

ACHIEVEMENTS OF CONTEMPORARY BHARAT



सत्यमेव जयते

MINISTRY
OF EDUCATION
Government of India

CHANDRAYAAN UTSAV

CODE
1.6S



SPECIAL MODULE

विद्यया ऽ मृतमश्नुते



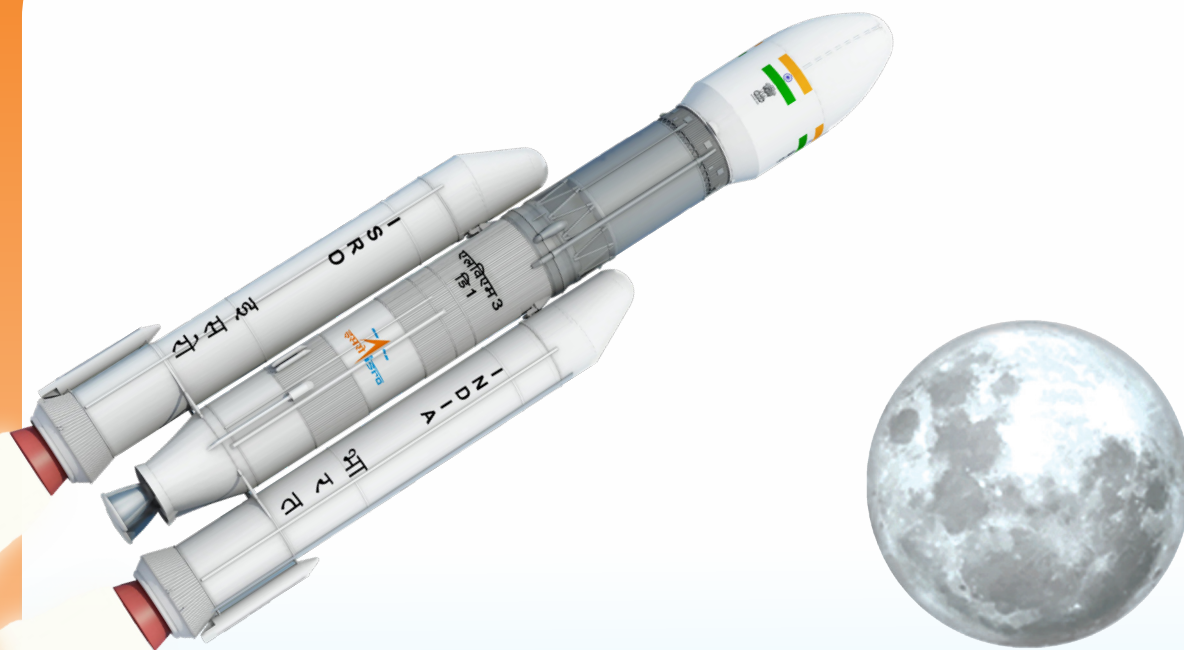
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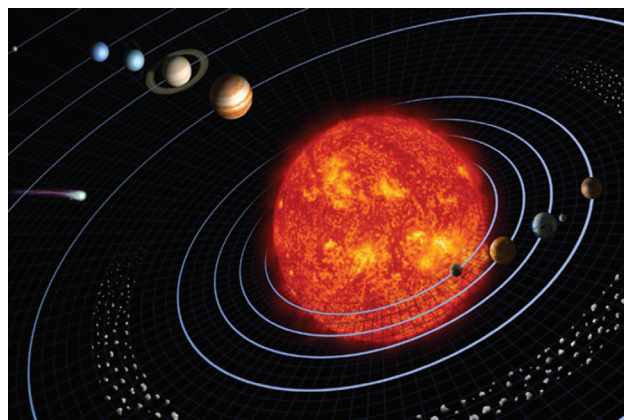
Towards Moon and Beyond

Secondary Stage

TOWARDS MOON AND BEYOND

We all know that the universe consists of billions of galaxies and planetary systems like our solar system. About 4.6 billion years ago, our solar system was formed due to the gravitational collapse of a giant interstellar molecular cloud. Over time, the molecules of cloud shaped the sun and a protoplanetary disk that gradually coalesced with it and formed planets and other objects (satellites, asteroids, comets, etc.).

