Chapter : 10 : **SPACE MISSION**

Topics to be learn :

* Satellite

* Space mission

* Artificial satellites

* Orbit of the artificial satellite

* Satellite Launch Vehicle

* Space missions away from the earth

* Contribution of ISRO

* Management of space debris

Sky : The visible portion of the atmosphere and outer space seen by simple eyes, without any equipment from the earth, is known as the sky.

Space :-

The infinite three dimensional expanse in which the solar system, stars, celestial bodies, galaxies and the endless universe exist is known as space .

* Both sky and space lack a definite boundary.

* The sky is a very tiny part of space.

***Objects in the Solar system:**

* Our Solar System is a small portion of the vast Milky Way Galaxy.

* The Sun is located at the center of the Solar System. Sun is a star.

* Our Solar System includes the planets **Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.** The planets orbit the Sun and have natural satellites.

www.mathsciencedears.com

* The Solar system also includes **asteroids, meteoroids, comets, and meteors.**

Satellite :- An astronomical object orbiting any planet of our Solar system is called a satellite.

* Mercury and Venus have no satellites.

* Some planets have more than one satellite. E.g. Jupiter has 69 satellites.
* The earth has one natural satellite called the moon.

Telescopes orbiting around the earth:

The following three types of telescopes are orbiting around the earth :

* Optical Refracting Telescope.

* Optical Reflecting Telescope.

* Radio Telescope.

Necessary of Telescopes to put in the space:

* Telescopes are essential in space as visible light and radio waves from celestial bodies pass through the atmosphere before reaching Earth's surface.

However the intensity of light at the surface decreases due to absorbed light and atmospheric turbulence caused by temperature and air pressure.

* City lights and bright sunlight during the day also limit the use of optical telescopes on Earth.

* To address these limitations, telescopes are placed on mountain tops, away from inhabited areas. However, these limitations persist.

* To overcome these issues, scientists have successfully launched telescopes in space, resulting in brighter and clearer images than those on Earth's surface.

www.mathsciencedears.com

Space missions :

There are 4 specific objectives of a space mission :

* (i) Launch artificial satellites into Earth's orbit for study and research.

* (ii) Launch artificial satellites into Earth's orbit for applications telecommunications, a such variety of as weather research radio and television program transmission and so on.
(iii) Launch artificial satellites beyond Earth's orbit to watch, research, and collect data on other planets, meteors, meteoroids, asteroids, and comets.

* (iv) Gain an understanding of the

Universe beyond the Solar System.

Need and missions: importance of space

Space missions are crucial for understanding the origin and evolution of our solar system and studying the universe beyond it.

Space Missions: Importance and Benefits:

* Provides communication. real-time global

* Offers entertainment and access to vast internet information.
* Aids in natural resource management.

* Provides advanced alerts and management of natural calamities and pollution.

* Provides satellite surveillance for defense purposes.

* Allows access to trade, tourism, and navigation activities.

Artificial satellite :

www.mathsciencedears.com

www.mathsciencedears.com

A manmade object orbiting the earth or any other planet is called an artificial satellite.

* Satellites work on solar energy and hence photovoltaic panels are attached on both sides of the satellite, which look like wings.

* Satellites are installed with various transmitters and other equipment to receive and transmit signals between the earth and the satellites.

► Classification of artificial satellites :

Orbits of Artificial Satellites :

Orbit of a satellite is its path around the earth.

* The function of a satellite decides its orbit.

* The orbit can be circular or elliptical. The orbital plane of a satellite can be the equatorial plane of the earth or a plane at an angle to the equatorial plane.

► Critical velocity :

Classification of satellites based on orbit height:
Based on the height of the satellite from the earth's surface, satellites are classified as follows:

* High Earth Orbit Satellites

* Medium Earth Orbit Satellites

* Low Earth Orbit Satellites

(i) High Earth Orbit Satellite (HEO) :

A satellite orbiting at a height equal to or greater than 35780 km above the earth's surface is called High Earth Orbit satellite.

www.mathsciencedears.com

* If such a satellite revolves in the equatorial plane of the earth, in the same sense as the earth's rotation and has period equal to that of the earth's rotation, it will appear stationary with respect to a place on the earth. This satellite is, therefore, called geostationary geosynchronous satellite. or

* Such satellites are used for climatology, telecommunication, transmission of TV and radio programs etc.

(ii) Medium Earth Orbit Satellite (MEO):

A satellite orbiting at a height between 2000 km and 35780 km above the earth's surface is called a Medium Earth Orbit satellite.

* The orbital path of such a satellite is normally elliptical and passes through the North and the South polar regions.

* These satellites are useful for navigation.

(iii) Low Earth Orbit Satellite (LEO): A satellite orbiting at a height between 180 km and 2000 km above the earth's surface is called a Low Earth Orbit satellite.

