# Chandrayaan-3 ChaSTE: three layers in the top 10 cm of lunar soil

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## News

A study published in November 2026 in 'npj Space Exploration', a Nature Portfolio journal, reports that data from 'ChaSTE' (Chandra's Surface Thermophysical Experiment) on the Chandrayaan-3 Vikram lander show three distinct layers with different thermal properties within the top 10 cm of lunar soil (regolith) at the 'Shiv Shakti' landing site (69.37° S). The team is from the Physical Research Laboratory (PRL), Ahmedabad, with K. Durga Prasad as lead author and Anil Bhardwaj as corresponding author. The top 0–3 cm layer is highly porous (about 80%) with very low thermal conductivity; the middle 3–6 cm layer conducts heat best; the bottom 6–10 cm layer is intermediate. The authors link the layering to material thrown out (ejecta) from several nearby impact craters at different times, and say it may vary from place to place, so more in-situ measurements are needed. Earlier, a study by the same group released by ISRO in May 2026 described how, at the spot where Vikram 'hopped' about 50 cm, engine exhaust stripped away the top ~3 cm of loose dust, exposing a compact, 'cake-like' two-layer structure beneath. ChaSTE, built by the Space Physics Laboratory (SPL) of VSSC, Thiruvananthapuram, with PRL, is a rod-shaped probe with 10 temperature sensors that measured temperatures down to about 10 cm. Such data will help future landings and the search for water ice in the Moon's south polar region.

## Key facts for the exam

| Point | Details |
|---|---|
| **Instrument** | ChaSTE – Chandra's Surface Thermophysical Experiment |

| Point | Details |
|---|---|
| **Built by** | SPL (VSSC, Thiruvananthapuram) + PRL (Ahmedabad) |
| **Sensors** | 10 temperature sensors; top ~10 cm measured |
| **Site** | Shiv Shakti Point, about 69°S (south polar region) |
| **New study** | Three layers (0–3, 3–6, 6–10 cm) – npj Space Exploration, 16 Nov 2026; PRL team |
| **Earlier study** | Hop site: two layers – ISRO, May 2026 |
| **Landing** | 23 Aug 2023 – 'National Space Day' |
| **Project Director** | P. Veeramuthuvel (Villupuram) |

## Background

- Science: the layer of loose dust and broken rock covering the Moon's bedrock is called 'regolith'; with no atmosphere, meteorites and micrometeorites strike the surface directly and create it. The lack of an atmosphere also causes huge day–night temperature swings. The soil's density, porosity and thermal conductivity matter for designing future landers and human bases.
- History: Chandrayaan-3 was launched on an LVM3 rocket from Sriharikota on 14 July 2023 and landed in the Moon's south polar region on 23 August 2023. The site was named 'Shiv Shakti Point' and 23 August was declared 'National Space Day'. Before ChaSTE, ISRO says, temperatures inside lunar soil had been measured directly only by Apollo 15 and 17, near the equator.
- South pole significance: the south polar region matters because 'permanently shadowed craters', never reached by sunlight, may hold water ice – a future source of water, oxygen and rocket fuel. A 2025 study based on ChaSTE data suggested that ice could collect a few tens of centimetres deep on pole-facing slopes (ISRO).

**Tamil Nadu link:** Chandrayaan-3 Project Director P. Veeramuthuvel hails from Villupuram district, is the son of a former railway employee and an IIT Madras alumnus (DT Next). Chandrayaan-1 Project Director Mylswamy Annadurai is from Coimbatore district. The ISRO Propulsion Complex at Mahendragiri, Tirunelveli district, tests the engines of ISRO's rockets and spacecraft.

## Frequently asked questions

### What is this news about?

A study published in November 2026 in 'npj Space Exploration', a Nature Portfolio journal, reports that data from 'ChaSTE' (Chandra's Surface Thermophysical Experiment) on the Chandrayaan-3 Vikram lander show three distinct layers with different thermal properties within the top 10 cm of lunar soil (regolith) at the 'Shiv Shakti' landing site (69.37° S). The team is from the Physical Research Laboratory (PRL), Ahmedabad, with K. Durga Prasad as lead author and Anil Bhardwaj as corresponding author.

### What are the key facts to remember for the exam?

Instrument: ChaSTE – Chandra's Surface Thermophysical Experiment; Built by: SPL (VSSC, Thiruvananthapuram) + PRL (Ahmedabad); Sensors: 10 temperature sensors; top ~10 cm measured; Site: Shiv Shakti Point, about 69°S (south polar region).

**What is the background to this news?**

Science: the layer of loose dust and broken rock covering the Moon's bedrock is called 'regolith'; with no atmosphere, meteorites and micrometeorites strike the surface directly and create it. The lack of an atmosphere also causes huge day–night temperature swings.

## Practice questions (with answers)

**1. To mark the Chandrayaan-3 Moon landing, 23 August is observed in India as –**

**A)** National Science Day

**B) National Space Day**

**C)** National Tech Day

**D)** National Mathematics Day

**Answer: B** – Explanation: National Space Day (first observed in 2024). Science Day – 28 Feb; Technology Day – 11 May; Mathematics Day – 22 Dec.

**2. The layer of loose dust and broken rock covering the Moon's bedrock is called –**

**A)** Mantle

**B) Regolith**

**C)** Maria

**D)** Magma

**Answer: B** – Explanation: Regolith – formed by billions of years of meteorite and micrometeorite impacts. 'Maria' are the Moon's dark volcanic plains.

**3. Before ChaSTE, which missions alone had measured temperatures directly inside lunar soil?**

**A) Apollo (USA)**

**B)** Luna (USSR)

**C)** Chang'e (China)

**D)** SLIM (Japan)

**Answer: A** – Explanation: Apollo 15 and 17, near the equator. ISRO says ChaSTE made the first in-situ measurement at a high southern latitude (about 69°S).

**4. Chandrayaan-3 Project Director P. Veeramuthuvel hails from which Tamil Nadu district?**

**A)** Coimbatore

**B)** Tirunelveli

**C)** Kanniyakumari

**D) Villupuram**

**Answer: D** – Explanation: Villupuram – the son of a railway employee. Chandrayaan-1 Project Director Mylswamy Annadurai is from Coimbatore district.

**5. Why are space agencies especially keen on the Moon's south polar region?**

**A)** Active volcanoes

**B)** Strong magnetic field

**C) Ice in shadowed craters**

**D)** Thick atmosphere

**Answer: C** – Explanation: Permanently shadowed craters may hold water ice – a future source of water, oxygen and rocket fuel for human bases.

**Sources:** npj Space Exploration (Nature Portfolio), 16 Nov 2026; ISRO; SPL–VSSC; News On AIR; DT Next. © Shanmugam IAS Academy.