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INDEX

1. **ASTRA Mk I Missile System**
2. **Soft robots**
3. **Liquid-Mirror Telescope**
4. **Single Use Plastic (SUP)**
5. **Indian National Space Promotion and Authorization Centre (IN-SPACE)**
6. **ICAR-National Research Centre on Equines new Vaccines**
7. **Miniproteins**
8. **Binary super massive black hole**
9. **Prasar Bharati**
10. **PSLV Orbital Experiment Module [POEM]**
11. **Leprosy**
12. **Large Hadron Collider**
13. **New material discovered can convert infrared light to renewable energy**
14. **Critical Minerals**
15. **Nairobi Flies**
16. **Direct Seeding of Rice(DSR)**
17. **Hox genes**
18. **Monkey Pox**
19. **Marburg virus**
20. **Kakrapar atomic plant**
21. **Low-Temperature Thermal Desalination (LTTD) technology**
22. **Chandler Wobble**
23. **Ocean Thermal Energy Conversion**
24. **Small Satellite Launch Vehicle (SSLV)**
25. **National Mission on Interdisciplinary Cyber-Physical Systems [NM-ICPS]**
26. **Compostable Plastic**
27. **Exo-Moons**
28. **Cosmic dust**
29. **Artemis mission**
30. **Rabies**
31. **CERVAVAC**
32. **Night Sky Sanctuary - Dark Sky Reserve**
33. **Fermi bubbles**
34. **e-SIM Technology**
35. **Ebola virus Disease**
36. **Double Asteroid Redirection Test (DART)- NASA**
37. **Rohini Sounding Rocket**
38. **Navigation with Indian Constellation (NavIC)**

39. International Mobile Equipment Identity (IMEI)
40. LVM3 M2 / OneWeb India-1 Mission
41. Grey Zone Operation
42. Compressed Bio-Gas
43. Pillars of Creation
44. Genetic Engineering Appraisal Committee (GEAC)
45. Overhauser (OVH) Magnetometer
46. India's first private satellite vehicle
47. NASA's CAPSTONE Mission
48. Photonic crystals
49. The Square Kilometer Array Observatory (SKA)
50. Base Editing
51. HPV vaccine
52. MATSYA 6000
53. Gaganyaan
54. Sepsis
55. Kala Azar
56. Local Bubbles
57. Doppler Weather Radar Network
58. ChatGPT
59. BharOS
60. Scandium Nitride
61. Aditya-L1
62. iNCOVACC
63. Neglected Tropical Diseases
64. Sickle Cell Anaemia
65. E20 Fuel
66. Deepfakes Voice
67. NISAR Mission
68. CAR T-cell Therapy
69. Diyodar Meteorite
70. Lab-Grown Diamonds (LGD)
71. India's First DNA Vaccine for Dengue
72. Earth's 5th Layer
73. Multi-Angle Imager for Aerosols mission
74. Goldilocks star
75. South Atlantic Anomaly (SAA)

1. ASTRA Mk I Missile System

In News

MoD signs over Rs 2,900 crore contract with Bharat Dynamics Limited (BDL) for procurement of ASTRA Mk I *Beyond Visual Range Air to Air Missile System* & Associated Equipment for Indian Air Force & Indian Navy.

What is it?

- ✓ **ASTRA MK-I BVR AAM** has been *indigenously Designed & Developed* by Defence Research and Development Organisation (DRDO).
- ✓ **Air to Air missile** with *BVR capability* provides large Stand-Off Ranges to own fighter aircraft which can neutralise the adversary aircraft without exposing itself to adversary Air Defence measures, thereby gaining & sustaining superiority of Air Space.
- ✓ It is fully integrated on the Su 30 MK-I fighter aircraft & will be integrated with other fighter aircraft in a phased manner, including the Light Combat Aircraft (Tejas).
- ✓ The Indian Navy will integrate the missile on the MiG 29K fighter aircraft.

LCA Tejas



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LCA Tejas

- History - The Light Combat Aircraft (LCA) programme was started by the Government of India in 1984.
- Aim - It replaced the ageing Mig 21 fighter planes.
- Designed by - Aeronautical Development Agency under the Department of Defence Research and Development.
- Manufactured by - State-owned Hindustan Aeronautics Limited (HAL).
- Features
 - The lightest, smallest and tailless multi-role supersonic fighter aircraft in its class.
 - Designed to carry a range of air-to-air, air-to-surface, precision-guided, weapons.
 - Air to air refuelling capability.
 - Maximum payload capacity of 4000 kg.
 - It can attend the maximum speed of Mach 1.8.
 - The range of the aircraft is 3,000km

Year 2020

Variants of Tejas	What is it?
Tejas Trainer	2-seater operational conversion trainer for training air force pilots
LCA Navy	Twin- and single-seat carrier-capable for the Indian Navy.
LCA Tejas Navy MK2	This is phase 2 of the LCA Navy variant.
LCA Tejas Mk-1A	This is an improvement over the LCA Tejas Mk1 with a higher thrust engine.



7994058393

www.enliteias.com enliteias@gmail.com

2. Soft robots

What is it?

- ***Soft robots are robots that are flexible and unlike their hard-edged cousins can be used to perform more delicate manoeuvres, such as reaching into difficult crevices or holding onto delicate objects.***
 - They can be programmed to execute specific tasks. These robots are usually made of ***liquid crystal elastomers***, which are polymers having viscosity and elasticity.
 - Researchers have now developed soft robots that are capable of navigating complex environments, such as mazes, without input from humans or computer software.
 - Many soft robots are made to resemble living organisms, such as octopuses, and ***are manufactured using 3-D printers.***
- **A drawback of soft robots derives from their advantage:** The soft materials reduce their durability as well as make them harder to control.
- Popular uses of these robots are in surgeries or making specialised exo-suits that can help in rehabilitating patients.

3. Liquid-Mirror Telescope

In News

A Unique Liquid-Mirror Telescope sees first light in the Indian Himalayas.

What is it?

- The telescope, commissioned at ***Devasthal, a hill in Uttarakhand***, is the first liquid mirror telescope in the country and the largest in Asia.
- It will help in surveying the sky making it possible to observe several galaxies and other astronomical sources just by staring at the strip of sky that passes overhead.
- It was built by astronomers from India, Belgium and Canada.
- It employs a 4-meter-diameter rotating mirror made up of a thin film of liquid mercury to collect and focus light.
- The scientists spun a pool of mercury which is a reflective liquid, so that the surface curved into a parabolic shape which is ideal for focusing light.
- A thin transparent film of mylar protects the mercury from wind.

- The reflected light passes through a sophisticated multi-lens optical corrector that produces sharp images over a wide field of view.
- A large-format electronic camera located at the focus records the images.
- The rotation of the earth causes the images to drift across the camera, but this motion is compensated electronically by the camera. This mode of operation *increases observing efficiency and makes the telescope particularly sensitive to faint and diffuse objects.*

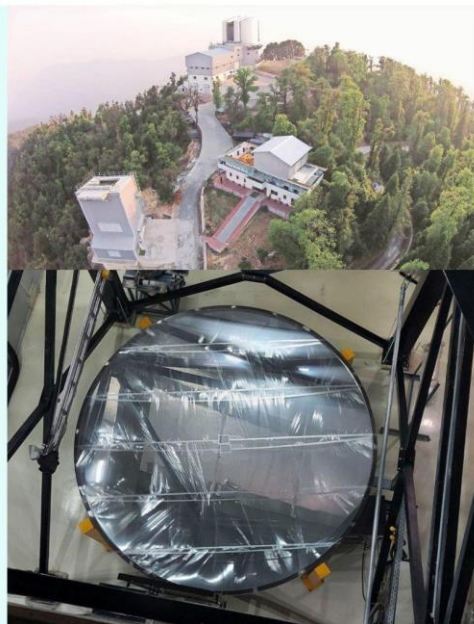
Liquid-Mirror Telescope



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Liquid-Mirror Telescope

- Location - Devasthal, a hill in Uttarakhand.
- It is the first liquid mirror telescope in the country and the largest in Asia.
- Use - It will help in surveying the sky making it possible to observe several galaxies and other astronomical sources just by staring at the strip of sky that passes overhead.
- It was built by astronomers from India, Belgium and Canada.
- It is located at an altitude of 2450 metres at the Devasthal Observatory campus of Aryabhata Research Institute of Observational Sciences (ARIES), an autonomous institute under the Department of Science and Technology (DST), Govt. of India in Nainital district, Uttarakhand.



