

## Chandrayaan 2 Mission [UPSC Notes GS III]

Context:

- The name Chandrayaan means Moon vehicle.
- It is India's unscrewed lunar mission. The aim of Chandrayaan 2 is to better grasp the Moon's origin and its evolution and progression by conducting topographical researches and mineralogical probes alongside a few other experiments on the Moon's surface.
- As reported by ISRO, the mission Chandrayaan 2 fostered the findings of Chandrayaan 1.
- The Chandrayaan 2 mission targeted a completely unexplored section of the Moon i.e. Moon's "South Polar region".
- While a few mature models do exist, the Moon's origin still needs further explanations. Extensive mapping of the lunar surface will aid us in studying variations in its composition — an essential piece of information in tracing the Moon's origin and evolution.
- The mission Chandrayaan 2 is considered as a challenge as no space agency has ever thought of exploring the South Polar Region of the Moon.

Why go to the Moon?

- Because it is the closest cosmic body at which space discovery can be attempted and documented.
- Also it is a promising test bed to determine the technologies required for deep-space missions.

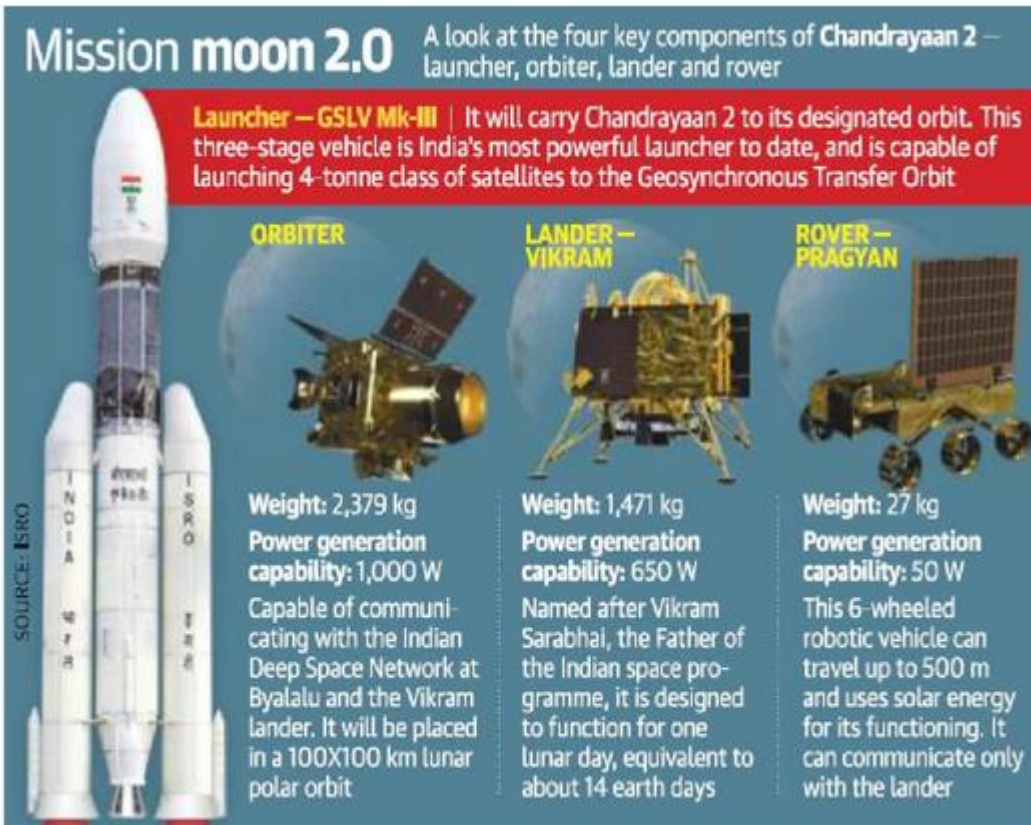
Chandrayaan 2 Mission components are:

- S200 solid rocket booster
- L110 liquid state
- C25 Upper stage

Launcher

- Geosynchronous Satellite Launch Vehicle Mark-III (GSLV Mk-III)

**Mission moon 2.0** A look at the four key components of Chandrayaan 2 — launcher, orbiter, lander and rover



Component	Weight	Power generation capability	Additional Information
Launcher — GSLV Mk-III	2,379 kg	1,000 W	It will carry Chandrayaan 2 to its designated orbit. This three-stage vehicle is India's most powerful launcher to date, and is capable of launching 4-tonne class of satellites to the Geosynchronous Transfer Orbit
ORBITER	1,471 kg	650 W	Capable of communicating with the Indian Deep Space Network at Bhalalu and the Vikram lander. It will be placed in a 100x100 km lunar polar orbit
LANDER — VIKRAM	27 kg	50 W	Named after Vikram Sarabhai, the Father of the Indian space programme, it is designed to function for one lunar day, equivalent to about 14 earth days
ROVER — PRAGYAN	50 W	50 W	This 6-wheeled robotic vehicle can travel up to 500 m and uses solar energy for its functioning. It can communicate only with the lander

## Chandrayaan-2 is composed of three modules

The orbiter, the Vikram lander (named after Vikram Sarabhai, the late father of India's space program) and the Pragyan rover (named after the Sanskrit word for wisdom).

