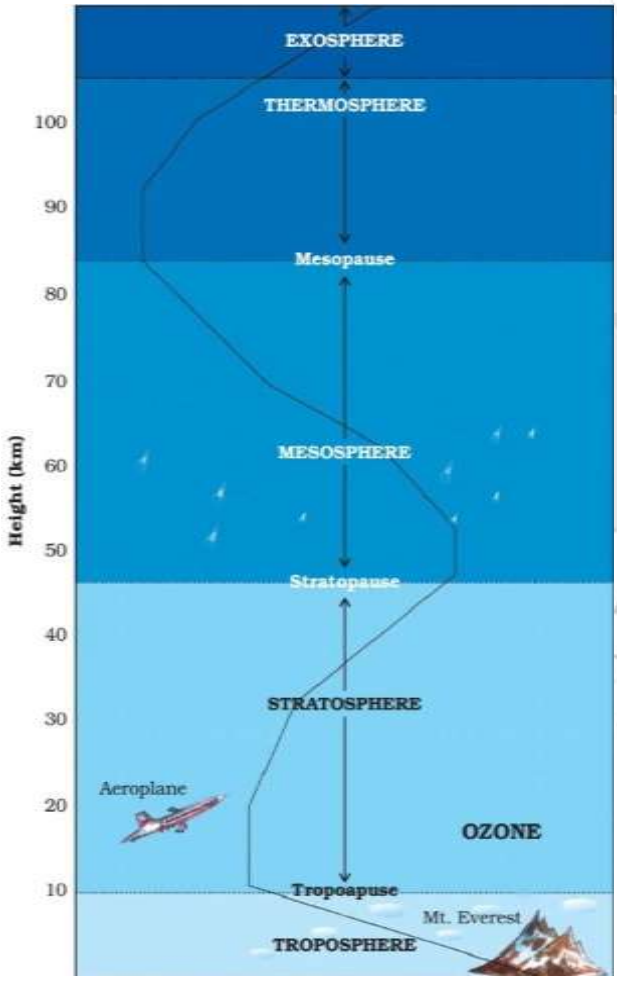
Space

Our earth is surrounded by an envelope of air that we call the atmosphere that sustains us. The atmosphere consist of mixture of gases – mainly Nitrogen, Oxygen and carbon dioxide, water vapour and minute amounts of other gases – space begins beyond the earth's atmosphere.

As earth's atmosphere is demest near the ground and becomes thinner as we go up and that's why is difficult to breathe at High altitudes. Beyond 100 km from the ground, the atmosphere is so thin that it is like a vacuum. Although there is no sharp boundary, this is where Space begins. This imaginary boundary has been named as 'Karman' line. Beyond Karman line Space extends to as far as we can see.

Layer of Atmosphere

STRUCTURE OF THE ATMOSPHERE



Our atmosphere is divided into five layers starting from the earth's surface. These are Troposphere, Stratosphere, Mesosphere, Thermosphere and Exosphere.

Troposphere: This layer is the most important layer of the atmosphere. Its average height is 13 km. The air we breathe exists here. Almost all the weather phenomena like rainfall, fog and hailstorm occur in this layer.

Stratosphere: Above the troposphere lies the stratosphere. It extends up to a height of 50 km. This layer is almost free from clouds and associated weather phenomenon, making conditions most ideal for flying aeroplanes. One important feature of stratosphere is that it contains a layer of ozone gas. We have just learnt how it protects us from the harmful effect of the sun rays.

Mesosphere: This is the third layer of the atmosphere. It lies above the stratosphere. It extends up to the height of 80 km. Meteorites burn up in this layer on entering from the space.

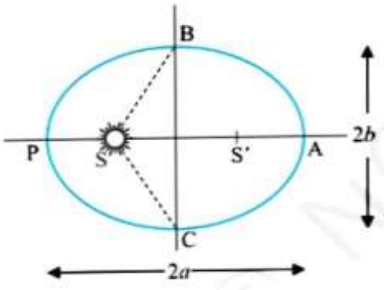
Thermosphere: In thermosphere temperature rises very rapidly with increasing height. Ionosphere is a part of this layer. It extends between 80-400 km. This layer helps in radio transmission. In fact, radio waves transmitted from the earth are reflected back to the earth by this layer.

Exosphere: The upper most layer of the atmosphere is known as exosphere. This layer has very thin air. Light gases like helium and hydrogen float into the space from here.