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4. Single Use Plastic (SUP)

In News

Centre writes to States to phase out Single Use Plastic (SUP).

What is it?

- Single-use plastic products (SUPs) are used once, or for a short period of time, before being thrown away. These items are things like plastic bags, straws, coffee stirrers, soda and water bottles and most food packaging.
- We produce roughly 300 million tons of plastic each year and half of it is disposable. Worldwide only 10-13% of plastic items are recycled.
- The nature of petroleum-based disposable plastic makes it difficult to recycle and they have to add new virgin materials and chemicals to it to do so.

- Under the **Swachh Bharat Mission – Urban 2.0**, currently being implemented by MoHUA, plastic waste management, including elimination of SUP - is a crucial area of focus.
 - Under the Mission, every *Urban Local Body (ULB)* is required to adopt 100% *source segregation of waste* and have access to a Material Recovery Facility (MRF) for sorting the dry waste into further fractions for recycling and/ or processing into value-added products.

Swachh Bharat Mission-Urban 2.0

Swachh Bharat Mission-Urban 2.0

- Ministry - Ministry of Housing and Urban Affairs
- SBM-U 2.0 envisions to make all cities 'Garbage Free' and ensure grey and black water management in all cities other than those covered under AMRUT, make all urban local bodies as ODF+ and those with a population of less than 1 lakh as ODF++, thereby achieving the vision of safe sanitation in urban areas.
- The Mission will focus on source segregation of solid waste, utilising the principles of 3Rs (reduce, reuse, recycle), scientific processing of all types of municipal solid waste and remediation of legacy dumpsites for effective solid waste management.

Features of SBM-U 2.0

- Ensuring complete access to sanitation facilities to serve additional populations migrating from rural to urban areas in search of employment and better opportunities over the next 5 years
- Complete liquid waste management in cities with less than 1 lakh population.
- Material Recovery Facilities, and waste processing facilities will be set up, with a focus on phasing out single-use plastic.
- All statutory towns will become at least ODF+; and all cities with <1 lakh population ODF++.
- Regarding Solid Waste Management, it is expected that all cities will achieve at least 3-star Garbage Free certification under SBM-U 2.0.
- Special focus will be put on the well-being of sanitation and informal waste workers, through the provision of personal protective equipment and safety kits, linkages with government welfare schemes along with their capacity building.

Swachh Bharat Mission-Urban (SBM-U)

- It was announced by the PM on 15th August 2014 but the mission was formally launched on 2nd October 2014.
- Ministry - Ministry of Housing and Urban Affairs

Objectives:

- Eradication of open defecation in all statutory towns.
- 100% scientific management of municipal solid waste in all statutory towns.
- Effecting behaviour change through Jan Andolan.

IMPROVED SANITATION HELPED AVERT DIARRHEAL DEATHS

No. of deaths averted due to diarrhoea (cumulative)

Year	No. of deaths averted
2014	12,413
2015	24,826
2016	1,00,069
2017	1,82,854
2018	3,05,011*

*Estimate

Ranking cleanliness

The tables list the top six urban local bodies (ULBs) and the best performing States according to Swachh Survekshan, 2022. Indore retained the tag of India's cleanest city for the sixth consecutive time, while Madhya Pradesh is ranked first among States.

City	State	Rank
Indore	Madhya Pradesh	1
Surat	Gujarat	2
Navi Mumbai	Maharashtra	3
Visakhapatnam	Andhra Pradesh	4
Vijayawada	Andhra Pradesh	5
Bhopal	Madhya Pradesh	6

Rank	State
1	Madhya Pradesh
2	Chhattisgarh
3	Maharashtra

Source: Swachh Survekshan 2022

5. Indian National Space Promotion and Authorization Centre (IN-SPACE)

In News

Prime Minister inaugurated the Headquarters of the **Indian National Space Promotion and Authorization Centre (IN-SPACE)** in Ahmedabad, Gujarat.

What is it?

- It is an autonomous and single window nodal agency in the Department of Space for the ***promotion, encouragement and regulation of space activities of both government and private entities***. It also facilitates the usage of ISRO facilities by private entities.
- IN-SPACE will have a Chairman, technical experts for space activities, Safety experts, experts from Academia and Industries, Legal and Strategic experts from other departments, members from PMO and MEA of Government of India.
- It will permit and oversee the following activities of National Graduate Physics Examination (NGPEs):

- Space activities including building of launch vehicles and satellites and providing space-based services as per the definition of space activities.
 - Sharing of space infrastructure and premises under the control of ISRO with due consideration to on-going activities.
 - Initiation of launch campaign and launch, based on readiness of launch vehicle and spacecraft systems, ground and user segment.
 - Building, operation and control of spacecraft for registration as Indian Satellite by NGPEs and all the associated infrastructure for the same.
 - Usage of spacecraft data and rolling out of space-based services and all the associated infrastructure for the same.
- IN-SPACE will draw up an integrated launch manifest considering the requirements for ISRO, NSIL and NGPEs based on priorities and readiness level.
- IN-SPACE will work out a suitable mechanism for promotion & hand holding, sharing of technology and expertise to encourage participation of NGPEs in space activities.
 - IN-SPACE will work out a suitable mechanism to offer sharing of technology, expertise and facilities free of cost wherever feasible or at a reasonable cost basis to promote NGPEs.
- The decision of IN-SPACE shall be final and binding on all stakeholders including ISRO. NGPEs will not be required to seek separate permission from ISRO.

6. ICAR-National Research Centre on Equines new Vaccines

In News

Shri Narendra Singh Tomar launches Animal Vaccine and Kits developed by the ICAR-NRC on Equines.

What is it?

- **Ancovax Vaccine:**
- The Ancovax Vaccine on Equines is an inactivated SARS-CoV-2 Delta (COVID-19) Vaccine for Animals.
 - The immunity induced by Ancovax neutralizes both Delta and Omicron Variants of SARS-CoV-2.
 - The Vaccine contains inactivated SARS-CoV-2 (Delta) antigen with Alhydrogel as an adjuvant.
 - It is safe for dogs, lions, leopards, mice and rabbits.

➤ **CAN-CoV-2 ELISA Kit:**

- The diagnostic kits launched today include CAN-CoV-2 ELISA Kit.
- It is a sensitive and specific nucleocapsid protein-based indirect ELISA Kit for antibody detection against SARS-CoV-2 in Canines.
- There are no laboratory animals required for the preparation of the antigens.
- The Kit is made in India and a patent has been filed for the same.
- No other comparable kits for detection of antibodies in Canines are available in the market.

➤ **Surra ELISA Kit:**

- The Surra ELISA Kit is a suitable Diagnostic Assay for Trypanosoma evansi infection in multiple animal species.
- The Surra is one of the most important haemoprotozoan diseases of the different livestock species caused by Trypanosoma evansi.
- The disease is prevalent in all the agro-climatic parts of India.
- In India, losses to livestock productivity are estimated to be Rs. 44.740 Billion annually due to Surra.

➤ **Equine DNA Parentage Testing Ki:**

- The Equine DNA Parentage Testing Kit is a powerful genomic technology for parentage analysis.
- The Parentage among the Horses can be definitely established using Multiplex PCR Technology to compare allele sizes.
- At ICAR-NRC on Equines, an optimized 21 DNA Marker Panel is being used for Parentage testing.

7. **Miniproteins**

In News

IISc scientists develop miniproteins that may prevent COVID infection.

What is it?

- ***Miniproteins are smaller, rigid scaffolds that can be produced recombinantly or synthetically.*** Their small size typically results in short serum half-life, but they can bind with high affinity, and the small, robust scaffolds may act in tissues and compartments that are unavailable to larger proteins.

- Researchers at the Indian Institute of Science (IISc) Bangalore have designed a new class of artificial peptides or miniproteins that can render viruses like SARS-CoV-2 inactive.
- The *miniproteins can not only block virus entry into our cells* but also clump virus particles together, reducing their ability to infect.
- These miniproteins are helical, hairpin-shaped peptides, each capable of pairing up with another of its kind, forming what is known as a *dimer*. Each dimeric ‘bundle’ presents two ‘faces’ to interact with two target molecules.
- The miniprotein was also found to be stable for months at room temperature without deteriorating.

8. Binary super massive black hole

In News

Binary super massive black hole discovered in a system which could be site of future gravitational waves detection.