From orbit, instruments will create detailed three-dimensional maps of the surface,

- ✓ To ascertain the safety of potential landing sites and
- ✓ To track the distributions of water molecules, hydrated minerals and other materials of interest on and around the moon.
- If touchdown is successful, the Vikram lander will serve as a listening station for seismic waves from moonquakes, which could reveal more details about the structure of the lunar core, mantle and crust.
- Further studies are set to take place via the Pragyan rover, which is meant to drill into the surface to gather samples for additional mineralogical and chemical analysis.

The orbiter, lander and rover will collectively carry 14 scientific payloads, including a Laser Retro Reflector Array from NASA to provide precise measurements of the distance between the Moon and the Earth.

### Soft-Landing

- A soft-landing occurs when the rocket is designed to touch down as gently as possible.
- India would join the U.S., China and the former Soviet Union on the list of countries that have completed a "soft" moon landing, or a touchdown that doesn't result in a crash landing.

### Why Chandrayaan 2 is on a mission to explore the Moon's South Polar Region and the reason why it's a huge challenge?

The Dark Side of the moon – the significance of exploring Moon's South Pole.

- Due to the moon's axis, few regions on the South Pole always remain dark especially the craters and have higher chances of containing water.
- The temperature at the poles remains frigid, hitting as low as -248 degree Celsius making it among the lowest temperatures in the Solar System. The reason is that the bottom of the polar craters remain under shadows permanently because of the low angular tilt of the axis (1.54-degree tilt in comparison to earth's 23.5 degrees).
- The craters might have never received sunlight because it is at very low angles in the Polar Regions and thus, increasing the chances of presence of ice on such surfaces.
- The lunar surface area at the south pole of the Moon that remains in shadow is much larger than North Pole thus making moon's South Pole interesting. This also increases the probability of the existence of water in permanently shadowed areas around it.

### Totally Unexplored Territory

- No one has ever explored the South Polar Region of the Moon. In all the space missions, be it manned or unmanned, no country has ever attempted to land a spacecraft in the polar regions of the moon.
- The South Polar Region is far from the equator and it is totally uncharted till now. This could give India a lead in space exploration on an international level.

- The South Pole region has depressions that are cold traps and contain a fossil record of the early Solar System.

### Significance

- The success of the mission is going to boost national morale and contribute to scientific achievement of India in ways ranging from academic research to national security.
- The mission is completely home-grown, with heavy participation from the academia and the private sector and involving young scientists from across the country that shows a reflection of India's rising scientific temper.

### Chandrayaan-1 Vs Chandrayaan-2

- Chandrayaan-1 was launched from the Satish Dhawan Space Centre, Sriharikota by India's Polar Satellite launch Vehicle — PSLV-C11 in 2008. On the other hand, Chandrayaan-2 was launched by the GSLV Mk-III.
- The spacecraft in Chandrayaan-1 made more than 3,400 orbits around the Moon and was operational for 312 days till August 29, 2009. Chandrayaan-2's orbiter shall continue its mission for around a year.
- There were 11 scientific instruments onboard the Chandrayaan-1 spacecraft. Five of them were Indian while the others were from ESA-European Space Agency, NASA-National Aeronautics and Space Administration and Bulgarian Academy of Sciences. Orbiter of Chandrayaan-2 carried eight scientific loadings for mapping the lunar surface and to study the exosphere (outer atmosphere) of the Moon.
- The lander carries three scientific payloads to conduct surface and subsurface science experiments. The rover transmits two payloads to enrich our understanding of the lunar surface. An inert experiment from NASA will also be conceded onboard Chandrayaan.
- Chandrayaan-1 convincingly discovered traces of water on the Moon. This was a path-breaking discovery. It also discovered water ice in the north polar region of the Moon. It also detected aluminum, magnesium, and silicon on the lunar surface. Global imaging of the Moon is another achievement of Chandrayaan-1 mission.
- Chandrayaan-2 by way of soft landing on the Moon and deploying a rover to study the lunar surface aims to widen the scientific objectives of Chandrayaan-1.