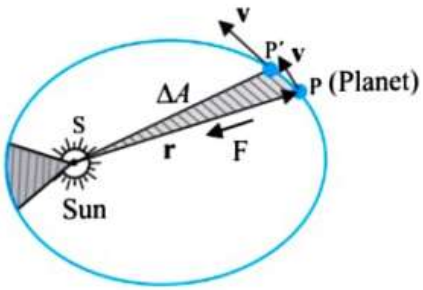
Kepler's Laws

The three laws of Kepler can be stated as follows:

1. Law of orbits: All planets move in elliptical orbits with the Sun situated at one of the foci.



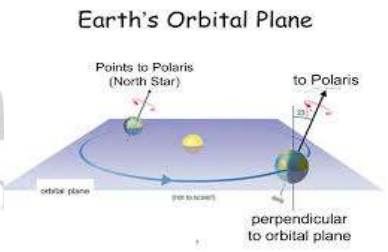
2. Law of areas: The line that joins any planet to the sun sweeps equal areas in equal intervals of time.



3. Law of periods: The Square of the time period of revolution of a planet is proportional to the cube of the semi-major axis of the ellipse traced out by the planet.

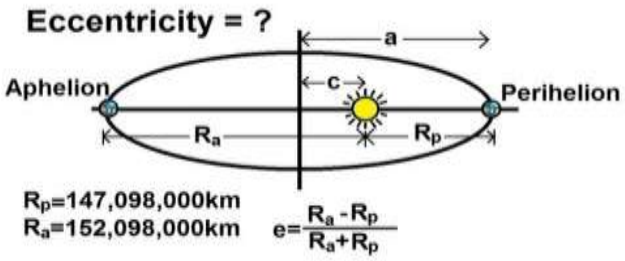
Orbit :- An orbit is a regular, repeating path that an object takes around another object or center of Gravity.

Orbital Plane:- It is a flat, disk shaped, space that connects the center of orbiting objects.



Orbital Period:- The time that the orbiting object takes in orbiting another object is known as orbital period.

Eccentricity:- It is the amount an orbits path differs from a perfect circle.



Ecc. of earth = 0.017

Ecc. of Mercury = 0.206

Types of Orbits:-

1. Galactocentric Orbits
2. Heliocentric Orbits
3. Geocentric Orbits

1) Galactocentric Orbits:- Orbit that goes around the centre of Galaxy.

For eg:- Solar system follows this type of orbit around Milky way.

2) Heliocentric Orbits:- Orbit that goes around the centre of the Sun.

For eg:- All planets in our solar system, Asteroid belts comets follow this kind of orbit.

3) Geocentric Orbits:- Orbit that goes around the center of the Earth.

For eg:- 1) Moon follows this kind of orbit.
2) All the artificial satellites revolving around the earth follows this kind of orbit.

Note:- (Artificial satellite may be heliocentric or center towards a particular planet also)

Eg:- Mars mission satellite orbiting around mars is mars centric and not Geo centric.

3.1) Low Earth Orbit (LEO) :- An orbit which is relatively close to earth's surface normally at an altitude of Range 160 km – 1000 km above earth.

(Aeroplane fly at maximum 14km – 16km above earth's surface, so even the lowest LEO is more than 10 times higher than that)

Applications –

1) Satellite imaging [nearer to earth allows it to take higher resolution images]
2) Setting up international space centers [easy to travel to and from shorter distance]
3) High orbiting speed [About 7.8 km/s, orbiting 16 times/day]
4) IRS, Rohini, Bhaskara are placed in LEO

3.1.1) Polar Orbit :- Satellites in Polar orbits travels from North to South rather than from west to east passing roughly over earth's poles.

Note – Even a deviation within 20 to 30 degrees from the poles is still classed s a Polar orbit.

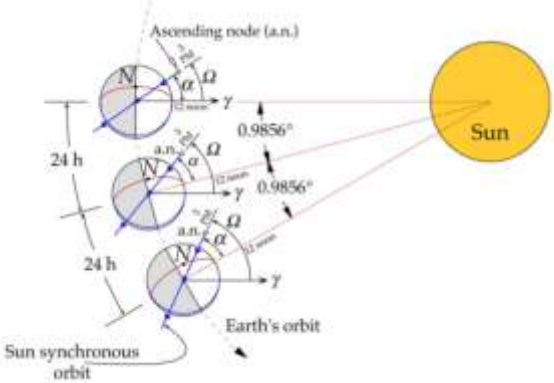
It comes under LEO [200km – 1000km]

3.1.1.1) Sun Synchronous Orbit (SSO):- It is a particular kind of polar orbit which is in synchronous with the sun i.e. they are synchronized to always be in the same 'fixed' position relative to sun.

The satellite always visits the same spot at the same local time.