What is it?

- ***A binary black hole (BBH) is a system consisting of two black holes in close orbit around each other.***
 - Like black holes themselves, binary black holes are often divided into stellar binary black holes, formed either as remnants of high-mass binary star systems or by dynamic processes and mutual capture; and binary supermassive black holes, believed to be a result of galactic mergers.
- A group of astronomers from Argentina, Spain, Italy, USA and India has discovered a binary super massive black hole system in the gravitationally lensed blazar AO 0235+164 using extensive optical photometric observations carried out around the globe during last 4 decades (1982 - 2019).

Black Hole



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Black Hole

- Black-holes were theorized by Albert Einstein in 1915.
- A black hole is a place in space where gravity pulls so much that even light cannot get out.
- The gravity is so strong because matter has been squeezed into a tiny space.
- This can happen when a star is dying.
- Because no light can get out, people can't see black holes. They are invisible.
- Space telescopes with special tools can help find black holes.

Elements of a black hole

Accretion disc

A swirling mass of matter destined to spiral into the black hole or be ejected into space

Event horizon

Gravitational boundary beyond which neither light nor matter can escape

Relativistic jets

Matter and radiation extending out hundreds of thousands of light years

What the Event Horizon Telescope image shows us

Gravity bends light from the disc around the black hole, giving it the appearance of a halo regardless of what angle it is viewed from

Radiation from particles moving away appears dimmer. This imbalance makes the ring appear brighter on one side

Radiation from gas and dust moving towards us appears brighter

Event horizon

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9. Prasar Bharati

In News

I&B secretary releases Prasar Bharati's procurement policy.

What is it?

- Prasar Bharati is India's public broadcaster, headquartered in New Delhi. It is a *statutory autonomous body* set up by an Act of Parliament.
 - It comprises the *Doordarshan Television Network and All India Radio*, which were earlier media units of the Ministry of Information and Broadcasting.
 - The Parliament of India passed the Prasar Bharati Act to grant this autonomy in 1990, but it was not enacted until 15 September 1997.
- *The major objectives of the Prasar Bharati Corporation as laid out in the Prasar Bharati Act, 1990 are as follows:*
 - To uphold the unity and integrity of the country and the values enshrined in the Constitution.
 - To safeguard the citizen's right to be informed freely, truthfully and objectively on all matters of public interest, national or international, and to present a fair and balanced flow of information including contrasting views without advocating any opinion or ideology of its own.
 - To promote national integration.
 - To pay special attention to the fields of education and spread of literacy, agriculture, rural development, environment, health & family welfare and science & technology.

10. PSLV Orbital Experiment Module [POEM]

In News

PSLV C53 on its 55th mission, besides placing three Singaporean satellites in precise orbit, also achieved the feat of successfully launching the PSLV Orbital Experimental Module or 'POEM.

What is it?

➤ POEM

- The PSLV Orbital Experimental Module is a platform that will help perform in-orbit experiments using the final, and otherwise discarded, stage of ISRO's PSLV.
- The PSLV is a *four-stage rocket where the first three spent stages fall back into the ocean, and the final stage (PS4) after launching the satellite into orbit — ends up as space junk.*
- In PSLV-C53 mission, the spent final stage will be utilised as a “stabilised platform” to perform experiments
- POEM has a dedicated Navigation Guidance and Control (NGC) system for altitude stabilisation, which stands for controlling the orientation of any aerospace vehicle within permitted limits. The NGC will act as the platform's brain to stabilize it with specified accuracy.
- POEM will derive its power from solar panels mounted around the PS4 tank, and a Li-Ion battery
- **Utility:** POEM would enable to do cost effective experiments in orbit that can satisfy the growing demand from start-ups students and scientific communities

Polar Satellite Launch Vehicle (PSLV)



Polar Satellite Launch Vehicle (PSLV)

- Polar Satellite Launch Vehicle (PSLV) is the third generation launch vehicle of India.
- It is the first Indian launch vehicle to be equipped with liquid stages.
- first successful launch in October 1994
- It is a four stage launch vehicle.
- Major Missions - Chandrayaan-1 and Mars Orbiter Spacecraft .

				
SLV-3	ASLV	PSLV-XL	GSLV Mk II	GSLV Mk III
Height : 22.7m Lift-off weight : 17 t Propulsion : All Solid Payload mass : 40 kg Orbit : Low Earth Orbit	Height : 23.5m Lift-off weight : 39 t Propulsion : All Solid Payload mass : 150 kg Orbit : Low Earth Orbit	Height : 44m Lift-off weight : 320 t Propulsion : Solid & Liquid Payload mass : 1860 kg Orbit : 475 km Sun Synchronous Polar Orbit (1300 kg in Geosynchronous Transfer Orbit)	Height : 49m Lift-off weight : 414 t Propulsion : Solid, Liquid & Cryogenic Payload mass : 2200 kg Orbit : Geosynchronous Transfer Orbit	Height : 43.43 m Lift-off weight : 640 t Propulsion : Solid, Liquid & Cryogenic Payload mass : 4000 kg Orbit : Geosynchronous Transfer Orbit

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11. Leprosy

In News

For months there has been an acute shortage of the key drug named Clofazimine which is used in Leprosy treatment in the private market.


Clofazimine is one of the three essential drugs in the MultiDrug Treatment of Multibacillary Leprosy (MBMDT) cases, along with **Rifampicin** and **Dapsone**.

What is it?

➤ About Leprosy


- Leprosy is also known as *Hansen's Disease*
- Leprosy is a chronic, progressive bacterial infection caused by the bacterium *Mycobacterium leprae*.
- It primarily affects the nerves of the extremities, the skin, the lining of the nose, and the upper respiratory tract.
- It produces skin ulcers, nerve damage, and muscle weakness. If it isn't treated, it can cause severe disfigurement and significant disability.
- **Mode of Transmission:** Mainly by breathing airborne droplets from the affected individuals. It can be contacted at any age.
- Leprosy is curable with a combination of drugs known as Multi-Drug Therapy (MDT).
- It is common in many countries, especially those with tropical or subtropical climates including India.
- The World Health Organization (WHO) reports that leprosy is endemic in several Indian states and union territories, with an annual case detection rate of 4.56 per 10,000 population


Leprosy



Leprosy

- Leprosy is also known as Hansen's Disease.
- Leprosy is one of the oldest diseases in recorded history
- Cause - Bacteria called *Mycobacterium Leprae*
- Areas of Infection - Skin, Peripheral nerves, Upper respiratory tract and Lining of the nose.
- Mode of Transmissio - Mainly by breathing airborne droplets from the affected individuals.
- Symptoms - Red patches on the skin, skin lesion, numbness in arms, hands, and legs, ulcers on the soles of feet, muscle Weakness and excessive weight loss.
- Effect - Disfigurement, permanent nerve damage in arms and legs and even loss of sensation in the body.
- Treatment - Leprosy is curable with the combination of drugs known as Multi-Drug Therapy (MDT).





Mycobacterium leprae

LEPROSY

7994058393

www.enliteias.com enliteias@gmail.com

Government Initiatives

➤ National Leprosy Eradication Programme (NLEP):

- It is a Centrally Sponsored Scheme under the umbrella of National Health Mission (NHM).
 - The NLEP aims at eliminating leprosy in each of the districts by 2030.
 - India has achieved the goal set by the National Health Policy, 2002, elimination of leprosy as a public health problem i.e., defined as less than 1 case per 10,000 populations, at the National level.
- **SPARSH Leprosy Awareness Campaign** was launched to promote awareness and address the issues of stigma and discrimination.

12. Large Hadron Collider

In News

The world's most powerful particle collider, the Large Hadron Collider (LHC), will begin smashing protons into each other at unprecedented levels of energy.

What is it?

➤ **The LHC**

- The Large Hadron Collider is a giant, complex machine built to study particles that are the smallest known building blocks of all things.
- It is a 27-km-long track-loop buried 120 metres underground on the *Swiss-French border*.
- It was constructed by the *European Organization for Nuclear Research (CERN)* between 1998 and 2008 in partnership with over 10,000 scientists and engineers from over 100 countries, universities, and laboratories.
- The CERN convention was signed in 1953 by the 12 founding states Belgium, Denmark, France, the Federal Republic of Germany, Greece, Italy, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom and Yugoslavia, and entered into force in 1954. *India later joined as an associate member*.
- The aim of the LHC's detectors is to allow physicists to test the predictions of different theories of particle physics, including measuring the properties of the *Higgs boson* and searching for the large family of new particles predicted by super symmetric theories, as well as other unsolved questions of physics.

