MISSION X PRESENTS

# X TECH

WEEKLY SCIENCE & TECHNOLOGY COMPILATION

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GS PAPER III · SPACE TECHNOLOGY · INTERNATIONAL COOPERATION

# NASA Invites ISRO to Join Its Moon Base Programme

## NEWS IN BRIEF

- During the India-US Civil Space Joint Working Group meeting at ISRO headquarters, Bengaluru, NASA formally invited ISRO to join its Moon Base programme, an ambitious plan to build humanity's first permanent lunar outpost.
- The Moon Base will be located near the Moon's South Pole, chosen because it is believed to hold water ice that can support long-duration astronaut stays and be converted into fuel.
- The invitation builds on the growing India-US space partnership under the Artemis Accords, which India joined after the success of Chandrayaan-3's South Pole landing.
- NASA plans to build the base step by step through a mix of robotic and human missions, with the earliest missions expected from late 2026 onward.

### ⚡ UNIQUE FACT

India's invitation to join the Moon Base programme is being described as a direct pay-off of Chandrayaan-3's 2023 landing near the lunar South Pole, the very region NASA has now chosen for its permanent base.

### ⚠ UPSC TRAP

Don't confuse NASA's Moon Base programme (a permanent lunar outpost near the South Pole) with the Gateway lunar space station or the Artemis Accords (a separate international agreement on norms of behaviour in space) — they are related but distinct pieces of America's Moon strategy.

### 📌 PRELIMS MEMORY BANK

- Invitation extended: India-US Civil Space Joint Working Group, ISRO HQ, Bengaluru
- Programme lead: NASA
- Location: near the Moon's South Pole
- Basis: India's Artemis Accords membership + Chandrayaan-3 success
- Goal: permanent, sustainable human lunar outpost

PRACTICE MCQ · UPSC PRELIMS STYLE

# NASA Invites ISRO to Join Its Moon Base Programme

Consider the following statements regarding NASA's Moon Base programme:

1. It aims to establish a permanent human outpost near the Moon's South Pole.
2. India was invited to join the programme after the success of Chandrayaan-3's landing near the lunar South Pole.
3. The programme is being jointly led by NASA and ISRO as equal partners from its inception.

**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**

The invitation to ISRO is described as NASA inviting India to 'join' an already NASA-led initiative — a programme built jointly 'from inception' would not need a later invitation extended to a partner, so a claim of equal joint leadership from the start contradicts this framing.

**② THROUGH FACTUAL KNOWLEDGE**

NASA's Moon Base programme aims for a permanent outpost near the lunar South Pole; India's invitation followed Chandrayaan-3's South Pole landing; and the programme is NASA-led, with ISRO invited to join rather than co-leading from inception.

GS PAPER III · SPACE TECHNOLOGY · DEEP SPACE MISSIONS

# Voyager 2 Gets a Power-Saving ‘Big Bang’ Fix

## NEWS IN BRIEF

- NASA engineers carried out a clever power-saving manoeuvre, nicknamed the ‘Big Bang’, on Voyager 2, freeing up enough electricity to keep its three remaining science instruments running for at least another year.
- Voyager 2 and its twin Voyager 1 run on radioisotope thermoelectric generators, which convert heat from decaying plutonium into electricity — losing about 4 watts of power every year as the plutonium naturally decays.
- The fix involved switching off some powered devices and replacing their job with lower-power alternatives, all while keeping the spacecraft warm enough to keep functioning.
- On 20 August 2026, Voyager 2 marks 49 years in space; it is still transmitting data from interstellar space, more than 13.2 billion miles from Earth.

### ⚡ UNIQUE FACT

Voyager 2 has been flying for nearly 49 years — almost ten times longer than its original planned mission — and engineers are still finding new ways to squeeze extra life out of its dwindling power supply.

### ⚠ UPSC TRAP

Don't mix up Voyager 1 and Voyager 2 — Voyager 1 is currently the more distant of the two from Earth, while this particular power-saving fix was applied to Voyager 2 first, with engineers hoping to replicate it on Voyager 1.

