, two identical mannequin 'phantoms', nicknamed Helga and Zohar, flew around the Moon inside Orion; only Zohar wore the AstroRad vest, and both carried thousands of radiation sensors to compare exposure.
- The vest addresses solar particle events (short, intense radiation bursts from solar storms) but does not protect against galactic cosmic radiation, the continuous background radiation that remains unresolved for long-duration Mars missions.

⚡ UNIQUE FACT

To test the vest without risking a human life, NASA sent two human-shaped mannequins named Helga and Zohar around the Moon — with Zohar wearing the AstroRad vest and Helga left unprotected — to directly compare radiation doses.

⚠ EXAM TRAP

Don't assume AstroRad protects astronauts from all forms of space radiation — it specifically shields against solar particle events, not galactic cosmic radiation, which remains a separate, unresolved hazard for missions like a crewed trip to Mars.

📌 PRELIMS MEMORY BANK

- Vest: AstroRad; Developer: StemRad (Israel), with Lockheed Martin support
- Tested during: Artemis I (uncrewed), using phantoms Helga & Zohar
- Findings published: Science Advances, August 2026
- Radiation reduction: up to ~60% (severe solar particle event)
- Does NOT protect against: galactic cosmic radiation (separate hazard)

PRACTICE MCQ · UPSC PRELIMS STYLE

AstroRad Vest Could Cut Astronaut Radiation Exposure by 60%

With reference to the AstroRad radiation-shielding vest, consider the following statements:

1. It protects astronauts equally against solar particle events and galactic cosmic radiation.
2. It was tested using human-shaped mannequin phantoms during NASA's Artemis I mission.
3. It was developed by an Israeli company with support from Lockheed Martin.

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

AstroRad's protective mechanism is explicitly designed for the sudden, intense radiation of solar particle events — it does not address galactic cosmic radiation, a continuous, different hazard requiring different countermeasures, so a claim of equal protection against both contradicts this basic distinction.

② THROUGH FACTUAL KNOWLEDGE

AstroRad was tested using the Helga and Zohar phantoms during Artemis I; and it was developed by StemRad, an Israeli company, with support from Lockheed Martin and the Israel Space Agency.

GS PAPER III · SPACE TECHNOLOGY · PLANETARY GEOLOGY

Valles Marineris — Evidence of an Ancient Martian Coastline

NEWS IN BRIEF

- A University of Bern-led international research team identified geological structures in Mars's Valles Marineris canyon system that closely resemble river deltas on Earth, providing evidence of an ancient coastline where a river once met a large body of water.
- These 'scarp-fronted deposits' indicate sediment laid down at the mouth of a river flowing into an ocean roughly three billion years ago, helping researchers reconstruct Mars's former sea level and coastline.
- Valles Marineris, discovered during NASA's Mariner 9 mission in 1971 and named in its honour, is the largest canyon system in the solar system — about 4,000 km long, up to 200 km wide, and as deep as 7 km.
- The canyon is believed to have formed through tectonic fracturing of the Martian crust linked to the nearby Tharsis volcanic rise, followed by further widening from erosion and landslides over billions of years.

⚡ UNIQUE FACT

Valles Marineris is so vast that if placed across the continental United States, it would stretch from coast to coast — while its depth of up to 7 km is more than half the depth of Earth's deepest ocean trenches.

⚠ EXAM TRAP

Don't assume Valles Marineris was formed primarily by flowing water like Earth's Grand Canyon — it originated mainly from tectonic fracturing linked to the Tharsis volcanic region, with water and erosion playing only a secondary, later role.

📌 PRELIMS MEMORY BANK

- Length: ~4,000 km; Width: up to 200 km; Depth: up to 7 km
- Discovered by: Mariner 9 mission, 1971 (named after it)
- Formation: tectonic fracturing linked to the Tharsis Rise
- 2026 finding: river-delta-like structures suggest an ancient coastline (~3 bn yrs ago)
- Located: just south of the Martian equator

PRACTICE MCQ · UPSC PRELIMS STYLE

Valles Marineris — Evidence of an Ancient Martian Coastline

Consider the following statements regarding Valles Marineris:

1. It was primarily formed through erosion caused by flowing water, similar to the Grand Canyon on Earth.
2. It was discovered during NASA's Mariner 9 mission.
3. Recent research has found geological structures resembling ancient river deltas within the canyon system.