➤ **Operation**

- In its operational state, it fires two beams of protons almost at the speed of light in opposite directions inside a ring of superconducting electromagnets.

- *Guided by magnetic field:* The magnetic field created by the superconducting electromagnets keeps the protons in a tight beam and guides them along the way as they travel through beam pipes and finally collide.
- High precision: The particles are so tiny that the task of making them collide is akin to firing two needles 10 km apart with such precision that they meet halfway.

➤ **Achievements:**

- ***God Particle discovery:*** In scientists at CERN had announced the discovery of the Higgs boson or the ‘God Particle’ during the LHC’s first run.
 - This led to Peter Higgs and his collaborator François Englert being awarded the Nobel Prize for physics in 2013.
 - The Higgs boson is the fundamental particle associated with the Higgs field, a field that gives mass to other fundamental particles such as electrons and quarks.
- ***New Physics’ beyond Standard Model:*** After the discovery of the Higgs boson, scientists have started using the data collected as a tool to look beyond the Standard Model, which is currently the best theory of the elementary building blocks of the universe and their interactions.

➤ **Aims of New Run**

- This is the LHC’s third run, it will operate round-the-clock for four years at unprecedented energy levels of 13 tera electron volts. (A TeV is 100 billion, or 10-to-the-power-of-12, electron volts.
- The third run will see 20 times more collisions as compared to Run 1.
- Scientists hope to use the collisions to further the understanding of so-called “*dark matter*”. This hard-to-detect, hoped-for particle is believed to make up most of the universe, but is completely invisible as it does not absorb, reflect, or emit light.

13. New material discovered can convert infrared light to renewable energy

In News

Researchers discovered a material called *single-crystalline scandium nitride (ScN)* that can emit, detect, and modulate infrared light with high efficiency

What is it?

➤ **Utility of the Discovery**

- *Electromagnetic waves are a renewable energy source* used for electricity generation, telecommunication, defence and security technologies, sensors, and healthcare services.
 - Scientists use high-tech methods to manipulate such waves precisely, using specialized materials.
 - However, not all the wavelengths of light (electromagnetic waves) are easy to utilize, especially infrared light, since it is difficult to detect and modulate.
- Researchers from Bengaluru's Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute of Department of Science and Technology (DST) have discovered a novel material called single-crystalline scandium nitride (ScN) that can emit, detect, and modulate infrared light with high efficiencies
- *Infrared light is beyond the light range that is visible to the human eye, and falls between the visible light and microwave regions (the wavelength is longer than visible light).*
 - Infrared sources, emitters, and sensors are in high demand across a wide range of industries, including electronics, healthcare, defense and security, and energy.
 - The discovery is useful for solar and thermal energy harvesting as well as for optical communication devices and has significant potential in the strategic arena of defence and space as well as the power sector.

14. Critical Minerals

In News

India and Australia have decided to strengthen their partnership in the field of projects and supply chains for critical minerals.

What are Critical Minerals?

- Critical minerals are elements that are the building blocks of essential modern-day technologies, like mobile phones, computers, batteries, electric vehicles and green technologies like solar panels and wind turbines.
 - Based on their individual needs and strategic considerations, different countries create their own lists.
 - Such lists mostly include graphite, lithium, cobalt, rare earths and silicon which is a key mineral for making computer chips, solar panels and batteries.
 - Industries like Aerospace, communications and defense also rely on several such minerals as they are used in manufacturing fighter jets, drones, radio sets and other critical equipment.
- **Why is this resource critical?**

- Critical minerals are key to the transition towards clean energy and digital economy.
- The minerals help India to fulfil its ambitions to lower emissions and help India's space and defense industries, and the manufacture of solar panels, batteries and electric vehicles.
- Any disruption in the supply chain of minerals can severely imperil the economy and strategic autonomy of a country.
- Eg: China is the world's largest producer of 16 critical minerals.
- In 2010, China suspended rare earth exports to Japan for two months over a territorial dispute
- They are critical as the world is fast shifting from a fossil fuel-intensive to a mineral-intensive energy system.

➤ **Indian Initiatives**

- India has set up KABIL or the Khanij Bidesh India Limited, a joint venture of three public sector companies, to ensure a consistent supply of critical and strategic minerals to the Indian domestic market.
- KABIL would ensure mineral security of the nation, it would also help in realizing the overall objective of import substitution

15. Nairobi Flies

In News

More than a hundred students of an engineering college in Sikkim recently suffered severe skin infections after coming in contact with 'Nairobi flies'.

About

- Nairobi flies also known as Kenyan flies, are native to East Africa
- They are small, beetle-like insects, with very long bodies in orange and black colour.
 - They are mostly found in areas with high rainfall.
 - Farm pests are the primary food source of Nairobi flies, so in a way, these insects are beneficial for humans.
 - But like most insects, they are attracted to Bright lights.
 - These flies do not bite or sting, but if disturbed while sitting on anyone's skin, they release a potent acidic substance that causes burns.
 - The fluid released by these bugs can cause unusual burns, dermatitis or lesions on the skin

- More severe cases could happen if the toxin is more widespread over the body and could cause fever, nerve pains, joint pains or vomiting
- The damage of its habitat due to excessive rainfall is one of the reasons why the fly is entering human habitats in large numbers.

16. Direct Seeding of Rice (DSR)

In News

Punjab has been able to bring only 77,000 hectares (ha) under direct-seeded rice (DSR) through June 30 this year, way below the 1.2 million ha (mha) it targeted.

About

- DSR, also called the '*broadcasting seed technique*', is a *water-saving method* of sowing paddy.
 - *Seeds are directly drilled into the fields* in this method.
- In Normal transplanting paddy,
 - Farmers prepare nurseries where the paddy seeds are first sown and raised into young plants.
 - These seedlings are then uprooted and replanted 25-35 days later in the waterlogged field.
- In DSR, the pre-germinated seeds are directly drilled into the field by a tractor-powered machine.
- **Advantages of DSR**
 - Water savings [Less consumption of groundwater therefore electricity]
 - Saves labour cost.
 - *Reduce methane emissions* due to a shorter flooding period and decreased soil disturbance compared to transplanting rice seedlings.
- **Drawbacks**
 - The *seed requirement for DSR is high*, 8-10 kg/acre, compared to 4-5 kg/acre in transplanting.
 - Further, laser land levelling is compulsory in DSR. This is not so in transplanting.
 - The sowing needs to be done timely so that the plants have come out properly before the monsoon rains arrive.

- DSR technology requires *more spraying of herbicides and pesticides*. [In normal planting water prevents growth of weeds by denying them oxygen in the submerged stage]

17. Hox genes

In News

Researchers have created artificial Hox genes using new synthetic DNA technology and genomic engineering in stem cells.

What is it?

- ***Hox genes are a family of transcription factors that are major regulators of animal development.*** Unlike most genes, the order of Hox genes in the genome actually holds meaning.
 - The Hox genes are a set of transcription factor genes that exhibit an unusual property: They provide a glimpse of one way in which gene expression is translated into the many different forms that animals (metazoans) exhibit.
 - The Hox genes, in contrast, seem like an island of comprehensible structure. These are genes that specify segment identity—whether a segment of the embryo will form part of the head, thorax, or abdomen, for instance—and they are all clustered together in one (usually) tidy spot. Within that cluster, there is even further evidence of order.
- The creation of synthetic DNA and artificial Hox genes paves the way for future research on animal development and human diseases.

18. Monkey Pox

In News

Centre rushes High Level multi-disciplinary team to Kerala for supporting the State in public health interventions and investigating for Monkey Pox outbreak.

What is it?

- ***Monkeypox is a viral zoonosis*** (a virus transmitted to humans from animals) with symptoms similar to those seen in the past in smallpox patients, although it is clinically less severe.
 - Monkeypox virus is an enveloped double-stranded DNA virus that belongs to the Orthopoxvirus genus of the Poxviridae family. There are two distinct genetic clades of the Monkeypox virus: the central African (Congo Basin) clade and the West African clade.
 - The Congo Basin clade has historically caused more severe disease and was thought to be more transmissible. The geographical division between the two

clades has so far been in Cameroon, the only country where both virus clades have been found.