### 📌 PRELIMS MEMORY BANK

- Fix name: the 'Big Bang' power-saving manoeuvre
- Announced: early August 2026
- Power source: radioisotope thermoelectric generators (RTGs)
- Power loss: ~4 watts per year
- Launched: 1977; turns 49 years old on 20 August 2026

PRACTICE MCQ · UPSC PRELIMS STYLE

# Voyager 2 Gets a Power-Saving ‘Big Bang’ Fix

With reference to Voyager 2 and the 'Big Bang' power-saving manoeuvre, consider the following statements:

1. It involved switching on additional science instruments to gather more data.
2. Voyager spacecraft draw power from radioisotope thermoelectric generators.
3. Voyager 2 loses approximately 4 watts of power every year.

**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**

A 'power-saving' fix is, by definition, aimed at conserving dwindling power — a manoeuvre that switches ON additional instruments would increase power draw, directly contradicting its stated conservation purpose.

**② THROUGH FACTUAL KNOWLEDGE**

The 'Big Bang' fix involved switching off certain devices and using lower-power alternatives, not switching on more instruments; Voyager spacecraft use RTGs; and they lose about 4 watts of power annually as onboard plutonium decays.

GS PAPER III · SPACE TECHNOLOGY · ASTRONOMY INFRASTRUCTURE

# Nancy Grace Roman Space Telescope Nears Launch

## NEWS IN BRIEF

- NASA's Nancy Grace Roman Space Telescope is set to launch on 30 August 2026 aboard a SpaceX Falcon Heavy rocket from Kennedy Space Center — nine months ahead of its original schedule.
- Named after NASA's first chief astronomer, Roman will have a field of view at least 100 times larger than the Hubble Space Telescope, despite carrying a primary mirror of the same 2.4-metre size.
- It will study dark energy, search for exoplanets using a technique called gravitational microlensing, and use a special coronagraph instrument to directly block starlight and image planets around other stars.
- After launch, Roman will travel to the Sun-Earth Lagrange Point 2 (L2), about 1.5 million km from Earth, the same gravitationally stable region where the James Webb Space Telescope also operates.

### ⚡ UNIQUE FACT

Roman's mirror is exactly the same size as Hubble's, yet its camera can capture a patch of sky about 100 times wider — the difference comes entirely from a much bigger, more advanced imaging sensor behind the mirror.

### ⚠ UPSC TRAP

Don't confuse Roman's mission focus with Hubble's or James Webb's — Roman is built mainly for wide-area surveys of dark energy and exoplanets, not the deep, narrow views Hubble and Webb specialise in.

### 📌 PRELIMS MEMORY BANK

- Launch date: 30 August 2026, Falcon Heavy, Kennedy Space Center
- Named after: Nancy Grace Roman, NASA's first chief astronomer
- Mirror size: 2.4 m (same as Hubble)
- Field of view: ~100x larger than Hubble
- Destination: Sun-Earth Lagrange Point 2 (L2)

PRACTICE MCQ · UPSC PRELIMS STYLE

# Nancy Grace Roman Space Telescope Nears Launch

With reference to the Nancy Grace Roman Space Telescope, consider the following statements:

1. Its primary mirror is significantly larger than that of the Hubble Space Telescope.
2. It will operate from the Sun-Earth Lagrange Point 2 (L2).
3. It is designed to study dark energy and search for exoplanets.

**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**

Roman's headline feature, repeated in every description, is that its mirror is the SAME size as Hubble's — its wide field of view comes from a different camera, not a bigger mirror — so a claim of a significantly larger mirror misattributes the source of its wide view.

**② THROUGH FACTUAL KNOWLEDGE**

Roman's mirror is 2.4 m, the same size as Hubble's; it will operate from Sun-Earth L2; and its mission goals include studying dark energy and searching for exoplanets via gravitational microlensing.