As you are aware, our solar system is located in the Milky Way Galaxy and consists of the Sun, the planets, viz., Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune; the dwarf planets like Pluto, more than 200 moons, millions of asteroids, comets, meteoroids, and everything bound to it by gravity.



Source: NASA

Our Home Planet: The Earth

Our Earth is a territorial planet. It is about 147.1–152.1 million kilometers from the Sun. It is the densest of the inner planets and the only planet inhabited by living things.



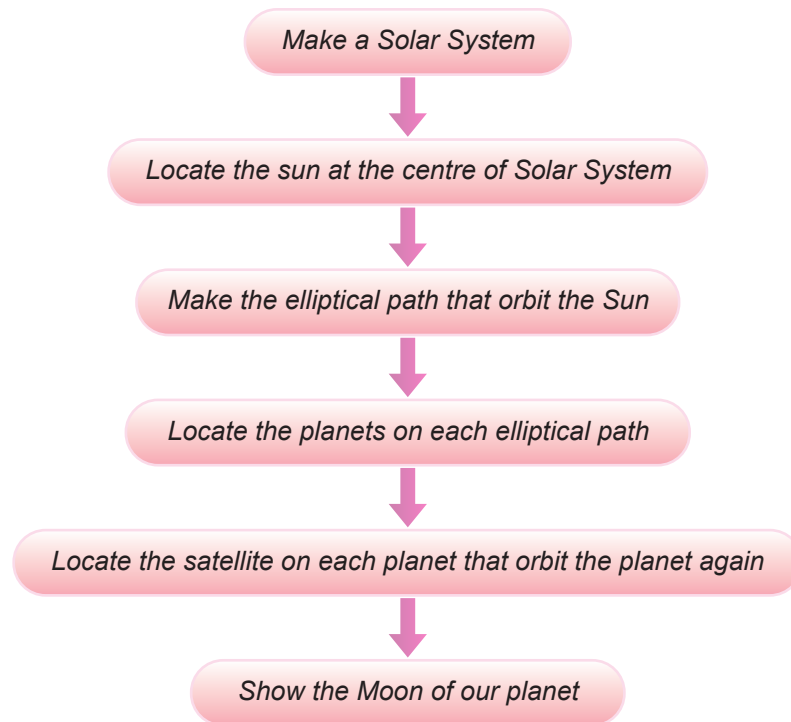
Quick facts

Day	23.9 hours
Year	365.25 days
Radius	3,959 miles / 6,371 kilometers
Planet type	Terrestrial
Moon	1

Source: NASA

Activity 1

Prepare a simulation model to make the solar system, planets and satellite. Specially placed the moon with their planets Earth.

**The Moon**

The moon, adorably known as Chandamama is deeply intertwined in Indian culture and tradition. Many folktales and folksongs have been orally passed down from generation to generation. Traditional rituals are held according to the phases of the moon. Scientifically, the moon is the only natural satellite of the Earth. The Moon has fascinated humans for millennia.



There are many hypotheses and theories that explain the origin of the moon. The most expected theory suggested that a Mars-sized heavenly body collided with Earth about 4.5 billion years ago. The debris from the Earth and the Mars-sized heavenly body accumulated to form the Moon.

Quick facts about Moon

Radius	1,079.6 miles / 1,737.5 kilometers
Orbit	27 Earth days
Rotation	Synchronous rotation
Distance from Earth	384,400 kilometers / 238,855 miles
Human visitors	24
Moonwalkers	12
Robotic visits	100+

Source: NASA

Why Moon is Important for the Earth

The moon is the brightest and largest heavenly body in our night sky. There are many benefits Earth gets from the moon, the moon moderates Earth's wobble in its axis, leading to a relatively stable climate. It also creates tides and protects Earth from solar winds, ideal for studying the universe.

Indian Space Research Organisation (ISRO)

The Indian National Committee for Space Research (INCOSPAR) was established as the first space research platform in 1962 as envisioned by Dr. Vikram Sarabhai. After 7 years of its operation, ISRO was established on 15th August 1969 and superseded INCOSPAR with an expanded role to harness space technology for various national needs. In 1972, ISRO was brought under the Department of Space, Government of India.