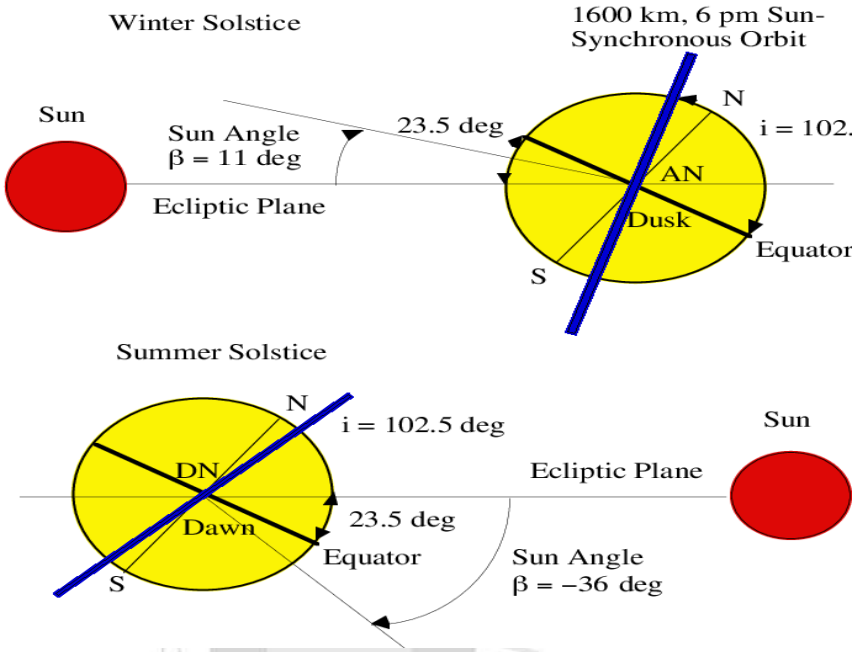
Applications –

1) Comparing changes over time using satellite images. Eg:- Aral Sea.
2) Weather pattern emerging over time.
3) Predicting weather and storms.



4) Monitoring emergency situation like Forest Fires.

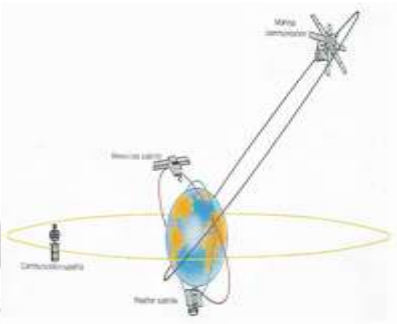
Note – SSO often synchronized at an angle where the earth never shadows them.



3.2) Medium Earth Orbit (MEO):- It comprises of wide range of orbits anywhere between LEO and GEO (HEO).

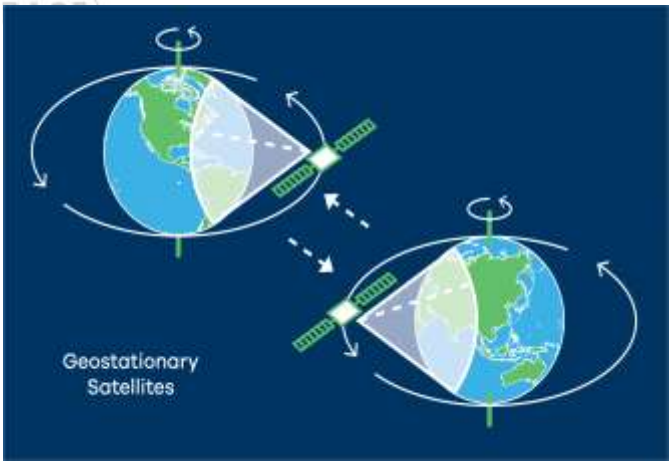
Applications –

1) Navigation (IRNSS); Galileo (Europe)
2) Communication



3.2.1) Molniya Orbit :- It is developed by Russia to check Northern hemisphere accurately for more time and remains about 2/3rd time of total period of satellite in Northern Hemisphere.

3.3) GEO Stationary Orbit (GEO) :- It is the orbit above equator of earth where satellite orbits west to east at exactly same rate as earth. Making it appear at a fixed position.

