Current Affairs 28th December 2023 by Saurabh Pandey

Huntington's disease

What is Huntington's disease Huntington's disease is a genetic disorder that affects the brain and causes the breakdown of nerve cells over time, leading to problems with movement, cognition, and behavior.

- **Huntington's disease (HD) is an inherited disorder that causes nerve cells (neurons) in parts of the brain to gradually break down and die.**
- **The disease attacks areas of the brain that help to control voluntary (intentional) movement, as well as other areas.**
- **People living with HD develop uncontrollable dance-like movements (chorea) and abnormal body postures, as well as problems with behavior, emotion, thinking, and personality.**
- **For example, uncontrolled movements in the person's fingers, feet, face, or torso.**
- **These movements are signs of chorea.**
- **They can get more intense when the person is nervous or distracted; as HD progresses, the person's movements can become more extreme and obvious.**

Who is more likely to get Huntington's disease?

- **HD is an inherited disorder. It is passed from parent to child through a mutation (a change) in a particular gene.**
- **When a parent has HD, each child has a 50% chance of inheriting the copy of chromosome 4 that carries the HD mutation.**
- **If a child does not inherit the HD mutation, he or she will not develop the disease and cannot pass it on to future generations. When HD occurs without a family history, it is called sporadic HD.**
- **HD is caused by a mutation in the gene for a protein called huntingtin. The defect causes the building blocks of DNA called cytosine, adenine, and guanine (CAG) to repeat many more times than they normally do.**
- **The Hindu**

Glutamine repeats

- **The patient's misfortune is that they carry a mutated version of a gene called HTT.**
- **The HTT gene codes for a protein called huntingtin, or Htt.**

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- Nerve cells in the human body require the Htt protein for their normal functioning and survival.
- The mutated gene, however, encodes an abnormal Htt protein that instead destroys the neurons that regulate movement, thinking, and memory.
- The normal HTT gene contains a stretch of DNA that specifies the number of times the amino acid glutamine is repeated in the Htt protein.
- This number varies from 11 to 31. In the mutant versions of the HTT gene, this stretch is expanded to encode 35 or more repeats. Researchers have even found variants with more than 150 repeats.
- The team investigated 32 genes and found that excessive expression – or overexpression – of one, called Yod1, removed all of the disease like effects in the flies, including neurodegeneration, impediments to motor activity, and lower viability and longevity.

The Hindu

Climate milestone in 2023

- Hottest year: The year is all but set to be declared the hottest in history.
- Highest sea surface temperature ever: Marine heatwaves periods when ocean temperatures are warmer than 90% of prior observations for a given time of year were widespread in 2023.
- Lowest Antarctic sea ice extent: Sea ice extent is the area of ice covering the Antarctic Ocean at a given time.
- Record carbon dioxide levels: Global carbon dioxide emissions are expected to have hit a new high in 2023, up 1.1% from 2022.
- Loss and damage fund: The world's first loss and damage fund for the impacts of climate change was created in 2023, at the start of the COP28 climate talks in the U.A.E. in early December

Impact of food systems:

- For the first time in the history of climate summits, 134 countries at COP28 pledged to tackle the climate impact of the food industry.
- These countries represent over 5.7 billion people, 70% of the food we eat, nearly 500 million farmers, and 76% of total emissions from the global food system.
- Smart Lander for Investigating Moon (SLIM)
- Japan's Smart Lander for Investigating Moon (SLIM) spacecraft entered into orbit around the moon