- Various animal species have been identified as susceptible to Monkeypox virus. This includes rope squirrels, tree squirrels, Gambian pouched rats, dormice, non-human primates and other species.
- Uncertainty remains on the natural history of Monkeypox virus and further studies are needed to identify the exact reservoir(s) and how virus circulation is maintained in nature.
- Monkeypox is usually a self-limited disease with the symptoms lasting from 2 to 4 weeks. Severe cases can occur. In recent times, the case fatality ratio has been around 3–6%.
- Monkeypox is transmitted to humans through close contact with an infected person or animal, or with material contaminated with the virus.
- Monkeypox virus is transmitted from one person to another by close contact with lesions, body fluids, respiratory droplets and contaminated materials such as bedding.
- Monkeypox is a viral zoonotic disease that occurs primarily in tropical rainforest areas of central and West Africa and is occasionally exported to other regions.
- Vaccines used during the smallpox eradication programme also provided protection against Monkeypox. Newer vaccines have been developed of which one has been approved for prevention of Monkeypox.

19. Marburg virus

In News

Ghana confirms its first outbreak of highly infectious Marburg virus.

What is it?

- Marburg virus is the causative agent of Marburg virus disease (MVD), a disease with a case fatality ratio of up to 88%, but can be much lower with good patient care. The disease formerly known as Marburg haemorrhagic fever, is a severe, often fatal illness in humans.
 - Marburg virus disease was initially detected in 1967 after simultaneous outbreaks in Marburg and Frankfurt in Germany; and in Belgrade, Serbia.
- *Marburg and Ebola* viruses are both members of the Filoviridae family (filovirus). Though caused by different viruses, the two diseases are clinically similar. Both diseases are rare and have the capacity to cause outbreaks with high fatality rates.
- The outbreak was associated with laboratory work using African green monkeys (*Cercopithecus aethiops*) imported from Uganda.

- The outbreaks and sporadic cases have been reported in Angola, the Democratic Republic of the Congo, Kenya, South Africa (in a person with recent travel history to Zimbabwe) and Uganda.
- There is as yet ***no licensed treatment proven to neutralize the virus***, but a range of blood products, immune therapies and drug therapies are currently under development.
 - Early supportive care with rehydration, and symptomatic treatment improves survival.
- *Rousettus aegyptiacus*, ***fruit bats*** of the Pteropodidae family, are considered to be natural hosts of Marburg virus.
 - The Marburg virus is transmitted to people from fruit bats and spreads among humans through human-to-human transmission.
 - Marburg spreads through human-to-human transmission via direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and with surfaces and materials (e.g. bedding, clothing) contaminated with these fluids.
- People remain infectious as long as their blood contains the virus.
 - The incubation period (interval from infection to onset of symptoms) varies from 2 to 21 days.

20. Kakrapar atomic plant

In News

Unit 3 of Kakrapar atomic plant is expected to commence commercial operation by December 2022.

What is it?

- ***Kakrapar Atomic Power Station*** is a nuclear power station in India, which lies in the proximity of Surat and Tapi River in the state of *Gujarat*.
- Phase I consist two 220 MW pressurised water reactor with heavy water as moderator (PHWR).
 - KAPP-3 is the country's first 700 MWe (megawatt electric) unit, and the biggest indigenously developed variant of the Pressurised Heavy Water Reactor (PHWR).
 - The PHWRs, which use natural uranium as fuel and heavy water as moderator, are the mainstay of India's nuclear reactor fleet.
- The nuclear power capacity constitutes less than 2% of the total installed capacity of 3,68,690 MW.



21. Low Temperature Thermal Desalination (LTTD) technology

In News

Ministry of Earth Sciences has developed indigenous technology for conversion of sea water to potable water.

What is it?

- *Low-temperature thermal desalination (LTTD) is a desalination technique which takes advantage of the fact that water evaporates at lower temperatures at low pressures, even as low as ambient temperature.*
- The system uses vacuum pumps to create a low-pressure, low-temperature environment in which water evaporates even at a temperature gradient of 8 °C (14 °F) between two volumes of water.

- Cooling water is supplied from deep sea depths of as much as 600 metres (2,000 ft). This cold water is pumped through coils to condense the evaporated water vapour. The resulting condensate is purified water.
- The LTTD technology utilizes the temperature difference available between surface water and deep-sea water. In this methodology, the warmer surface sea water is evaporated at low pressures and the vapor obtained are condensed using the colder deep-sea water.

22. Chandler Wobble

In News

On June 29, Earth sets record for the shortest day as it speeds up rotation

What is it?

- Earth completed one rotation in 1.59 milliseconds less than 24 hours, marking the shortest day ever since scientists began measuring the rotation of the Earth using atomic clocks.
- Scientists studying the Earth's rotation use a measurement called "length of day" to describe how fast or slow the planet is spinning.
 - *Length of day is the difference between the time the planet takes to complete one rotation on its axis and 86,400 seconds (24 hours).*
 - When the length of day is a positive number and rising, the Earth is spinning slower.
 - When the length of day is a negative number, the Earth is spinning faster
- There is no clear explanation for what causes speeding of Earth's rotation.
- Some scientists propose that the decrease in length of day could have something with what is known as the "**Chandler Wobble**"
 - The **Chandler Wobble** refers to a *small deviation in the Earth's axis of rotation relative to solid earth* ie, Its "poles" do not spin in a perfectly straight line.
- **Why Wobble?**
 - Since Earth is not a perfect sphere, the spinning of Earth does not always happen exactly in line with its axis, the line between the North and South Poles.
 - Spinning is also influenced by ocean tides and gravity from the Moon.

23. Ocean Thermal Energy Conversion

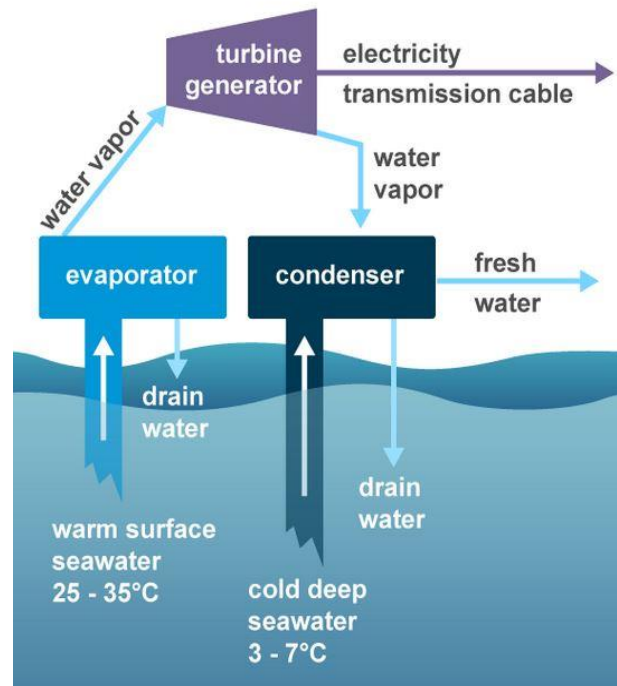
In News

The National Institute of Ocean Technology, an autonomous institute under the Union Ministry of Earth Sciences (MoES) is establishing an Ocean Thermal Energy Conversion plant with a capacity of 65 kilowatt (kW) in Kavaratti, the capital of Lakshadweep.

About

- Ocean thermal energy conversion (OTEC) is a technology for producing energy by harnessing the temperature differences (thermal gradients) between ocean surface waters and deep ocean waters.
 - Energy from the sun heats the surface water of the ocean.
 - In tropical regions, surface water can be much warmer than deep water.
 - This temperature difference can be used to produce electricity and to desalinate ocean water.
 - The OTEC technology uses the *temperature difference between the cold water in the deep sea (5°C) and the warm surface seawater (25°C)* to generate clean, renewable electricity.
 - The technology requires a minimum of 20°C difference between the surface and deep ocean temperatures.
 - Warm surface water is pumped through an evaporator containing a working fluid. The vaporized fluid drives a turbine/generator.
 - The vaporized fluid is turned back to a liquid in a condenser cooled with cold ocean water pumped from deeper in the ocean.
 - OTEC systems using seawater as the working fluid can use the condensed water to produce desalinated water.

- **Significance for India:** India is geographically well-placed for deploying this system



and has a total OTEC potential of 180,000 MW

24. Small Satellite Launch Vehicle (SSLV)

In News

The maiden lift-off of ISRO's SSLV ended in failure after the two satellites — EOS-02 and AzaadiSAT — were placed in an elliptical orbit instead of a circular one, rendering them 'no longer usable'.