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

Valles Marineris's formation is consistently attributed to tectonic fracturing linked to the nearby Tharsis volcanic rise, with water and erosion identified only as later, secondary shaping forces — a statement claiming water erosion as the primary formation mechanism reverses this established sequence.

② THROUGH FACTUAL KNOWLEDGE

Valles Marineris was discovered during NASA's Mariner 9 mission in 1971; and a University of Bern-led study identified scarp-fronted deposits resembling ancient river deltas within the canyon.



SECTION

Defence Technology

03 Typhon Missile System Continues Indo-Pacific Deployment

04 IAF Tests Indigenous Khagantak-243 Glide Bomb

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

Typhon Missile System Continues Indo-Pacific Deployment

NEWS IN BRIEF

- The US Army's Typhon Mid-Range Capability (MRC) missile system remained deployed in Japan through September 2026, having taken part in the multinational Valiant Shield exercise before continuing on to Orient Shield, the annual US-Japan ground forces exercise.
- Typhon is a mobile, ground-launched missile system capable of firing both the SM-6 (originally a naval missile) and the Tomahawk cruise missile, giving ground forces a long-range precision-strike option once available only from ships or aircraft.
- In May 2026, the US fired a Tomahawk missile from a Typhon launcher in the Philippines for the first time operationally, striking a target roughly 600 km away during Exercise Balikatan — part of a 'mobile missile arc' along the First Island Chain.
- Typhon's deployment was made possible after the US withdrew from the Intermediate-Range Nuclear Forces (INF) Treaty in 2019, which had previously banned ground-launched missiles of this range.

⚡ UNIQUE FACT

Typhon can fire two entirely different missile types from the same ground launcher — the SM-6 (originally designed for ships) and the Tomahawk cruise missile — giving it unusual flexibility for a land-based system.

⚠ EXAM TRAP

Don't assume Typhon is a new missile itself — it's a ground-based launcher system that fires existing missiles (SM-6 and Tomahawk) that were originally designed for naval platforms.

📌 PRELIMS MEMORY BANK

- Full name: Mid-Range Capability (MRC) missile system
- Manufacturer: Lockheed Martin, for the US Army
- Missiles fired: SM-6 and Tomahawk cruise missile
- First operational Philippines firing: May 2026, Exercise Balikatan (~600 km)
- Enabled by: US withdrawal from the INF Treaty (2019)

PRACTICE MCQ · UPSC PRELIMS STYLE

Typhon Missile System Continues Indo-Pacific Deployment

With reference to the Typhon (Mid-Range Capability) missile system, consider the following statements:

1. It is itself a newly developed missile with a unique warhead design.
2. It can launch both the SM-6 and Tomahawk missiles from the same ground-based launcher.
3. Its deployment was enabled after the US withdrew from the INF Treaty.

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

Typhon is consistently described as a launcher system firing existing naval-origin missiles (SM-6, Tomahawk), not as a missile itself with its own warhead — a statement calling it a newly developed missile misidentifies what kind of system it actually is.

② THROUGH FACTUAL KNOWLEDGE

Typhon can fire both the SM-6 and Tomahawk cruise missile from the same ground launcher; and its deployment became possible after the US withdrew from the INF Treaty in 2019.

GS PAPER III · DEFENCE TECHNOLOGY · PRECISION-GUIDED MUNITIONS

IAF Tests Indigenous Khagantak-243 Glide Bomb

NEWS IN BRIEF

- The Indian Air Force successfully conducted the maiden drop test of the indigenous Khagantak-243 Long Range Glide Bomb from a Su-30MKI fighter at the Pokhran Field Firing Range on 2 September 2026, with all mission objectives met.
- Khagantak-243 is a 300 kg-class stand-off precision-guided glide bomb, developed by Nagpur-based private company JSR Dynamics along with Bharat Electronics Limited, designed to strike targets over 140 km away.
- Unlike a conventional free-fall bomb, which follows a largely ballistic path after release, a glide bomb has no propulsion of its own — it uses deployable wings and aerodynamic lift to glide toward its target, guided by inertial and satellite navigation.
- The successful trial does not mean the weapon is yet operational — further evaluation, integration and production steps are still required before Khagantak-243 enters full service with the IAF.

⚡ UNIQUE FACT

Development of the broader Khagantak family of weapons traces back over a decade to private research supported early on by a ₹10 lakh grant from DRDO, following a visit by Dr APJ Abdul Kalam.