Journey Towards the Moon

ISRO, since its inception, has made tremendous progress in the field of space sciences and technology. Chandrayaan mission is utmost achievement of Indian Space Research Organization for knowing the lunar surface ecosystem. Chandrayaan word is transliteration of the Sanskrit word Chandrayāna. It means "moon vehicle" (Chandra means 'moon', yaan means 'craft' or 'vehicle'). The vehicle which reaches lunar surface. Chandrayaan-1 is the first lunar mission for India. The mission traces the presence of water on the moon's surface. Following the success of Chandrayaan-1,

Chandrayaan-2 was launched.

The mission discovered an ice sheet in the lunar crater.

Chandrayaan-3 was launched

with the scientific objective of soft landing on the south pole and with further exploration of a lunar surface ecosystem. The success of the Chandrayaan-3 mission demonstrates the true potential of India in space science and technology in the world.

Activity 2

Organised a field trip to planetarium, science centre, etc.

Story of Chandrayaan-1

Chandrayaan-1 is the first Indian mission to the Moon. It was launched successfully on 22nd October 2008 from SDSC SHR, Sriharikota to study the chemical, mineralogic, and photogeologic mapping of the moon.

Specifications of Chandrayaan-1

Specification

Launch date	22 October, 2008
Launch mass	1380 Kilogram
Launch vehicle	PSLV- C11
Manufacturer	ISRO
Power	700 Watt
Mission life	2 years
Orbit type	Lunar
Application	Planetary Observation
Type of satellite	Science & Exploration
Orbit	100×100 km: Lunar orbit
Major achievement	Discovering water on the Moon
Expenditure	386 crores

Source: ISRO

Chandrayaan-1's X-ray Spectrometer (C1XS) detected titanium, and confirmed presence of Magnesium, Aluminium, Silica and Calcium on the surface of the Moon. The presence of hydroxyl and water molecules in the lunar soil is the major discovery of this mission and also confirmed that the Moon was completely molten once. Three dimensional conceptualisation of craters of interest and detailed maps of lunar surface features.

Did you know?

By sending Chandrayaan-1, Bharat became the 4th country to send a Moon mission!

Chandrayaan-2

Chandrayaan-2 is the first attempt to soft land on the surface of the moon. The mission comprises of orbiter, lander, and rover. The mission objective is to study the exosphere, surface, and sub-surface of the moon in a single mission.

The mission targeted the “South Pole” of the lunar space which was completely unexplored. The major focus of this mission is to extensive mapping of the lunar surface ecosystem study its composition and trace the Moon's origin and evolution. The mission explores the potential presence of ice on crater surfaces that might have never received sunlight because it is at very low angles in the Polar Regions. It detected the presence of Argon-40 in the lunar exosphere. It has taken the image of the Sarabhai Crater located on the northeast quadrant of the lunar surface.

Specifications of Chandrayaan-2

Specification

Launch date	22 July, 2019
Launch mass	3850 kilograms
Launch vehicle	GSLV-Mk III - M1
Manufacturer	ISRO
Power	1000 Watt
Mission life	7 years
Orbit type	Lunar

Application	Planetary Observation
Type of satellite	Science & Exploration
Major achievement	Trace the location of lunar water
Expenditure	978 crores

Source: ISRO

The first set of data from the Chandrayaan-2 mission is now released for the people through the PRADAN portal hosted by the Indian Space Science Data Centre (ISSDC).

Activity 3

- Observe the lunar surface by Google Earth Pro.
- Observe the lunar surface by telescope.

Chandrayaan-3

“Chandrayaan-3 is a follow-up mission to Chandrayaan-2 to demonstrate end-to-end capability in safe landing and roving on the lunar surface” ISRO.

Chandrayaan-3 aimed to demonstrate a safe and soft landing on the lunar surface rover roving on the Moon and conduct in-situ scientific experiments.