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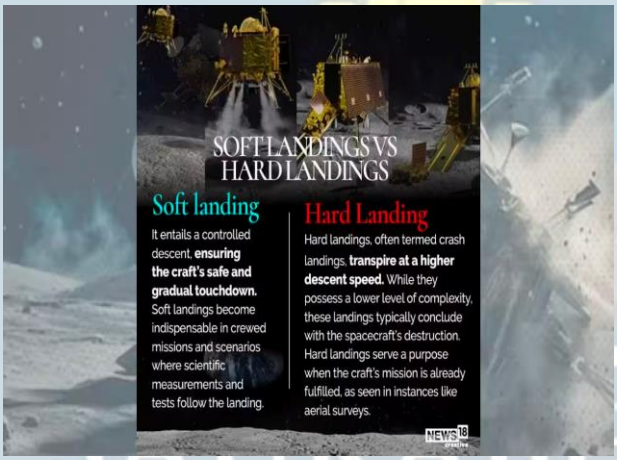
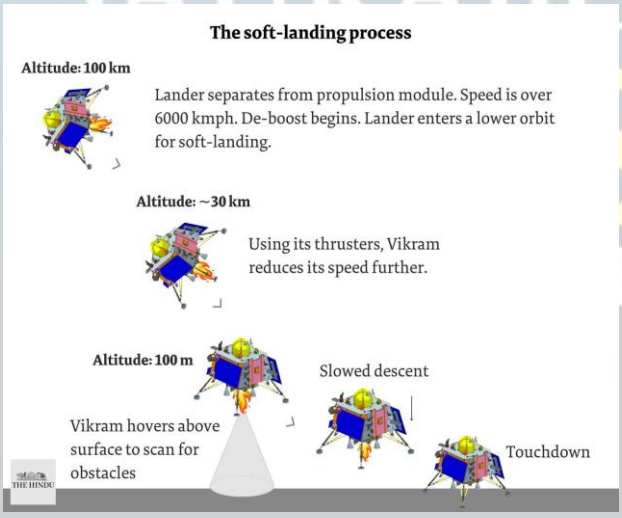
after a months-long journey, and ahead of its planned moon landing attempt on January 19.

- If the attempt succeeds, Japan will become only the fifth country to soft land a robotic craft on the natural satellite, months after India succeeded with its Chandrayaan 3 mission in August



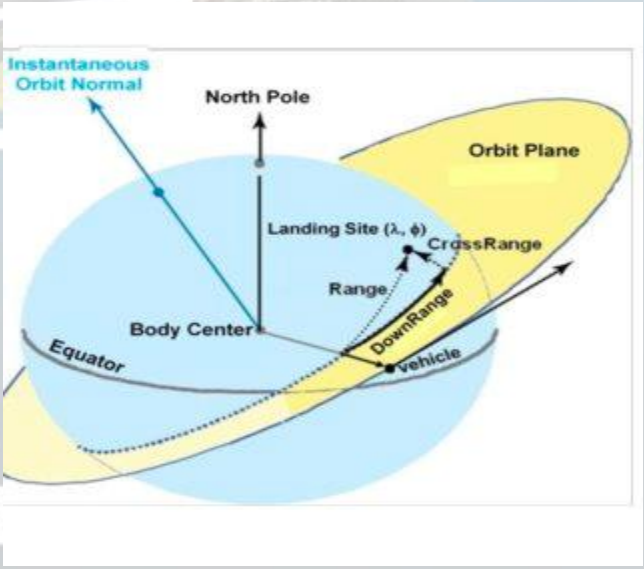


What is SLIM?

- SLIM is a spacecraft built and launched by the Japan Aerospace Exploration Agency (JAXA) on September 7, 2023, from the Tanegashima spaceport.
- It weighed only 590 kg at launch, which is almost one-seventh of Chandrayaan3, which weighed 3,900 kg at launch. Of course, the latter mission also carried a larger suite of instruments.
- SLIM was launched together with XRISM, a next generation X-ray space telescope, onboard an H2A rocket.
- The HAKUTOR M1 lander, built by Japanese company ispace, crashed in late April after its engines shut down too soon during the landing.
- How did SLIM get to the moon?
- SLIM is lighter because it carried much less fuel. Of Chandrayaan3's 3.9 tonnes, the propulsion module alone weighed 2.1 tonnes.
- This is why the mission was launched on July 14 and could reach the moon less than a month later, by following a route called the Hohmann transfer orbit.
- On the other hand, SLIM took four months because it followed a longer but more fuelthrifty route based on weak stability boundary theory.
- Once it was launched into an orbit around the earth, SLIM swung around the planet multiple times,

building up its kinetic energy with each swing.