⚠ EXAM TRAP

Don't confuse a successful drop test with full operational induction — the IAF's September 2026 trial confirmed the weapon met its objectives, but further evaluation and production steps remain before Khagantak-243 becomes fully operational.

📌 PRELIMS MEMORY BANK

- Test date: 2 September 2026, Pokhran Field Firing Range, Rajasthan
- Developer: JSR Dynamics (Nagpur) with Bharat Electronics Limited
- Type: 300 kg-class stand-off precision-guided glide bomb
- Range: 140+ km; Launch platform: Su-30MKI
- Guidance: Inertial Navigation System + satellite navigation

PRACTICE MCQ · UPSC PRELIMS STYLE

IAF Tests Indigenous Khagantak-243 Glide Bomb

With reference to the Khagantak-243, recently in the news, consider the following statements:

1. It is a self-propelled, engine-powered precision missile.
2. Its successful drop test confirms it has entered full operational service with the IAF.
3. It was developed by a private Indian company along with Bharat Electronics Limited.

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

A glide bomb, by definition, has no onboard propulsion and instead uses aerodynamic lift from deployable wings — describing it as self-propelled contradicts this basic classification. Since further evaluation and production steps are explicitly required before service entry, claiming full operational status overstates what a drop test confirms.

② THROUGH FACTUAL KNOWLEDGE

Khagantak-243 was developed by private company JSR Dynamics along with Bharat Electronics Limited; it has no onboard propulsion, relying on gliding flight; and its September 2026 drop test was a trial, not confirmation of operational induction.

II

SECTION

Biotechnology & Health

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GS PAPER III · BIOTECHNOLOGY · ENVIRONMENTAL TOXICOLOGY

Rotenone — Natural Piscicide, Neurological Risk

NEWS IN BRIEF

- Wildlife agencies across the US, including Alaska and Washington state, continued using rotenone through 2026 to eradicate invasive northern pike from lakes — a naturally occurring piscicide derived from the roots of tropical plants like Derris and Lonchocarpus.
- Rotenone works by blocking Complex I of the mitochondrial electron transport chain, cutting off cellular energy production in fish and insects, making it effective against invasive aquatic species and crop pests.
- Despite its natural origin, rotenone is a potent neurotoxin; studies have linked chronic exposure to an increased risk of Parkinson's disease, since it damages dopamine-producing neurons the same way it kills fish cells.
- Its high toxicity and links to neurological disease have led to strict regulation, with authorities favouring targeted, monitored, one-time treatments over routine or repeated agricultural use.

⚡ UNIQUE FACT

The same mechanism that makes rotenone deadly to fish and insects — blocking mitochondrial Complex I — is also used by scientists to deliberately induce Parkinson's-disease-like symptoms in laboratory animals for research.

⚠ EXAM TRAP

Don't assume rotenone's 'natural, plant-derived' origin makes it safe — it is a potent mitochondrial toxin linked to Parkinson's disease, and its natural origin has no bearing on its toxicity or regulatory scrutiny.

📌 PRELIMS MEMORY BANK

- Source: roots of tropical plants (Derris, Lonchocarpus, Tephrosia)
- Mechanism: blocks Complex I of the mitochondrial electron transport chain
- Common use: piscicide (invasive fish eradication), insecticide
- Health link: increased Parkinson's disease risk
- 2026 use: Alaska/Washington lake treatments against invasive northern pike

PRACTICE MCQ · UPSC PRELIMS STYLE

Rotenone — Natural Piscicide, Neurological Risk

With reference to rotenone, consider the following statements:

1. It is a synthetic industrial chemical with no natural origin.
2. It works by blocking Complex I of the mitochondrial electron transport chain.
3. Chronic exposure has been linked to an increased risk of Parkinson's disease.

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

Rotenone is repeatedly described as a naturally occurring compound derived from tropical plant roots, not a synthetic industrial chemical — a statement denying its natural origin directly contradicts this well-established basic fact.

② THROUGH FACTUAL KNOWLEDGE

Rotenone blocks Complex I of the mitochondrial electron transport chain, cutting off cellular energy production; and chronic exposure has been scientifically linked to increased Parkinson's disease risk.