Specifications of Chandrayaan-3

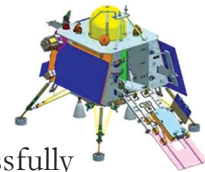
Specification

Launch date	14 July, 2023
Launch mass	3900 Kilogram
Launch vehicle	LVM3- M4
Manufacturer	ISRO
Power	738 W, Summer solstices and with bias
Mission life	In operation
Orbit type	Lunar
Application	Planetary Observation
Type of satellite	Science and Exploration

Chandrayaan Utsav

Mission director	Dr. Somnath Roy
Major achievement	Reached at south pole of moon
Expenditure	615 crores

Source: ISRO



On 23 August 2023, the *Vikram* lander from Chandrayaan-3 successfully landed on the South Pole of the Moon. With this successful soft landing, India joins an elite club of countries, viz., The United States of America, the erstwhile Soviet Union, and China.

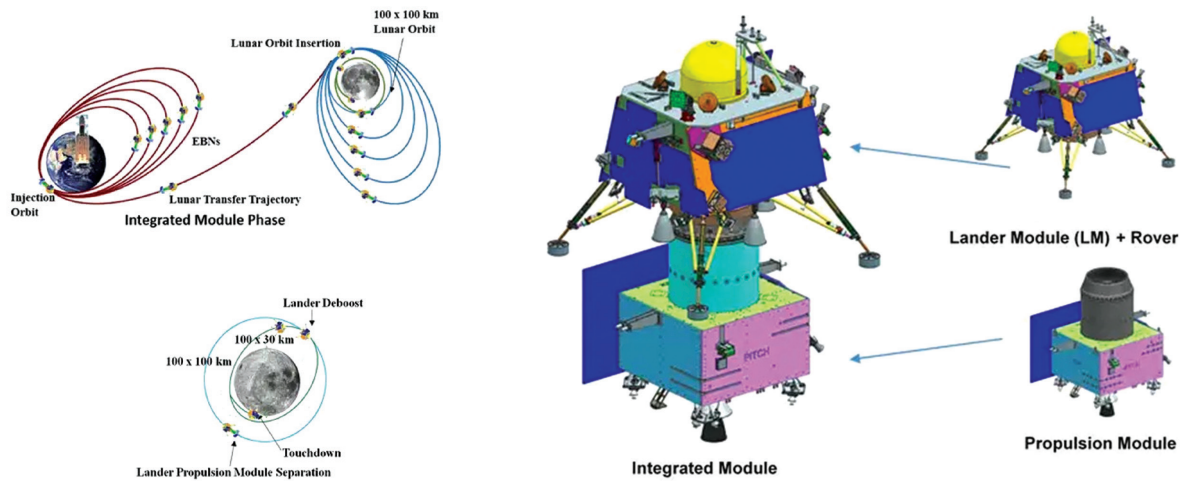
The mission demonstrates India's technological capabilities on the global platform, attracting attention and collaboration from around the world. The mission's life is one lunar day or 14 earth days.



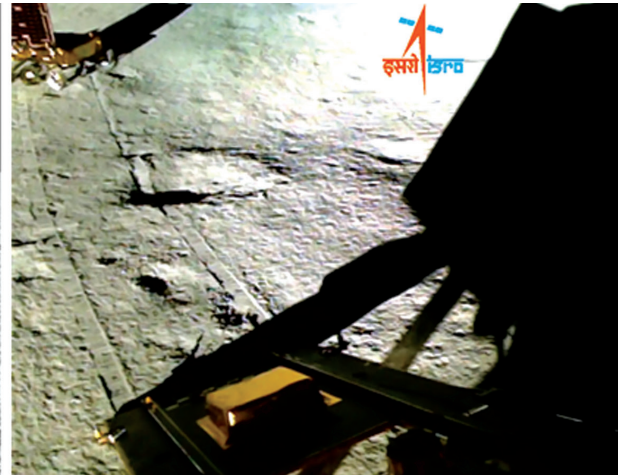
Honourable Prime Minister Shri Narendra Modi with ISRO Scientists

The mission's successive stages are as follows:

- The mission consists of a lander module, a propulsion module, and a rover.
- The propulsion module payload is named the Spectro-polarimetry of HABitable Planet Earth (SHAPE).