GS PAPER III · SCIENCE & AWARDS · THEORETICAL PHYSICS

# Deepak Dhar Wins the 2026 Dirac Medal

## NEWS IN BRIEF

- Indian theoretical physicist Deepak Dhar has been awarded the 2026 Dirac Medal, one of the most prestigious honours in theoretical physics, by the International Centre for Theoretical Physics (ICTP), Trieste.
- He shares the honour with Bernard Derrida (Collège de France), Marc Mézard (Bocconi University) and Haim Sompolinsky (Harvard University), for pioneering work extending statistical mechanics into new areas including optimisation, neuroscience and artificial intelligence.
- Dhar, 75, is an INSA Distinguished Professor at the International Centre for Theoretical Sciences (ICTS), TIFR, Bengaluru, and is best known for his work on the Abelian Sandpile Model, which explains self-organised criticality — how small events can occasionally trigger large, unpredictable cascades.
- This adds to Dhar's long list of honours, including the 2022 Boltzmann Medal (making him the first Indian to receive it) and the 2023 Padma Bhushan.

### ⚡ UNIQUE FACT

Dhar's sandpile model — originally built to explain why some grains added to a sandpile cause no change while occasionally one grain triggers a big avalanche — has gone on to help explain patterns as varied as earthquakes and financial market crashes.

### ⚠ UPSC TRAP

Don't confuse the Dirac Medal (ICTP, Trieste, physics) with the Fields Medal (mathematics) or the Dirac Medal for the Advancement of Physics awarded separately by the University of New South Wales — three different, similarly-named prizes.

### 📌 PRELIMS MEMORY BANK

- Awarded by: ICTP, Trieste, Italy (instituted 1985)
- Winner: Deepak Dhar, INSA Distinguished Professor, ICTS-TIFR
- Shared with: Bernard Derrida, Marc Mézard, Haim Sompolinsky
- Known for: Abelian Sandpile Model, self-organised criticality
- Other honours: 2022 Boltzmann Medal (first Indian), 2023 Padma Bhushan

PRACTICE MCQ · UPSC PRELIMS STYLE

# Deepak Dhar Wins the 2026 Dirac Medal

With reference to the 2026 Dirac Medal awarded to Deepak Dhar, consider the following statements:

1. The Dirac Medal is awarded by the International Centre for Theoretical Physics, Trieste.
2. Deepak Dhar is known for his work on the Abelian Sandpile Model and self-organised criticality.
3. This is the first international honour Deepak Dhar has received in his career.

**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**

Dhar's citation explicitly lists a long history of prior honours, including the 2022 Boltzmann Medal, making him the first Indian to receive it — a claim that the Dirac Medal is his first international honour contradicts this well-documented prior recognition.

**② THROUGH FACTUAL KNOWLEDGE**

The Dirac Medal is awarded by ICTP, Trieste; Dhar is known for the Abelian Sandpile Model and self-organised criticality; and he had already received honours including the 2022 Boltzmann Medal and 2023 Padma Bhushan before this award.

GS PAPER III · BIOTECHNOLOGY · OCCUPATIONAL HEALTH

# Gujarat Announces Compensation for Silicosis Victims

## NEWS IN BRIEF

- The Gujarat government announced a policy decision to grant a one-time ex-gratia payment of Rs 3 lakh to living silicosis patients from the unorganised sector.
- Silicosis is an incurable, irreversible lung disease caused by breathing in tiny crystalline silica dust particles, common in stone quarrying, mining, ceramics and agate-polishing work.
- In August 2024, the Supreme Court had ruled that failing to prevent silicosis violates the constitutional right to life under Article 21, directing the National Green Tribunal to monitor silica-prone industries and the National Human Rights Commission to oversee compensation.
- India's silica-exposed worker population is projected to have grown from 11.5 million in 2015-16 to around 52 million by 2025-26, with especially high prevalence in Rajasthan's stone mines and Gujarat's agate sector.

### ⚡ UNIQUE FACT

Silicosis is often misdiagnosed as tuberculosis, and many death certificates don't even mention it — making it one of India's most underreported occupational diseases despite affecting tens of millions of workers.

