

10. Space Missions

Space exploration is a term used to explore the outer space using the principles of astronomy and technology.

1. Dr. Vikram Sarabhai (1919–1997) is known as the father of space research in India.
2. The first step in this direction was taken by establishing TERL (Thumba Equatorial Rocket Launching Station). In 1969, ISRO (Indian Space Research organisation) was set up under the department of Atomic Energy Research.
3. Artificial satellites are used for space research.
4. After launching Aryabhata in 1975, the first Indian satellite, India gained foothold in the field of space research. Indian scientists and engineers have been able to develop many artificial satellites and launch vehicles, like GSLV (Geostationary Satellite Launching Vehicle) and PSLV (Polar Satellite Launching Vehicle).
5. Equatorial satellite revolves around the earth in an orbit just above the equator. If the time period of a revolution of the equatorial satellite is equal to that of the Earth, then the satellite is called a **geostationary satellite**.
6. Geostationary satellites are used in communicating radio, T.V. and telephone signals across the oceans.
7. The satellite that revolves along an orbit passing above the North and South Pole of the earth, at an altitude of 200 - 1000 km, is called a **polar satellite**.
8. Polar satellites are used for taking pictures of clouds; monitoring the climatic changes; remote sensing, meteorology as well as for environmental studies, spying and surveillance and monitoring the growth of crops.

Various programmes have been launched by ISRO that has helped India make its mark on international level. It has launched various satellites like METSAT, EDUSAT for purposes of weather forecast and education.

A satellite is launched into its orbit by a multistage rocket. The rocket is given sufficient velocity to acquire a desirable height, such that it never falls back to the earth but orbits around it under the influence of gravitational force.

1. Geostationary satellite

- (i) These satellites have revolution period same as that of the earth's rotation. So, they seem to be stationary with respect to the earth.

2. Indian space programmes

- (i) An organization known as Indian Space Research Organisation (ISRO) takes care of the progress of space research in India.

1. Principle of rockets

- (i) The basic principle behind the working of rocket is conservation of momentum. This principle states that the total momentum of the system remains conserved if the external force acting on the system is zero.



(ii) On firing the rocket, the gases at higher pressure escape out of the exhaust nozzle with high velocity, which provides forward thrust to the rocket.

(iii) The amount of fuel burnt and the exhaust velocity (V_e) of the gases decide the acceleration of the rocket.

Rate of fuel consumption \times exhaust velocity = mass of rocket \times acceleration = thrust

$$R \times V_e = Ma = \text{thrust on the rocket}$$

where, R is the rate of the fuel consumption

2. Multi stage rockets

(i) A single rocket is not capable of carrying heavy payloads to higher heights. So, several rockets are joined together, one on top of another, to provide the necessary power. Such type of rockets in the form of stages is known as multistage rockets.

1. Orbital velocity

(i) The velocity of a body in its circular path is known as orbital velocity.

$$(ii) v_o = \sqrt{\frac{GM_e}{R}} = \sqrt{Rg}$$

2. Escape velocity

(i) The minimum velocity required to project a body to escape from the earth's gravitational field is known as escape velocity.

$$(ii) v_e = \sqrt{\frac{2GM_e}{R}} = \sqrt{2Rg}$$

$$(iii) v_e = \sqrt{2}v_o$$

(iv) Escape velocity of earth is 11.2 kms^{-1} .

1. Sputnik was the first satellite launched by the Soviet Union in October, 1957.

2. America was the first country to send a man on the Moon.

3. In 2008, India also started its expedition to the Moon with its Chandrayaan project.

4. Chandrayaan was launched by the PSLV C-11 space vehicle from the Satish Dhawan Space centre in Sriharikota, on 22 October 2008.

5. On November 11, Chandrayaan started rotating in the polar orbit of the Moon, which is at the height of 100 km.

6. According to the plan, on November 14, Chandrayaan had to separate the Moon Impact Probe (MIP) from the mother vehicle and land it on the Moon near the South Pole.

7. The basic aim behind launching the Chandrayaan was to enhance the knowledge about the Moon.