Chandrayaan-3 Mission's Path (Sling-short technique)

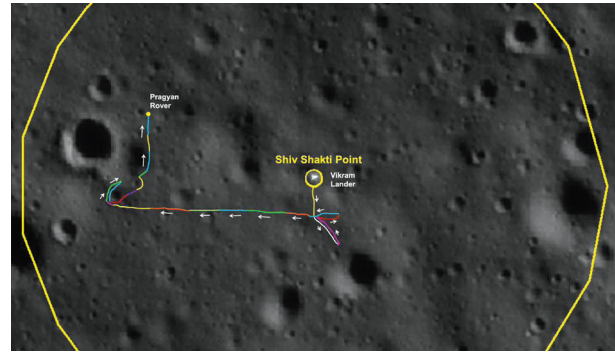


Successive foot prints of Lander (Vikram) and Rover (Pragyan)

- Its objective is to explore exo-planets for habitability by studying reflected light.
- The payloads on the lander Vikram are:
 - Moon's Surface Thermophysical Experiment (ChaSTE) to measure the thermal temperature and conductivity
 - Instrument for Lunar Seismic Activity (ILSA) measured the seismicity around the landing site
 - Langmuir Probe (LP) to evaluate the plasma density and its variations

Chandrayaan Utsav

- The payloads on the rover *Pragyan* are:
- Alpha Particle X-ray Spectrometer (APXS) and Laser Induced Breakdown Spectroscope (LIBS) explore the lunar surface ecosystem.

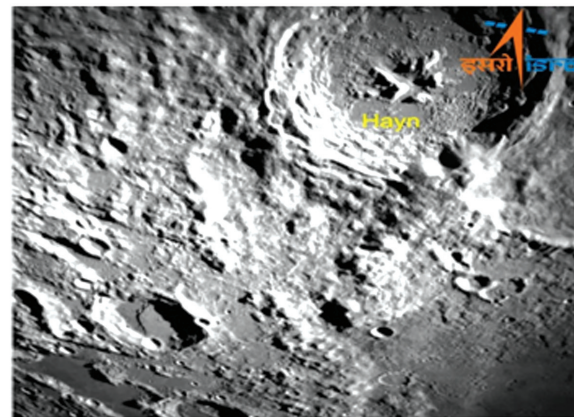


Visualisation of Shiva Shakti (Landing Point) at lunar surface

Chandrayaan-3 Mission's Path (Sling-short technique)

Importance of Moon mission

- Chandrayaan-3's successful soft landing on the South Pole of lunar set up India as part of an exclusive club alongside the USA, Russia, and China. This milestone achievement showcases India's prowess in space exploration and technological advancement.
- The Chandrayaan-3 mission ignites national pride, boosts economic growth, and creates employment opportunities in the IT sector. It demonstrates India's technological competencies on a global stage, attracting attention and collaboration around the world.
- The Chandrayaan-3 mission propels India into the emerging 'moon economy' in the sector of tourism the Government and private stakeholders. The slogan *Chanda mama door ke* will be replaced by *Chanda mama tour ke* near in the near future.
- India's space sectors open the door for new technological advancement, and business opportunities, and make the lunar surface exploratory of a precious resource (minerals like oxygen, titanium, iron, silicon, sulphur, etc.)



Lunar far side area as imaged from the Lander Hazard Detection and Avoidance Camera (LHDAC) onboard Chandrayaan-3 on August 19, 2023

- Chandrayaan-3 mission's in-situ exploratory observation and experiments on lunar surface material reveal the mystery of the moon's composition and broader planetary studies.
- Chandrayaan-3 mission teaches us that failures are the stepping stones to success. By capitalising on lessons learned from Chandrayaan- 2, this mission showcases the adaptability, significance of resilience, and growth through setbacks.
- Chandrayaan-3 mission illustrates the importance of proactive leadership. ISRO's forward-thinking approach, embracing risk, retrieved from failure-based design, emphasizes the significance of anticipating challenges, overcoming them strategically, and becoming an inspiration for future space science leaders.
- Chandrayaan-3 mission teaches us to embrace challenges, leverage experience, and pave the way for a bright scientific temperament future among the people of our nation.

Activity 4
 Prepare a chart about significant contribution of the Moon mission by students of the class.