About SSLV

- SSLV is a rocket that is designed to orbit satellites weighing less than 500kg in Low Earth Orbit and 300 kg to Sun Synchronous Orbit (SSO).
- It is a **3 stage Launch Vehicle** configured with three Solid Propulsion Stages and liquid propulsion-based Velocity Trimming Module (VTM) as a terminal stage.
 - It will take only 72 hours to integrate, unlike the 70 days taken now for a launch vehicle. Only six people will be required to do the job, instead of 60 people
- The SSLV is intended to cater to a market for the launch of small satellites into low earth orbits which has emerged in recent years on account of the need for developing countries, private corporations and universities for small satellites.
- The launch of small satellites has until now been dependent on 'piggy-back' rides with big satellite launches on ISRO's Polar Satellite Launch Vehicle (PSLV)

Small Satellite Launch Vehicle(SSLV - D2)



Why in news?

- The Indian Space Research Organisation (ISRO) successfully launched the second edition of the Small Satellite Launch Vehicle (SSLV-D2) from the first launch pad of Satish Dhawan space centre at Sriharikota, Andhra Pradesh.
- It placed the Indian Space Research Organisation (ISRO) earth observation satellite EOS-07 and two co-passenger satellites — Janus-1 and AzaadiSat2

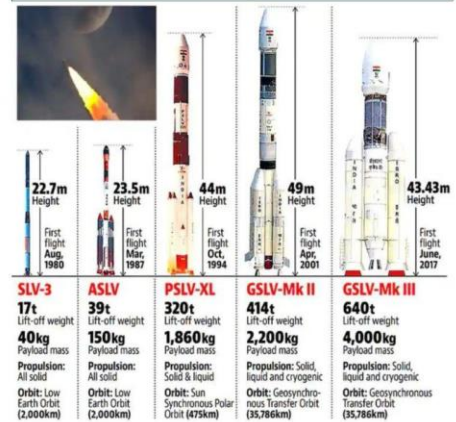
SSLV

- The SSLV aims to service the rapidly expanding market for the launch of tiny satellites into LEO (Earth's low orbits)
- SSLV is a three-stage Launch Vehicle configured with three solid propulsion stages and a liquid propulsion-based velocity trimming module as a terminal stage.
- SSLV can transport satellites weighing less than or equal to 500 kg.
- SSLV is ISRO's lightest launch vehicle, weighing around 110 tons.

Janus-1

- Janus-1 is a technology demonstrator satellite built by United States-based Antaris and its Indian partners XDLinks and Ananth Technologies.
- It weighs only 10.2 kg and is a six-unit cube satellite with five payloads on board — two from Singapore, and one each from Kenya, Australia, and Indonesia.

Other Launch Vehicles Use by ISRO



AzaadiSat2

- The payloads have been built by 750 girl students from across India.
- The payloads include: LoRa amateur radio, a sensor to measure radiation levels in space, and sensors to measure the health of the satellite such as temperature, reset count, and inertial data.

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www.enliteias.com enliteias@gmail.com

25. National Mission on Interdisciplinary Cyber Physical Systems [NM-ICPS]

In News

Experts from the India and United States interacted to bring out the best plans for joint research projects that would be implemented through the **Technology Innovation Hubs (TIH)**.

Six TIHs under NM-ICPS have been identified for collaborative research and development with US National Science Foundation

National Mission on Interdisciplinary Cyber-Physical Systems

- It is being implemented by Department of Science & Technology under Ministry of Science and Technology for a period of five years.
- It is comprehensive mission to address technology development, application development, human resource development & skill enhancement, entrepreneurship and start-up development in Cyber-Physical Systems and associated technologies.
- It is aimed at complete convergence with all stakeholders by establishing strong linkages between academia, industry, Government and International Organizations.

- The Mission aims at establishment of 15 numbers of Technology Innovation Hubs (TIH), six numbers of Application Innovation Hubs (AIH) and four numbers of Technology Translation Research Parks (TTRP).
- These Hubs & TTRPs will connect to Academics, Industry, Central Ministries and State Government in developing solutions at reputed academic, R&D and other organizations across the country in a hub and spoke model
- The Mission has 4 major objectives:
 - Technology Development;
 - HRD & Skill Development;
 - Innovation, Entrepreneurship & Start-ups Ecosystem Development;
 - International Collaborations.
- **Cyber Physical Systems (CPS)** are a new class of engineered systems that integrate computation and physical processes in a dynamic environment. CPS encompasses technology areas of Cybernetics, Mechatronics, Design and Embedded systems, Internet of Things (IoT), Big Data, Artificial Intelligence (AI) among others.

26. Compostable Plastic

In News

Union Minister Dr Jitendra Singh approves StartUp loan for manufacturing and commercialising Compostable Plastic.

What is it?

- **Compostable plastics are derived from renewable materials like corn, potato, and tapioca starches, cellulose, soy protein, and lactic acid.**
 - Compostable plastics are non-toxic and decompose back into carbon dioxide, water, and biomass when composted.
 - Compostable plastics are made from **Polylactic Acid (PLA)**. PLA is made from dextrose, a sugar produced by plants.
 - The composite is a unique blend of Thermoplastic-Starch (TPS)-glycerin with some chemical modifications that provides higher strength with low manufacturing cost.
 - The granules prepared from this composite can be moulded into any shape and used as per the requirement, and it further breaks down into natural substances once thrown out.
- Currently, the most common raw material for PLA is field corn, although other plant sources may be used in the future.

- The production of PLA resin uses about 52% less energy than the production of petroleum-based resins. Manufacturing of PLA resin produces *80% less greenhouse gases than traditional petroleum-based resin.*
- Compostable plastics will *not fully break down on their own, as litter, or in marine environments. They need to be composted at commercial composting facilities* that have the equipment to grind up and compost material for a longer period of time.
- Compostable plastics are the best choice for foodservice ware that will have food residue.
- Compostable plastics are not the same as biodegradable, oxo-biodegradable, or bio-based conventional plastics. Some of the first alternative plastics were hybrid plastics made of both petroleum-based and plant-based resins. These hybrid plastics were not truly compostable because they contained petroleum.

27. Exo-Moons

In News

Scientists formulate model to trace elusive exo-moons from JWST data.

What is it?

- ***Exomoons are natural satellites that revolve around exoplanets.***
 - ***Exoplanets are planets orbiting stars other than the Sun.***
- Five thousand exoplanets have been discovered by using several ground-based and space telescopes such as Kepler, CoRoT, Spitzer, and Hubble space telescopes.
 - The natural satellites or exomoon around any of these planets still remain untraced.
- A large number of exomoons are expected to be present, and they may play a crucial role in the habitability of rocky exoplanets in the habitable zone of their host stars.
- Most exoplanets are detected through photometric transit method, signals from exomoons are too weak to detect mainly because of their extremely small size.
- Scientists have developed a model to trace the so far elusive exomoons.
 - Scientists at the Indian Institute of Astrophysics, Bangalore, an autonomous institute of the Department of Science and Technology, have demonstrated that the newly launched ***James Webb Space Telescope (JWST)*** is sufficiently powerful to detect the transit signal of exomoons in the photometric light curves of moon hosting exoplanets.

- The co-alignment or non-coalignment of the orbits of the planet and the moon are used as parameters (using two angular parameters), and they can be used to model all the possible orbital alignments for a star-planet-moon system.
- Using these generic models and the analysis of photometric transit light curves of exoplanets that is being obtained by JWST, a large number of exomoons can be detected in near future.

28. Cosmic dust

In News

Study of dust from cosmic dance of a white dwarf and companion star could unravel mysteries behind start of life.

What is it?

- ***Cosmic dust, also called extraterrestrial dust or space dust, is dust which exists in outer space, or has fallen on Earth. Most cosmic dust particles measure between a few molecules and 0.1 mm (100 micrometers).***
 - Cosmic dust consists of tiny particles of solid material floating around in the space between the stars.
 - Dust is formed in stars and is then blown off in a slow wind or a massive star explosion. The dust is then ‘recycled’ in the clouds of gas between stars and some of it is consumed when the next generation of stars begins to form.
 - The dust converts the stolen starlight it absorbs into light at longer wavelengths. Astronomers can see the dust shining using special instruments sensitive to the far-infrared and submillimeter part of the electromagnetic spectrum.
- Hundreds of kilograms of such dust fall on the Earth every day.