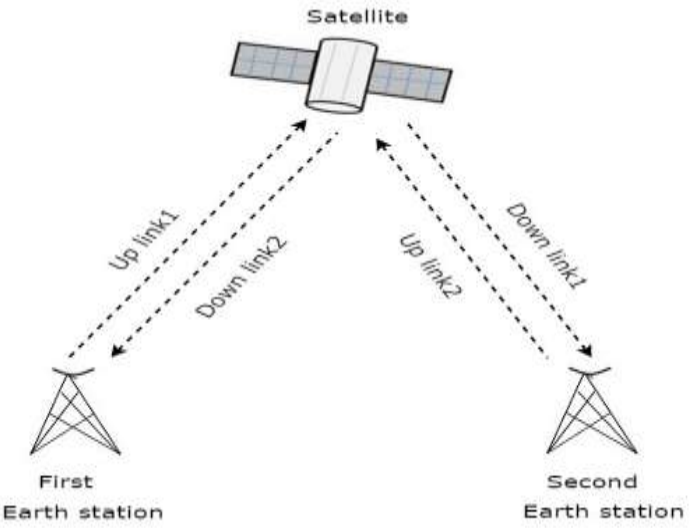


Altitude – 35786 KM

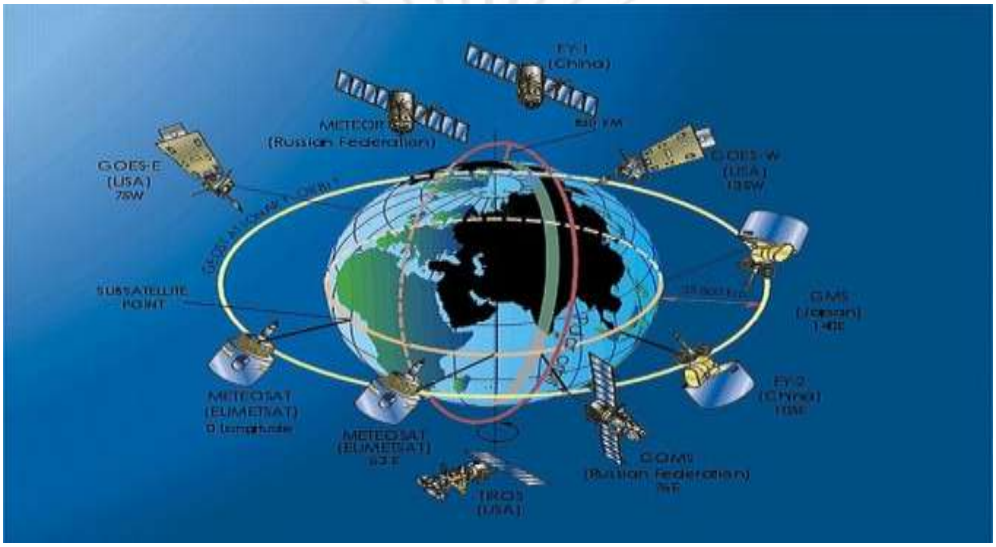
Velocity – 3 Km/s

Application –

1) Weather monitoring satellites (Continuously observing specific areas)
2) Communication Satellites –

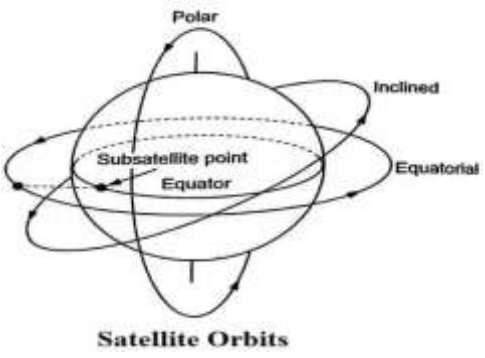


Note:- As the satellites are far away from the earth surface it covers a large area, so only 3 equally spaced satellite can give Global coverage.



3.4) GEO Synchronous Orbit –

- Orbit synchronized with earth but in inclined position.
- In GEO, antenna is fixed at one position in one direction.
- In GSO, antenna is fixed at one position but have to rotate in North south direction.



Satellite Orbits

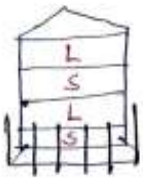
(Movement of Antenna in North-South direction)

3.5) GEO Transfer Orbits (GTO) – Transfer orbits are special kind of orbit used to get from one orbit to another.

Questions :-

1) What is the main reason for heavy space traffic at GEO?
2) How ISRO is responsible for creating India as a powerful nation among under developed countries?
3) As the height of Rocket increases in its flight, consumption of fuel becomes low. Explain?

PSLV के प्रकार -

	PSLV CA (Core Alone)	PSLV G1 (Standard)	PSLV XL (Extra Large)
			
स्ट्रैप मोटर	Zero	6-8	6-8
नीतभार Payload	800 kg	1500 kg	2500 kg
उपयोग Use	EOs	UPTO Navigation MEO	UPTO GTO HEO
कुल भार Lift off	230 Tn	295 Tn	320 Tn
ऊंचाई Height	44 m	44 m	44 m