Types of Orbit

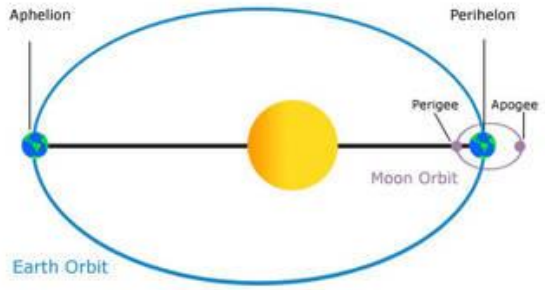
- The Indian Space Research Organisation (ISRO) on Sunday said the satellites on board its maiden Small Satellite Launch Vehicle "are no longer usable" after the SSLV-D1 placed them in an elliptical orbit instead of a circular one.
- The space agency said a committee would analyse, and make recommendations on, Sunday's episode. With the implementation of those recommendations, "ISRO will come back soon with SSLV-D2".

What Is an Orbit?

- An orbit is a regular, repeating path that one object in space takes around another one. An object in an orbit is called a satellite.
- A satellite can be natural, like Earth or the moon.
- Many planets have moons that orbit them. A satellite can also be man-made, like the International Space Station.
- Planets, comets, asteroids and other objects in the solar system orbit the sun. Most of the objects orbiting the sun move along or close to an imaginary flat surface. This imaginary surface is called the ecliptic plane.

What Shape Is an Orbit?

- Orbits come in different shapes. All orbits are elliptical, which means they are an ellipse, similar to an oval.
- For the planets, the orbits are almost circular. The orbits of comets have a different shape. They are highly eccentric or "squashed." They look more like thin ellipses than circles.
- Satellites that orbit Earth, including the moon, do not always stay the same distance from Earth. Sometimes they are closer, and at other times they are farther away. The closest point a satellite comes to Earth is called its perigee. The farthest point is the apogee.
- For planets, the point in their orbit closest to the sun is perihelion. The farthest point is called aphelion. Earth reaches its aphelion during summer in the Northern Hemisphere.
- The time it takes a satellite to make one full orbit is called its period.
- For example, Earth has an orbital period of one year. The inclination is the angle the orbital plane makes when compared with Earth's equator.



How Do Objects Stay in Orbit?

- An object in motion will stay in motion unless something pushes or pulls on it.
- This statement is called Newton's first law of motion. Without gravity, an Earth-orbiting satellite would go off into space along a straight line. With gravity, it is pulled back toward Earth.
- A constant tug-of-war takes place between the satellite's tendency to move in a straight line, or momentum, and the tug of gravity pulling the satellite back.

Where Do Satellites Orbit Earth?

- The International Space Station is in low Earth orbit, or LEO. LEO is the first 100 to 200 miles (161 to 322 km) of space.
- LEO is the easiest orbit to get to and stay in. One complete orbit in LEO takes about 90 minutes.
- Satellites that stay above a location on Earth are in geosynchronous Earth orbit, or GEO.
- These satellites orbit about 23,000 miles (37,015 km) above the equator and complete one revolution around Earth precisely every 24 hours.
- Satellites headed for GEO first go to an elliptical orbit with an apogee about 37,015 km. Firing the rocket engines at apogee then makes the orbit round. Geosynchronous orbits are also called geostationary.
- Any satellite with an orbital path going over or near the poles maintains a polar orbit. Polar orbits are usually low Earth orbits. Eventually, Earth's entire surface passes under a satellite in polar orbit.
- When a satellite orbits Earth, the path it takes makes an angle with the equator.
- This angle is called the inclination.
- A satellite that orbits parallel to the equator has a zero-degree orbital inclination. A satellite in a polar orbit has a 90-degree inclination.

THE HINDU

Regulation of minor minerals

Minor minerals vs major minerals

- Minor minerals are those which are prescribed by Mines and Minerals (Development and Regulation) Act,

1957 (section 3(e)) as being categorized as 'minor minerals'.