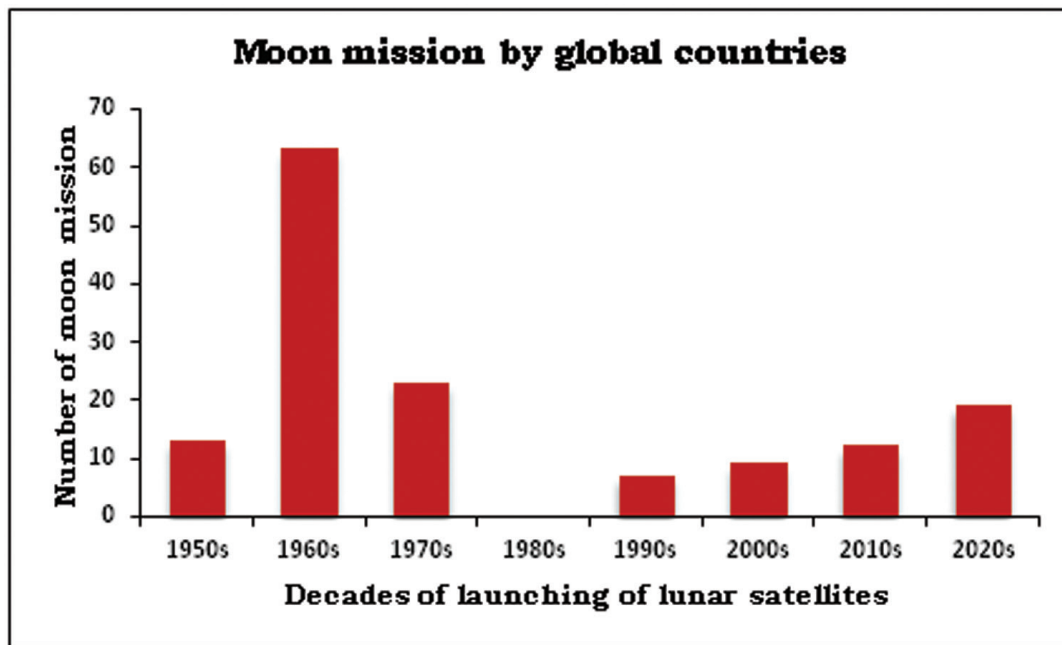
Chandrayaan Utsav

- The budget for this mission is less than the many Hollywood and Bollywood movies. Chandrayaan-3 launching budget was 615 crores rupees only whereas the budget of movies named Oppenheimer, Barbie, Adipurush, Mission Impossible, *Tare ke bich ka*, etc., were 826, 826, 700, 2397, and 1364 crores rupees respectively.
- After the historic landing of Chandrayaan-3 Mission on Moon's South Pole on 23 August various countries and space agencies congratulated India for its remarkable achievement including the USA (NASA), Russia, South Africa, Europe (ESA), Israel, UK, Nepal, Indonesia and other South East Asian countries including Pakistan.

Analysis of numbers of lunar missions

Country	Agency or company	Successful Launch	Partial Failure	Failure	Operartional	Total
INDIA	ISRO	2	1	-	2	3
USA	NASA	36	2	14	3	59
	USAF	1	-	1	-	
	Lockheed Martin	1	-	-	-	
RUSSIA	Lavochkin	16	2	22	-	58
	Energia	2	-	16	-	
CHINA	CNSA	5	-	-	5	5
EU	ESA	1	-	-	-	1
JAPAN	ISAS	2	-	2	-	6
	JAXA	1	-	-	-	
	Ispace	-	-	1	-	
SOUTH KOREA	KARI	1	-	-	1	1
ISRAEL	Spacell	-	-	1	-	1
UAE	UAESA	-	-	1	-	1
ITALY	ASI	1	-	-	-	1

Source: NASA



- The Chandrayaan-3 mission formulated some scientific assumptions for space researchers such as in-situ exploratory development on the lunar surface ecosystem. Launching spacecraft, studying the universe, discovering precious resources, resolving the mystery of celestial bodies of the universe, etc. will be possible to do from the lunar space ecosystem.