- Once it was travelling fast enough, it shot up towards the moon's orbit.
- Chandrayaan3 followed a qualitatively similar path until this point. Once it got close to the moon, Chandrayaan3 applied its brakes – which consume fuel in space – so that it could slow down enough to be captured by the moon's weaker gravity.
- But once SLIM got near the moon, instead of slowing down and being captured by the moon's gravity, it allowed itself to be deflected in the moon's direction even as it shot past lunar orbit, deeper into space
- This deflection is the result of the combined forces exerted by the earth and the moon. Physicists worked it out in the late 1980s for another JAXA mission, called 'Hiten'.
- **What will SLIM do on the moon?**
- All this said SLIM's standout feature is its reputation as the "moon sniper" a title derived from what it will do on the moon on January 19: it will try to land within 100 metres of its chosen landing site.
- This is an unusually tight limit given the history of moon-landing missions.
- For example, the 'Vikram' lander of Chandrayaan3 was designed to descend in an elliptical area that was 4 km long downrange and 2.5 km wide cross-range, and it eventually landed at a spot 350 metres away from a predetermined one.
- (Downrange means in the direction of the craft's motion and cross-range means to either side.
- In effect, these distances specify how much the craft's path can deviate in these two directions.)



Benefit for India

- The first mission of its third phase is the Lunar Polar Exploration (LUPEX) mission, a.k.a. Chandrayaan 4.
- LUPEX will be an Indian Japan joint enterprise (however, while JAXA has approved LUPEX, India is yet to) with an earliest launch date in 2026. It will explore an area closer to the moon's

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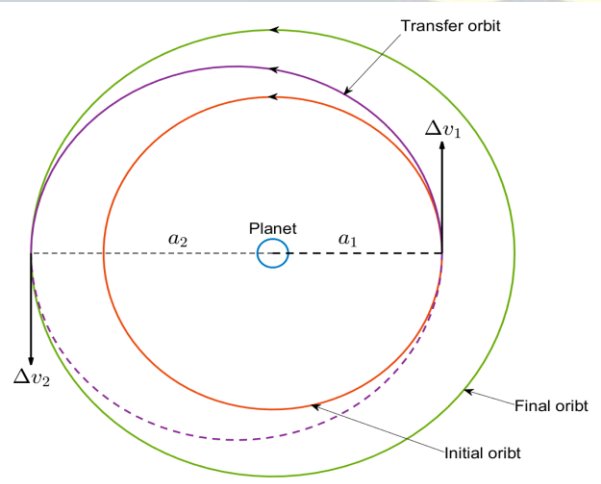
south pole than Chandrayaan 3 did – and this makes all the difference.

- The technologies JAXA will test with SLIM, but especially a feature-matching algorithm and navigation systems, will be crucial for this aspect of LUPEX.
- For now, JAXA is expected to provide the launch vehicle and the lunar rover while India will provide the lander module.
- The Hindu

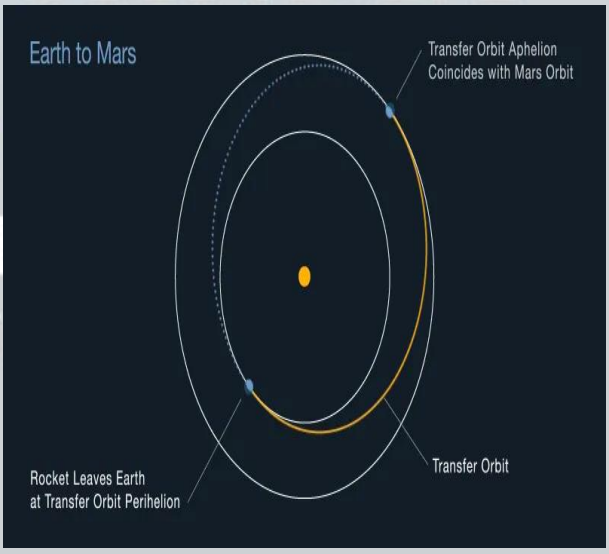
The Hohmann transfer orbit

- The Hohmann transfer orbit is an orbital maneuver used to transfer a spacecraft between two orbits of different altitudes around a central body. Examples would be used for travel between low Earth orbit and the Moon, or another solar planet or asteroid.



Hohmann Transfer Orbits

- To launch a spacecraft from Earth to an outer planet such as Mars using the least propellant possible, first consider that the spacecraft is already in solar orbit as it sits on the launch pad.
- This existing solar orbit must be adjusted to cause it to take the spacecraft to Mars: The desired orbit's perihelion (closest approach to the Sun) will be at the distance of Earth's orbit, and the aphelion (farthest distance from the Sun) will be at the distance of Mars' orbit. This is called a Hohmann Transfer orbit. The portion of the solar orbit that takes the spacecraft from Earth to Mars is called its trajectory.



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