29. Artemis mission

In News

NASA's mightiest rocket lifts off 50 years after Apollo.

About the Mission

- Artemis is a series of increasingly complex missions that will *enable human exploration to the Moon and Mars.*
- It is the mission in which NASA will land the *first woman and first person of colour on the Moon.*
- It will be the first long-term presence on the Moon.
- This will help in sending the first astronauts to Mars.



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I have done my complete preparation in general studies papers as well as optional subject (Philosophy) at Enlite IAS. I have also attended the current affairs classes and the Interview program there. I owe my success largely to the guidance and support I received from team Enlite and especially Mahesh Sir. I'm glad that I made the right choice in choosing the best institute.

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Additional District Magistrate (HQ)
– Central Islands & Minicoy
UPSC 2018 AIR 66



I cannot quantify in words the support provided by Team Enlite in helping me secure 66th rank in Civil Services Examination 2018. Personal care provided by the mentors - Abhilash sir, Mahesh Sir, Abu Sir helped me complete the syllabus in an efficient manner in less than seven months. True to their motto team Enlite enlightens anyone who associate with them and I owe my success completely to ENLITE IAS

Dr. Aswathy Srinivas IAS
Subcollector, Thiruvananthapuram
UPSC 2019 AIR 40



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- The mission has three phases: Artemis I, Artemis II, and Artemis III.

ARTEMIS I	ARTEMIS II	ARTEMIS III and Beyond
+	+	+
Artemis I will be an uncrewed flight test of the Space Launch System and the Orion spacecraft around the Moon.	Artemis II will be the first crewed flight test of the Space Launch System and the Orion spacecraft around the Moon.	Planning is underway for a regular cadence of Artemis missions with crew on and around the Moon.

Artemis I Mission



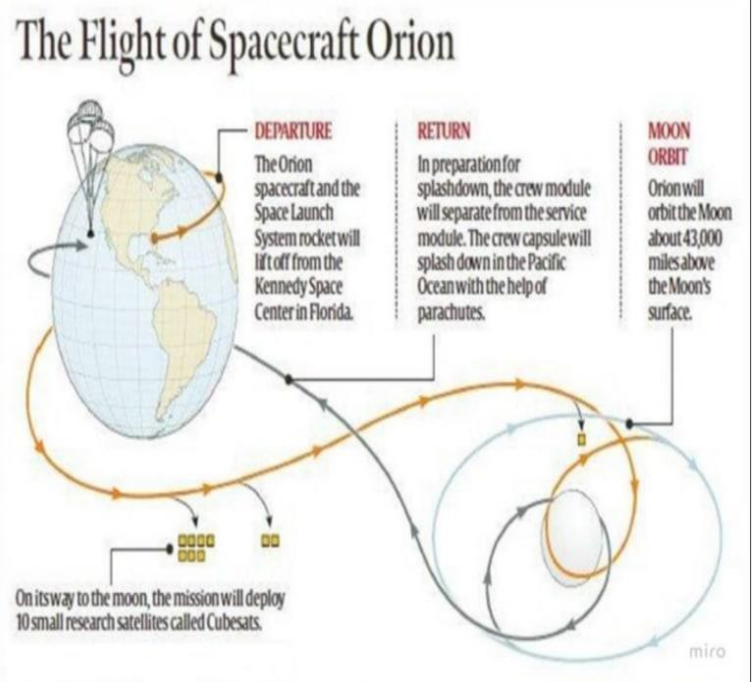
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Why in news?

- National Aeronautics and Space Administration (NASA) has successfully launched its unmanned Moon mission Artemis I on 16th November 2022.

Artemis I Mission

- Named after the sister of Apollo in Greek mythology, it is NASA's successor to the Apollo lunar missions from fifty years ago.
- It will test the agency's Space Launch System (SLS) rocket and Orion crew capsule
- Artemis I is the first in a series of increasingly complex missions to build a long-term human presence at the Moon for decades to come.
- Aim - Artemis I are to demonstrate Orion's systems in a spaceflight environment and ensure a safe re-entry, descent, splashdown, and recovery prior to the first flight with crew on Artemis II.
- It is only a lunar Orbiter mission even though, unlike most Orbiter missions, it has a return-to-Earth target.



30. Rabies

What is it?

- ***Rabies is a preventable viral disease most often transmitted through the bite of a rabid animal.***
- The rabies virus infects the central nervous system of mammals, ultimately causing disease in the brain and death.
- The vast majority of rabies cases reported each year occur in wild animals like bats, raccoons, skunks, and foxes, although any mammal can get rabies.
- Rabies virus belongs to the order Mononegavirales, viruses with a nonsegmented, negative-stranded RNA genomes.
- ***Rabies is an RNA virus.***
- The genome encodes 5 proteins designated as N, P, M, G, and L.
- The arrangement of these proteins and the RNA genome determine the structure of the rabies virus.
- Rabies vaccine can prevent rabies if given to a person after an exposure.
- After an exposure or potential exposure to rabies, the wound site should be thoroughly cleaned with soap and water.
- The vaccine should be given as soon as possible after exposure but may be effective any time before symptoms begin.
- Once symptoms begin, rabies vaccine is no longer helpful in preventing rabies

31. CERVAVAC

In News

Union Minister Dr Jitendra Singh announces *India's first indigenously developed vaccine, "CERVAVAC" for the prevention of cervical cancer.*

What is it?

- ***CERVAVAC is India's first indigenously developed quadrivalent human papillomavirus (qHPV) vaccine for the prevention of cervical cancer.***
 - Cervical cancer is a type of cancer that occurs in the cells of the cervix — the lower part of the uterus that connects to the vagina.
 - Cervical cancer ranks as the 2nd most prevalent cancers in India and accounts for nearly one-fourth of the world's cervical cancer deaths despite being largely preventable.
- It is estimated that HPV types 16 and 18 (HPV-16 and HPV-18) together contribute to approximately 70% of all invasive cervical cancer cases worldwide.
- CERVAVAC is a ***quadrivalent vaccine***, meaning it is effective against at least four variants of cancer-causing Human Papilloma Virus (HPV).

- **The key initiatives are** - Indo-US Vaccine Action Programme, National Biopharma Mission, Ind-CEPI Mission, and Mission COVID Suraksha.

32. Night Sky Sanctuary - Dark Sky Reserve

In News

India's first-ever Night Sky Sanctuary to be set up in Ladakh; the proposed Dark Sky Reserve will be at **Hanle**, Ladakh

What is it?

- A Dark Sky Sanctuary is public or private land that has an exceptional or distinguished quality of starry nights and a nocturnal environment that is protected for its scientific, natural, or educational value, its cultural heritage and/or public enjoyment.
 - A sanctuary differs from a Dark Sky Park or Reserve in that it is typically situated in a very remote location with few (if any) nearby threats to the quality of its dark night skies and it does not otherwise meet the requirements for designation as a park or reserve.
- The typical geographic isolation of Dark Sky Sanctuaries significantly limits opportunities for public outreach, so a sanctuary designation is specifically designed to increase awareness of these fragile sites and promote their long-term conservation.
- The proposed Dark Sky Reserve will be located in Ladakh as a part of Changthang Wildlife Sanctuary.
 - Hanle is best suited for the project as it is located in Ladakh's cold desert region, away from any form of human disturbance and clear sky conditions and dry weather conditions exist throughout the year.
 - It will boost Astro tourism in India and will be one of the world's highest-located sites for optical, infra-red, and gamma-ray telescopes.

Dark Sky Reserve



Dark Sky Reserve

- Announced by - Department of Science & Technology (DST)
- Location - Hanle, Ladakh
- Other Place Near to it -Changthang Wildlife Sanctuary.

What is it and who designates it ?

- It is a designation given to a place that has policies in place to ensure that a tract of land or region has minimal artificial light interference.
- The International Dark Sky Association is a U.S.-based non-profit that designates places as International Dark Sky Places, Parks, Sanctuaries and Reserves

Why the designation is significant?

- Boost astro tourism that result in generation of employment for youth.
- Enhance region based astronomical studies.
- Astronomical knowledge and skill for local people.



33. Fermi bubbles

In News

No Gamma rays from a dwarf galaxy solve an astronomical puzzle.

What is it?