The Global Space Race

The lunar mission is not every nation's cup of tea. The Chandrayaan-3's safe and soft landing near the South Pole of the Moon demonstrates Indian capabilities in space science and technology. With this successful soft landing, India joins an elite club of countries in lunar mission. Below is the analysis of space race in the world.

Leadership and Budget

The Prime Minister of India reminded the partial failure of Chandrayaan-2 that was directed by K. Sivan. He appreciated the team work of K. Sivan and offered their thought that the sustainability, equality, potentiality, punctuality, compatibility, accountability, etc., is responsible for growth in all dimension of life and nature. He stated that Bharat's ethos, value system rooted very deep with nature and nature is part of universe which give beautiful responsibility to steward of life, society, nature, and whole universe.

However, we never forget the role of leadership of present government of India that is Bharat. The Government of India has increased the space sector budget from Rs 5,615 crore in 2013-14 to Rs 12,543 crore in 10 years, a rise of 123 per cent.

After the successful landing of Chandrayaan-3 on the Moon, the Hon'ble Prime Minister of India, Shri Narendra Modi, in his speech stated that "Scientists are running many responsible spaces programme and accelerating the country's development, as well as innovation and the use of space technology to bring sustainability and equality among races of a global space mission".

Futuristic Approach About Journey Towards Moon

Astronauts working on the lunar surface could test advanced robotics. They try to set up new technologies identified in the Lunar Surface Innovation Initiative, focusing on *in-situ* resource utilisation (ISRU) and power systems generated on the lunar ecosystem. Rovers will carry a variety of instruments including ISRU experiments that will generate information on the availability and extraction of usable resources (e.g., oxygen and water). These advance technologies could enable the production of fuel, water, and oxygen from local materials, that enabling sustainable lunar surface operations with a decreasing supply of essential materials from Earth.

Activity 4

Let us ponder:

- Will there be increase in the scientific temperament among the students near future?
- Will employment opportunity generate through development in space science sector?
- What are the benefits of lunar mission for national perspectives?

You know now that Chandrayaan mission is the milestone attainment of our Space Scientists. ISRO, since its inception has made tremendous progress in the field of space sciences and technology. Chandrayaan-1 is the first lunar mission for India. The mission traces the water on the moon's surface. Following the success of Chandrayaan-1, Chandrayaan-2 was launched and discovered an ice sheet in the lunar crater. Chandrayaan-3 was launched with the scientific objective of soft landing near the

South Pole and with further exploration of a lunar surface ecosystem. The success of this mission demonstrates the true potential of India in space science and technology advancement in the world. Chandrayaan-3 successful soft landing near the South Pole of lunar set up India as part of an exclusive club alongside the USA, Russia, and China. This milestone achievement showcases India's prowess in space exploration. This mission ignites national pride, uplifts economic growth, and generates employment opportunities in the IT sector. It demonstrates India's technological competencies on a global stage, attracting attention and collaboration around the world. The s-3 mission formulated some scientific assumptions for space researchers such as *in-situ* exploratory development on the lunar surface ecosystem. Scientific temperament among students, launching spacecraft, studying the universe, discovering precious resources, resolving the mystery of celestial bodies of the universe, etc., will be possible to attain research on the lunar space ecosystem.