### ⚠ UPSC TRAP

Don't describe silicosis as curable or treatable — it is a permanent, irreversible scarring of lung tissue; government policies can only compensate and prevent it, not cure it.

### 📌 PRELIMS MEMORY BANK

- Gujarat's ex-gratia payment: Rs 3 lakh, for unorganised-sector patients
- Cause: inhaling crystalline silica dust
- Nature: incurable, irreversible lung disease
- SC ruling: August 2024, silicosis prevention linked to Article 21
- Estimated exposed workers in India: ~52 million (by 2025-26)

PRACTICE MCQ · UPSC PRELIMS STYLE

# Gujarat Announces Compensation for Silicosis Victims

With reference to silicosis, consider the following statements:

1. It is a curable lung disease if diagnosed early and treated with antibiotics.
2. In 2024, the Supreme Court linked its prevention to the constitutional right to life under Article 21.
3. It is commonly caused by prolonged inhalation of crystalline silica dust.

**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 silicosis stresses it is incurable and irreversible, with permanent lung scarring that cannot be reversed by any treatment, including antibiotics — a claim that it is curable directly contradicts this defining characteristic of the disease.

② THROUGH FACTUAL KNOWLEDGE

Silicosis is confirmed as an incurable, irreversible lung disease; the Supreme Court's August 2024 ruling linked its prevention to the Article 21 right to life; and it is caused by inhaling crystalline silica dust.

GS PAPER III · ICT · LANGUAGE TECHNOLOGY

# AICTE Launches Third Edition of VAANI Scheme

## NEWS IN BRIEF

- The All India Council for Technical Education (AICTE) launched the third edition of its VAANI scheme for 2026-27, short for Vibrant Advocacy for Advancement and Nurturing of Indian Languages.
- Around 200 institutions across the country, including Jadavpur University, Jamia Millia Islamia and IGDTUW, have been selected to host technology events in 21 regional languages, with Hindi leading at 50 grants.
- The scheme covers 16 emerging technology areas, including artificial intelligence, data science and quantum technology, delivered in students' and researchers' native languages.
- Each selected institution receives a grant of Rs 2 lakh, with the goal of building an inclusive knowledge ecosystem so regional-language speakers aren't left behind in emerging-tech education.

### ⚡ UNIQUE FACT

VAANI's 21-language footprint means a student in a small-town college can now learn cutting-edge topics like quantum technology in their own mother tongue, rather than only in English.

### ⚠ UPSC TRAP

Don't confuse AICTE's VAANI scheme (technical-education events in regional languages) with other similarly-named 'Vaani' initiatives — such as the Ministry of Tribal Affairs' Adi Vaani translation app or IISc's Project Vaani speech-dataset project — all are different programmes with the same evocative name.

### 📌 PRELIMS MEMORY BANK

- Scheme: VAANI (Vibrant Advocacy for Advancement and Nurturing of Indian Languages)
- Run by: AICTE; third edition, for 2026-27
- Coverage: ~200 institutions, 21 regional languages
- Tech areas covered: 16, including AI, data science, quantum tech
- Grant per institution: Rs 2 lakh

PRACTICE MCQ · UPSC PRELIMS STYLE

# AICTE Launches Third Edition of VAANI Scheme

With reference to AICTE's VAANI scheme, consider the following statements:

1. It aims to deliver emerging-technology education content in regional Indian languages.
2. The scheme is being launched for the first time in 2026-27.
3. It covers technology areas such as artificial intelligence, data science and quantum technology.

**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**

The 2026-27 edition is explicitly described as the THIRD edition of VAANI, meaning it has run in prior years — a claim that this is its first-ever launch contradicts this established multi-year continuity.

**② THROUGH FACTUAL KNOWLEDGE**

VAANI delivers technical-education content in 21 regional languages; the 2026-27 edition is its third, not first; and it covers 16 tech areas including AI, data science and quantum technology.