* Weather satellites, and International Space Station are low Earth orbit satellites.

Satellite Launch Vehicles :

* A Satellite Launch Vehicle carries an artificial satellite to a desirable height above the earth's surface and places it in the desired orbit. It needs a specific velocity as well as a thrust to reach to the desired height.

* The velocity and thrust of a Satellite Launch Vehicle depend on the weight and orbital height of the satellite. Accordingly, the structure of the launch vehicle designed. is decided and

* The weight of the fuel also contributes a major portion in the total weight of the launch vehicle. This also influences the structure of the launch vehicle.

* Launch vehicles are very costly as they can be used only once.

* To overcome this problem, USA has developed space shuttles which can chan be reused many times.

❖ **Space shuttles can be used for both,**
a) launching a satellite in space and b) journey of astronauts.

Importance vehicle: of multistage launch vehicle :-

* In order to use the fuel optimally, multiple stage launch vehicles are now designed and used.

* As the journey of the launch vehicle progresses, the vehicle achieves a specific velocity and a certain height. The fuel in the first stage is exhausted and the empty fuel tank gets detached from the main body of the launch vehicle and falls back into a sea or on unpopulated land.

* As the fuel in the first stage is exhausted, the fuel in the second stage is ignited.

* However, the weight of the launch vehicle is now less than what it was earlier and hence it can move with e with higher velocity.
* Most of the launch vehicles are made up of two or more stages.

* Polar Satellite Launch Vehicle, that is, PSLV, developed by ISRO (Indian Space Research Organisation) has four stages.

Place for satellite

Forth stage using liquid fuel

Third stage using solid fuel

Second stage using liquid fuel

First stage using solid fuel

Engine using solid fuel which provides the initial thrust

Structure of PSLV made by ISRO

Space missions away from earth :

Space missions are used to gain further knowledge about the universe. For such missions, the spacecraft must escape the earth's gravitational force to travel into the outer space. To achieve this, the initial velocity of the moving object must be greater than the escape velocity of the earth.

► Escape velocity :

Moon missions

* As of now, only Russia, USA, European Union, China, Japan and India have successfully undertaken moon missions.

* Russia executed 15 moon missions between 1959 and 1976. Of these, last four missions brought the stone samples from the moon for study and analysis. However all these missions were unmanned.
* USA executed moon missions between 1962 and 1972. Some of these missions were unmanned. However, the historic moon mission took place on 20th July 1969, when American astronaut Neil Armstrong became the first human to step on the moon.

* Indian Space Research Organisation (ISRO) successfully launched Chandrayaan-I and placed it in the orbit of the moon. It sent useful information to the earth for about a year. The most important discovery made during the mission was the presence of water on the moon's surface. India was the first country to discover this.

Mars missions:

* Many nations have sent space crafts towards Mars, but only few of these missions have been successful.

•* However, performance of Mangalyaan, the Indian spacecraft sent by ISRO towards Mars was remarkable. Mangalyaan was launched in November 2013 and was placed in the orbit of Mars successfully in September 2014. It has obtained useful information about the surface and atmosphere of Mars.

Missions to other planets :

* Some space crafts orbited the planets, some have landed on some planets and some just observed the planets, passed near them and went further to study other celestial bodies.

* Some space crafts were sent specifically to study asteroids and comets. Some space crafts have successfully brought dust and stone samples from the asteroids for study.

* All these space missions are very useful in getting information and helping us in clarifying our concepts about the origin of the Earth and the solar system.

India and space technology:

* India has indigenously built various launchers which can put the satellites having the mass up to 2500 kg in the orbit.

* Indian Space Research Organisation (ISRO) has designed and built two important launchers; Polar Satellite Launch Vehicle (PSLV) and Geo Satellite Launch Vehicle (GSLV).

* Successful space missions as well as scientific and technological accomplishments by India in space technology have made a significant contribution in the national and social development of our country.

* Many satellites in INSAT and GSAT series are telecommunication, television, broadcasting, meteorological services, disaster management and monitoring and management of natural resources.

Space Debris and its management:

* Many countries have satellites in orbit due to international cooperation and commercial prospects. However, many satellites and launcher parts are roaming freely in different orbits around the Earth, forming space debris.

* An estimated two crore pieces of satellites and launchers revolving around the Earth pose a threat to current functional satellites, space shuttles, and space stations.

* If unchecked, this collection of fragments could pose risks to future satellite and space shuttle launches and increase the possibility of space accidents.

* Research and dedicated efforts are being made to find ways to manage space debris effectively.

THANK YOU

Prepared By : Dr. P. W. MATTE

Janata Vidyalaya City Br. Ballapur Dt.Chandrapur