GS PAPER III · BIOTECHNOLOGY · NEUROSCIENCE

Cold Allodynia — When Mild Cold Triggers Intense Pain

NEWS IN BRIEF

- Research through 2026 has advanced understanding of cold allodynia, a nerve pain condition in which normally mild cold sensations — like a gentle breeze or cool water — trigger intense burning or freezing pain.
- A February 2026 University of Colorado Boulder study identified a neural circuit in an understudied brain region that plays a key role in turning temporary pain into pain that can persist for months or years.
- The condition is driven partly by a protein called TRPM8, a 'gate' in nerve cells that normally opens in response to cold to send a cooling signal to the brain; in cold allodynia, this pathway becomes abnormally sensitised.
- Cold allodynia is commonly linked to nerve damage from conditions like diabetes, chemotherapy (chemotherapy-induced peripheral neuropathy), and certain autoimmune or infectious diseases.

⚡ UNIQUE FACT

The same TRPM8 protein responsible for the pleasant, cooling sensation of menthol toothpaste is the very protein that misfires to cause the burning pain of cold allodynia.

⚠ EXAM TRAP

Don't confuse allodynia (pain from a normally non-painful stimulus, like a light touch or mild cold) with hyperalgesia (an exaggerated pain response to a stimulus that is already normally painful) — the two are distinct types of abnormal pain sensitivity.

📌 PRELIMS MEMORY BANK

- Key protein: TRPM8 (a cold-sensing 'gate' in nerve cells)
- Definition: pain triggered by a normally non-painful cold stimulus
- Common causes: diabetes, chemotherapy, nerve injury, autoimmune disease
- 2026 finding: Univ. of Colorado Boulder found a brain circuit turning pain chronic
- Distinct from: hyperalgesia (exaggerated response to an already-painful stimulus)

PRACTICE MCQ · UPSC PRELIMS STYLE

Cold Allodynia — When Mild Cold Triggers Intense Pain

With reference to cold allodynia, consider the following statements:

1. It refers to an exaggerated pain response to a stimulus that is already normally painful.
2. The protein TRPM8 plays a key role in the nerve signalling pathway involved.
3. It can result from nerve damage caused by chemotherapy or diabetes.

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 exaggerated response to an already painful stimulus is the definition of hyperalgesia, a distinct condition — allodynia specifically refers to pain triggered by a normally non-painful stimulus, so a statement describing allodynia using hyperalgesia's definition conflates the two.

② THROUGH FACTUAL KNOWLEDGE

TRPM8 is the key cold-sensing protein involved in cold allodynia's nerve signalling; and the condition is commonly linked to nerve damage from chemotherapy, diabetes and other causes.

GS PAPER III · BIOTECHNOLOGY · PUBLIC HEALTH

World Sepsis Day 2026 — Invest in Sepsis, Save Lives

NEWS IN BRIEF

- World Sepsis Day was observed on 13 September 2026, with the Global Sepsis Alliance's 2026 theme 'Invest in Sepsis — Save Lives,' calling for greater investment in awareness, prevention and treatment systems worldwide.
- Sepsis is a life-threatening condition that occurs when the body's response to an infection injures its own tissues and organs, and can rapidly progress to septic shock and multi-organ failure if not treated promptly.
- Updated 2026 clinical guidelines classify suspected cases into four grades — definite, probable, possible and unlikely sepsis — based on combinations of infection markers, to help doctors make faster, more accurate treatment decisions.
- Early recognition remains critical: standard emergency protocols call for obtaining blood cultures before starting antibiotics, using balanced fluids for initial resuscitation, and starting vasopressor medication if blood pressure remains dangerously low.

⚡ UNIQUE FACT

Despite being one of the leading causes of death in hospitals worldwide, sepsis is not a single disease but a dysregulated, excessive immune response to infection — meaning the body's own defence system, not the infection alone, causes the organ damage.

⚠ EXAM TRAP

Don't assume sepsis is itself an infection — it is the body's own dysregulated and excessive response to an infection that causes organ damage, distinguishing it from the underlying infection that triggered it.

📌 PRELIMS MEMORY BANK

- World Sepsis Day: 13 September 2026; Theme: 'Invest in Sepsis — Save Lives'
- Definition: life-threatening organ dysfunction from a dysregulated host response
- Diagnostic tool: SOFA score (Sequential Organ Failure Assessment)
- Severe form: septic shock (persistent low BP + high lactate)
- 2026 update: suspected cases graded into 4 categories (definite to unlikely)

PRACTICE MCQ · UPSC PRELIMS STYLE

World Sepsis Day 2026 — Invest in Sepsis, Save Lives

Consider the following statements regarding sepsis:

1. It refers directly to the presence of an infection in the bloodstream.
2. It is defined as a dysregulated host response to infection causing organ dysfunction.
3. The SOFA score is used to help assess sepsis-related organ dysfunction.