- Any mineral which by the notification of the Central Government may declare to be a minor mineral.
- The State Government may, by notification in the Official Gazette, make rules for regulating the grant of quarry leases, mining leases or other mineral concessions in respect of minor minerals and for purposes connected therewith.
- Major minerals are those specified in the Mines and Minerals (Development and Regulation) Act, 1957.
- Some of the major minerals include Lignite, Uranium, Coal, Gold, Iron ore, Lead-Zinc, Magnesium, Tungsten, and Diamond etc.
- Unlike major minerals, the regulatory and administrative powers to frame rules, prescribe rates of royalty, mineral concessions, enforcement, etc. are entrusted exclusively to the State governments.
- The Environment Impact Assessment (EIA) Notifications of 1994 and 2006 made environmental clearance compulsory for mining in areas more than or equal to five hectares.
- However, the Supreme Court of India after taking cognisance of a report by the Ministry of Environment, Forest and Climate Change on Environmental Aspects of Quarrying of Minor Minerals (2010) directed all State governments to make the requisite changes in the regulatory framework of minor minerals, requiring environmental clearance for mining in areas less than five hectares.
- Consequently, the EIA was amended in 2016 which made environmental clearance mandatory for mining in areas less than five hectares, including minor minerals.
- The amendment also provided for the setting up of a District Environment Impact Assessment Authority (EIAA) and a District Expert Appraisal Committee (EAC).
- The problem of illegal mining of minor minerals is often under-estimated, thus accentuating undesired environmental consequences.
- There have been numerous cases of the illegal mining of dolomite, marble and sand across States.

THE HINDU

Observations by agencies

- The United Nations Environment Programme, in 2019, ranked India and China as the top two countries where illegal sand mining has led to sweeping environmental degradation.
- Despite this, there is no comprehensive assessment available to evaluate the scale of sand mining in India.
- Protecting minor minerals requires investment in production and consumption measurement and also monitoring and planning tools.
- To this end, technology has to be used to provide a sustainable solution.

THE HINDU

The power of technology

- Satellite imagery can be used to monitor the volume of extraction and also check the mining process.
- Even for past infractions, the NGT and administrative authorities can obtain satellite pictures for the past 10 to 15 years and uncontrovertibly show how small hillocks of earth, gravel or small stone dunes have disappeared in an area.
- Drones, the internet of things (IoT) and blockchain technology can be leveraged to monitor mechanisms by using Global Positioning System, radar and Radio Frequency (RF) Locator.

What is Data Fudging?

- Data fudging on the other hand is clearly inventing data to fit the curve or trend, and is deliberate and thus harder to catch.
- It can also be included to give confusing rather than inaccurate data just to avoid greater scrutiny.

How data is often fudged?

- Factors-This starts be recognizing all factors that can positively or negatively impact the final numbers that are being presented. Note the list can be expanded to many more factors than needed just to divert attention from main causal factors.
- Sensitivity-This gives the range of answers gotten by tweaking individual factors within a certain range say +- 10 % and noting the final figures. Assumptions can be both conservative and aggressive in terms of recognizing the weightage of causal factors in order to suit the final numbers.
- Causal Equation-Recognizing the interplay between various factors due to correlation as well to the final numbers due to causing variance

changes. The causal equation can then be tweaked including playing with weightage, powers of polynomial expression, as well correlation between many factors.

THE HINDU

Coral reef

The story so far:

- The highest levels of coral cover, within the past 36 years, has been recorded in the northern and central parts of Australia's Great Barrier Reef (GBR), according to the annual long-term monitoring report by the Australian Institute of Marine Science (AIMS)

There are two types of corals:

- Hard, shallow-water corals the kind that builds reefs. Soft corals and deepwater corals that live in dark cold waters.
- Australia's Great Barrier Reef is the world's largest reef system stretching across 2,300 km and having nearly 3,000 individual reefs.
- It hosts 400 different types of coral, and gives shelter to 1,500 species of fish and 4,000 types of mollusc.
- Coral reefs support over 25% of marine biodiversity even as they take up only 1% of the seafloor.
- The marine life supported by reefs further fuels global fishing industries. Besides, coral reef systems generate $2.7 trillion in annual economic value through goods and service trade and tourism.
- In Australia, the Barrier Reef, in pre-COVID times, generated $4.6 billion annually through tourism and employed over 60,000 people including divers and guides.
- Incidentally, these fast growing corals are also the most susceptible to environmental pressures such as rising temperatures, cyclones, pollution, crown-of-thorn starfish (COTs) attacks which prey on hard corals and soon.
- Besides predatory attacks and tropical cyclones, scientists say that the biggest threat to the health of the reef is climate change-induced heat stress, resulting in coral bleaching.
- Corals share a symbiotic relationship with single-celled algae called zooxanthellae.
- The algae prepares food for corals through photosynthesis and also gives them their vibrant colouration.
- When exposed to conditions like heat stress, pollution, or high levels of ocean acidity, the zooxanthellae start producing reactive oxygen species not beneficial to the corals.

- So, the corals kick out the colour-giving algae from their polyps, exposing their pale white exoskeleton and leading to coral starvation as corals cannot produce their own food.
- Bleached corals can survive depending on the levels of bleaching and the recovery of sea temperatures to normal levels.
- Severe bleaching and prolonged stress in the external environment can lead to coral death.
- Over the last couple of decades, climate change-induced rise in temperature has made seas warmer than usual.
- Under all positive outlooks and projections in terms of cutting greenhouse gases, sea temperatures are predicted to increase by 1.5°C to 2°C by the time the century nears its end.
- The AIMS report says that the prognosis for the future disturbance suggests an increase in marine heatwaves that will last longer and the ongoing risk of COTs outbreaks and cyclones.

THE HINDU

Collegium system

- The Three Judges cases saw the evolution of the collegium system. In the First Judges case, the court held that the consultation with the CJI should be "full and effective".
- The Second Judges case introduced the collegium system in 1993. It ruled that the CJI would have to consult a collegium of his two senior-most judges in the apex court on judicial appointments.
- The court held that such a "collective opinion" of the collegium would have primacy over the government.
- It was the Third Judges case in 1998, which was a Presidential reference, which expanded the judicial collegium to its present composition of the CJI and four of his senior-most judges.

How does the collegium system work?

- The collegium of the CJI and four senior-most judges of the Supreme Court make recommendations for appointments to the apex court and High Courts. The collegium can veto the government if the names are sent back by the latter for reconsideration.
- The basic tenet behind the collegium system is that the judiciary should have primacy over the government

in matters of appointments and transfers in order to remain independent.

- However, over time, the collegium system has attracted criticism, even from within the judicial institution, for its lack of transparency. It has even been accused of nepotism.

How are judicial appointments to the Supreme Court made?

- The appointment of the CJI and judges of the apex court is governed by a Memorandum of Procedure.
- The CJI and the judges of the Supreme Court are appointed by the President under clause (2) of Article 124 of the Constitution.
- The appointment to the office of the CJI should be of the senior-most judge of the Supreme Court considered fit to hold the office.
- The Union Law Minister would, at an "appropriate time", seek the recommendation of the outgoing CJI on his successor.
- Once the CJI recommends, the Law Minister forwards the communication to the Prime Minister who would advise the President on the appointment.
- In the case of an appointment of a Supreme Court judge, when a vacancy is expected to arise in the apex court, the collegium would recommend a candidate to the Union Law Minister.
- The CJI would also ascertain the views of the senior-most judges in the Supreme Court, who hail from the High Court from where the person recommended comes from.
- The opinions of each member of the Collegium and other judges consulted should be made in writing and form part of the file on the candidate sent to the government.
- If the CJI had consulted non-judges, he should make a memorandum containing the substance of consultation, which would also be part of the file.
- After the receipt of the Collegium recommendation, the Law Minister would forward it to the Prime Minister, who would advise the President in the matter of appointment.

THE HINDU

CSIR

- The Council of Scientific and Industrial Research (CSIR) has, for the first time in its 80-year history, appointed a woman Director-General. N. Kalaiselvi, currently Director of the CSIR-Central Electro Chemical Research Institute (CSIR-

CECRI), Karaikudi, Tamil Nadu, will now lead the network of 38 laboratories and nearly 4,500 scientists, and has been appointed for two years.

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