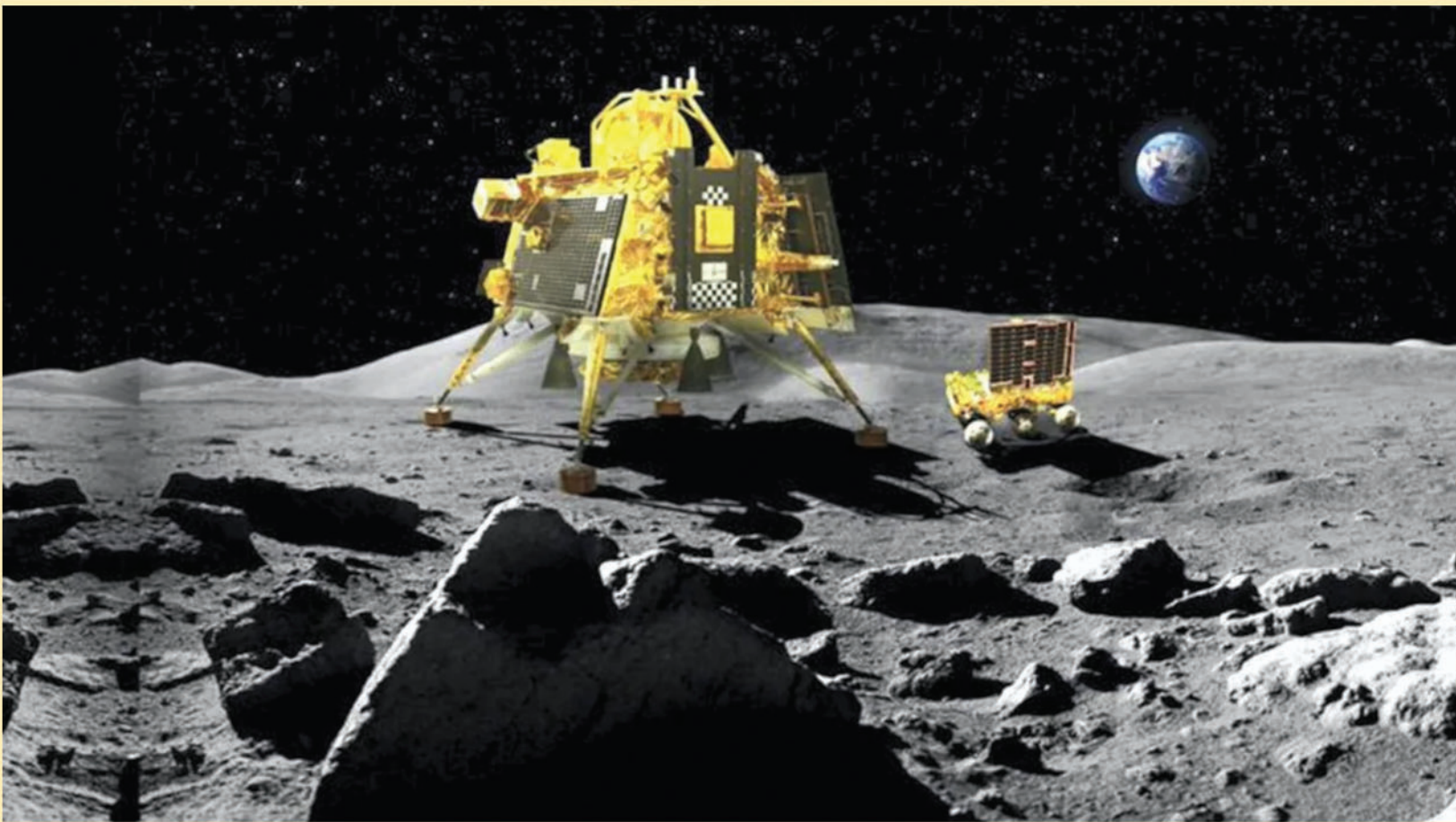


Theme 1.0 Chandrayaan Utsav

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|------|----|--|
| 1.1 | F | हमारा चंद्रयान
Our Chandrayaan |
| 1.2 | P | <i>Mera Pyara Chanda: Rani ki Khoj</i> |
| 1.3 | M | Chandrayaan Mission: Bharat's Expedition to the Moon |
| 1.4 | S | Chandrayaan: Journey Towards the Moon |
| 1.5 | S | Exploring the Moon Mission of Bharat |
| 1.6 | S | Towards Moon and Beyond |
| 1.7 | S | Exploring Chandrayaan-3: Bharat's Lunar Mission |
| 1.8 | HS | Bharat on the Moon |
| 1.9 | HS | Bharat Space Mission: The Chandrayaan Mission |
| 1.10 | HS | Physics of Chandrayaan-3 |

For participation in the activities related to Apna Chandrayaan:
Visit : www.bharatonthemoon.ncert.gov.in

For more information:
Email: dceta.ncert@nic.in
PMeVIDYA IVRS: 8800440559



An image of Rover *Pragyan* with Lander *Vikram*

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राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
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