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

Sepsis is consistently defined as the body's own dysregulated, excessive response to an infection — not the infection itself — so a statement equating sepsis directly with the presence of infection in the blood conflates the trigger with the condition it causes.

② THROUGH FACTUAL KNOWLEDGE

Sepsis is officially defined as life-threatening organ dysfunction caused by a dysregulated host response to infection; and the SOFA score is the standard tool used to assess this organ dysfunction.

GS PAPER III · BIOTECHNOLOGY · VACCINE DEVELOPMENT

Reverse Vaccinology 3.0 — Designing Vaccines from Genomes

NEWS IN BRIEF

- A May 2026 paper in Nature Microbiology by pioneering scientist Rino Rappuoli and colleagues outlined 'Reverse Vaccinology 3.0,' the latest evolution of a vaccine-design approach first introduced by Rappuoli in 2000.
- Reverse vaccinology uses computers to scan a pathogen's entire genome and predict which of its proteins are most likely to trigger a protective immune response, without needing to grow or culture the actual microorganism.
- The approach was first successfully used to design a vaccine against Meningococcus B, and later informed vaccines against other bacterial infections; each successive version has incorporated deeper human immunology data and AI-driven antigen design.
- A separate February 2026 review noted that despite two decades of promise, reverse vaccinology's real-world impact on licensed vaccines has been more limited than expected, with recent research shifting toward more technical, computational applications.

⚡ UNIQUE FACT

Reverse vaccinology flips the traditional vaccine-development process on its head — instead of growing a pathogen in a lab and testing which parts trigger immunity, scientists start with only its genetic sequence and use computers to predict the best vaccine targets first.

⚠ EXAM TRAP

Don't assume reverse vaccinology requires culturing or growing the target pathogen in a laboratory — its defining feature is that it can design vaccine candidates directly from genomic sequence data, without ever growing the organism.

📌 PRELIMS MEMORY BANK

- Concept introduced by: Rino Rappuoli, in 2000
- First successful use: Meningococcus B vaccine
- Latest version: 'Reverse Vaccinology 3.0' (Nature Microbiology, May 2026)
- Core method: genome-based computational prediction of antigens
- Key advantage: no need to culture the pathogen

PRACTICE MCQ · UPSC PRELIMS STYLE

Reverse Vaccinology 3.0 — Designing Vaccines from Genomes

With reference to reverse vaccinology, consider the following statements:

1. It requires first culturing and growing the target pathogen in a laboratory.
2. It was first successfully used to develop a vaccine against Meningococcus B.
3. The concept was originally introduced by scientist Rino Rappuoli in 2000.

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

Reverse vaccinology's defining innovation, repeated in every description, is designing vaccines directly from genomic sequence data without needing to culture the organism — a statement requiring culturing first directly contradicts this foundational feature.

② THROUGH FACTUAL KNOWLEDGE

Reverse vaccinology was first successfully used for a Meningococcus B vaccine; and the concept was introduced by Rino Rappuoli in 2000.

GS PAPER III · BIOTECHNOLOGY · MARINE ECOLOGY

Alexandrium — The Algae Behind New England's Red Tide

NEWS IN BRIEF

- The US National Centers for Coastal Ocean Science (NCCOS) issued its 2026 seasonal forecast for the Gulf of Maine's 'red tide,' predicting a low-to-moderate bloom of the toxic dinoflagellate Alexandrium catenella for the year.
- Alexandrium is a genus of microscopic algae that can multiply explosively into dense 'blooms', discolouring coastal waters and producing a potent neurotoxin called saxitoxin that accumulates in filter-feeding shellfish.
- Humans who eat shellfish contaminated with Alexandrium's toxin can develop Paralytic Shellfish Poisoning (PSP), a serious and potentially fatal illness, making regular shellfish-toxin monitoring essential in affected coastal regions.
- Forecasts are generated by counting dormant, seed-like 'cysts' that Alexandrium leaves in seafloor sediment the previous autumn, allowing scientists to estimate how large the following spring-summer bloom is likely to be.

⚡ UNIQUE FACT

Scientists can predict next year's red tide bloom size by counting microscopic dormant 'cysts' that Alexandrium algae leave behind on the ocean floor the previous autumn — effectively reading a seed bank buried in seafloor sediment.

⚠ EXAM TRAP

Don't assume all algal blooms or 'red tides' are caused by the same organism — Alexandrium causes Paralytic Shellfish Poisoning via saxitoxin, while other red-tide species like Karenia brevis (Gulf of Mexico) produce entirely different toxins with different health effects.

📌 PRELIMS MEMORY BANK

- Organism type: toxic dinoflagellate (genus Alexandrium)
- Toxin produced: saxitoxin
- Illness caused: Paralytic Shellfish Poisoning (PSP)
- Forecasting method: counting dormant cysts in seafloor sediment
- 2026 forecast: low-to-moderate bloom predicted for the Gulf of Maine

PRACTICE MCQ · UPSC PRELIMS STYLE

Alexandrium — The Algae Behind New England's Red Tide

With reference to the harmful algal bloom genus Alexandrium, consider the following statements:

1. It produces a neurotoxin called saxitoxin that can cause Paralytic Shellfish Poisoning.
2. All red tide-causing algae worldwide belong to the genus Alexandrium.
3. Bloom forecasts are based partly on counting dormant cysts in seafloor sediment.

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

Multiple distinct genera (Alexandrium, Karenia brevis, and others) are each responsible for different regional red tides with different toxins — a statement claiming all red tides come from a single genus overgeneralises from Alexandrium's specific case to the entire phenomenon.

② THROUGH FACTUAL KNOWLEDGE

Alexandrium produces saxitoxin, causing Paralytic Shellfish Poisoning; and its bloom forecasts rely on counting dormant cysts in seafloor sediment from the previous season.

SECTION

ICT & Emerging Tech

10 GPT-6 Astra — First Model to Cross a 'Critical' Risk Threshold

GS PAPER III · ICT · AI GOVERNANCE

GPT-6 Astra — First Model to Cross a 'Critical' Risk Threshold

NEWS IN BRIEF

- OpenAI released GPT-6 Astra on 3 September 2026 as a limited preview, describing it as its most intelligent and capable model yet, with a full rollout to paid users following the next day.
- Astra is the first OpenAI model to cross the company's 'Critical' cybersecurity capability threshold under its internal Preparedness Framework, meaning it can find and exploit previously unknown security flaws without step-by-step human guidance.
- Because of this risk, OpenAI is initially restricting Astra's most advanced cybersecurity capabilities to a select group of trusted organisations under a programme called 'Daybreak,' even as the model becomes broadly available for general use.
- Astra uses a reasoning technique called 'recurrent depth,' which improves efficiency but makes parts of the model's internal reasoning process ('chain of thought') harder for researchers to monitor and audit.

⚡ UNIQUE FACT

GPT-6 Astra is the first AI model any company has publicly classified as crossing a 'Critical' risk threshold for cybersecurity capability, marking a new stage in how AI developers themselves categorise the dangers of their own systems.

⚠ EXAM TRAP

Don't assume GPT-6 Astra's advanced cybersecurity capabilities are available to all users — OpenAI has restricted this specific capability to a select group of organisations under its 'Daybreak' programme, even though the model itself is broadly available.

📌 PRELIMS MEMORY BANK

- Released: 3 September 2026, by OpenAI
- Milestone: first model to cross 'Critical' cybersecurity capability threshold
- Restricted access programme: 'Daybreak' (for advanced cybersecurity use)
- Reasoning technique: 'recurrent depth' (reduces chain-of-thought transparency)
- Framework used: OpenAI's internal 'Preparedness Framework'

PRACTICE MCQ · UPSC PRELIMS STYLE

GPT-6 Astra — First Model to Cross a 'Critical' Risk Threshold

With reference to OpenAI's GPT-6 Astra model, consider the following statements:

1. It is the first OpenAI model to cross the company's 'Critical' cybersecurity capability threshold.
2. Its advanced cybersecurity capabilities are freely available to all general users immediately upon release.
3. It uses a reasoning technique that can make its internal 'chain of thought' harder to monitor.

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

OpenAI explicitly restricted Astra's most advanced cybersecurity capabilities to a select group of trusted organisations under its 'Daybreak' programme precisely because of the risks involved — a statement claiming free, immediate access for all general users contradicts this deliberate access restriction.

② THROUGH FACTUAL KNOWLEDGE

GPT-6 Astra is confirmed as the first OpenAI model to cross the 'Critical' cybersecurity threshold; and it uses a 'recurrent depth' reasoning technique that reduces the transparency of its chain-of-thought reasoning.