- ***The Fermi bubbles are two large structures in gamma-rays above and below the Galactic center.***
 - They are associated with the microwave haze around the Galactic center discovered in the WMAP data and recently confirmed in the Planck data.
 - These mysterious structures emerge above and below the center of our galaxy, spanning a total length of about 50,000 light-years.
 - The Fermi Bubbles emit higher-energy gamma rays than the rest of the galaxy's disk.
- The bubbles may be related to the release of vast amounts of energy emitted from the supermassive black hole at the center of Milky Way galaxy.
 - In other galaxies, supermassive black holes that ingest large amounts of matter can power high-energy jets, similarly the Milky Way's central black hole went

through such a phase in the past, producing jets responsible for the Fermi Bubbles.

34. e-SIM Technology

In News

The eSIM (or embedded SIM) is quickly becoming mainstream due to fitness-oriented smartwatches and smartphones.

What is an eSIM?

- An eSIM is an embedded SIM, essentially the same hardware of a regular SIM card chip, but now a permanently embedded part of the motherboard of a watch or smartphone.
- eSIMs were first established a decade ago in 2012, but despite their futuristic use-cases, have not completely made physical SIMs obsolete yet.

➤ Advantages of eSIMs

- Convenience: It will also save a trip to a telecom store/ service centre when you visit a different state or country where you may want to switch to another operator.
- Security: When a phone with a physical SIM card is lost or stolen , the SIM card can be used in illegal activities .An eSIM prevents this, as there is no physical element to pull out and use in another device.
- One less opening on your phone: Having an eSIM also means there is one less opening on the frame of your phone, in theory, which should reduce the likelihood of elements like dust and water entering the phone from yet another slot.

➤ Disadvantages of eSIMs

- Emergencies: Traditional SIMs can be quickly pulled out of the affected/Damaged phone and into another backup device or secondary phone. It is ***not possible*** with eSIMs.
- Unusable in countries with no eSIM support: It cannot be used in a country where the telecom operators simply don't support the technology yet.
- Support only available in premium phones: In India, eSIM support is currently available on more expensive devices like the Apple iPhones, Google Pixel series etc

35. Ebola virus Disease

In News

Recently, an outbreak of Ebola Virus Disease (EVD) has been declared in Uganda following the confirmation of a relatively rare Sudan strain case.

About: Ebola Virus Disease (EVD)

- EVD, formerly known as Ebola haemorrhagic fever is a deadly disease with occasional outbreaks that occur mostly on the African continent.
 - Ebola virus was first discovered in 1976 near the Ebola River in what is now the Democratic Republic of Congo.
 - It most commonly affects people and nonhuman primates (such as monkeys, gorillas, and chimpanzees).
- It is caused by an infection with a group of viruses within the genus Ebolavirus:
 - Ebola virus (species Zaire ebolavirus)
 - Sudan virus (species Sudan ebolavirus)
 - Taï Forest virus (species Taï Forest ebolavirus, formerly Côte d'Ivoire ebolavirus)
 - Bundibugyo virus (species Bundibugyo ebolavirus)
 - Reston virus (species Reston ebolavirus)
 - Bombali virus (species Bombali ebolavirus)
- **Host:** Fruit bats of the Pteropodidae family are natural Ebola virus hosts.
- **Transmission:**
 - Animal to Human Transmission occurs through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as fruit bats, chimpanzees, gorillas, monkeys, forest antelope or porcupines found ill or dead or in the rainforest.
 - Human-to-Human Transmission occurs via direct contact (through broken skin or mucous membranes) with the Blood or body fluids of a person who is sick with or has died from Ebola.
- **Diagnosis:**
 - It can be difficult to clinically distinguish Ebola from other infectious diseases such as malaria, typhoid fever, and meningitis but confirmation that symptoms are caused by Ebola virus infection are made using the following diagnostic methods:

- ELISA (antibody-capture enzyme-linked immunosorbent assay)
- Reverse transcriptase polymerase chain reaction (RT-PCR) assay, etc.

➤ **Vaccines:**

- The Ervebo (rVSV-ZEBOV) vaccine has been highly effective in containing the disease.
- However, this vaccine has only been approved to protect against the Zaire strain of the virus.

36. Double Asteroid Redirection Test (DART)- NASA

In News

Recently, NASA's Double Asteroid Redirection Test (DART) successfully crashed into *Dimorphous*.

About the DART Mission

- It is a planetary defence-driven test of technologies for ***preventing an impact on Earth by a hazardous asteroid.***
 - It was designed to assess how much a spacecraft impact deflects an asteroid through a transfer of momentum by hitting the asteroid head on and attempting to slow it
- DART is the first technology demonstration of the **kinetic impactor technique** that could be used to mitigate the threat of an asteroid hitting Earth.
- The kinetic impactor mitigation technique is the impulsive deflection of the asteroid through the sudden addition of momentum. In simpler terms, DART is being sent to collide with an asteroid to change its orbital period
 - This method will have DART deliberately collide with a target asteroid—which poses no threat to Earth—in order to change its speed and path.
- DART's target is the binary, near-Earth asteroid system *Didymos*, composed of the roughly 780-meter -diameter “Didymos” and the smaller, approximately 160-meter size “Dimorphos,” which orbits Didymos. DART will impact Dimorphos to change its orbit within the binary system.
- The goal of the mission is to determine how much DART's impact altered the moonlet's velocity in space by measuring the change in its orbit around Didymos.
- **Didymos Asteroid Pair**
- *Didymos* – which means "twin" in Greek – was discovered on April 11, 1996

- Asteroid *Didymos* and its small moonlet *Dimorphos* make up what's called a binary asteroid system – meaning the small moon (Dimorphos) orbits the larger body (Didymos).
- The two asteroids are not a threat to Earth, but because they do pass relatively close to Earth, they were chosen as the target for NASA's Double Asteroid Redirection Test (DART) mission – the agency's first mission to test planetary defense technology.

➤ **Follow-up mission: Hera**

- The European Space Agency is developing Hera, a spacecraft that will be launched to Didymos in 2024 and arrive in 2027 (5 years after DART's impact), to do a detailed reconnaissance and assessment.

37. Rohini Sounding Rocket

In News

The Indian Space Research Organization (ISRO) hopes to achieve a remarkable feat — the 200th successful launch of the Rohini RH-200 sounding rocket in a row.

About RH-200

- RH-200 is a two-stage rocket capable of climbing to a height of 70 km bearing scientific payloads.
 - The first and second stages of RH-200 are powered by solid motors.
 - The '200' in the name RH200 denotes the diameter of the rocket in mm.
 - Other operational Rohini variants are RH-300 Mk-II and RH-560 Mk-III.
- Sounding rockets have an important place in the ISRO story. The first sounding rocket to be launched from Thumba was the American Nike-Apache - on November 21, 1963. After that, two-stage rockets imported from Russia (M-100) and France (Centaure) were flown.
- The ISRO launched its own version - Rohini RH-75 - in 1967.

➤ **Sounding Rockets**

- Sounding rockets are one or two stage solid propellant rockets used for *probing the upper atmospheric regions and for space research*.
- Sounding rockets take their name from the nautical term "to sound," which means to take measurements.
- They also serve as easily affordable platforms to test or prove prototypes of new components or subsystems intended for use in launch vehicles and satellites.

- A sounding rocket is an 'Instrument-carrying rocket' designed to take measurements and perform scientific experiments during its sub-orbital flight.
- The rockets are used to launch instruments from 48 to 145 km above the surface of the Earth.

38. Navigation with Indian Constellation (NavIC)

In News

The Indian government is pushing smartphone makers to enable support for its NavIC navigation system in new devices to be sold in India from next year.

About NavIC

- Navigation in Indian Constellation (NavIC) is an Indian Regional Navigation Satellite System (IRNSS), developed by the Indian Space Research Organization (ISRO).
 - IRNSS is an independent regional navigation satellite system designed to provide position information in the **Indian region and 1500 km** around the Indian mainland.
 - It is a constellation of total **7 satellite** launched in space and a ground facility on land to receive signals from space satellites. **3 of its satellite Located in Geostationary orbit and 4 are inclined to geosynchronous orbit.** However full NAVIC system has 9 satellite, 2 on ground in standby mode.
- The main objective is to provide reliable position, navigation and timing services over India and its neighborhood.
 - It covers whole India and region surrounding it up to 1500 km.
 - It provides accuracy up to 20m as claimed by ISRO.
 - It gives real time information for 2 services i.e standard positioning service open for civilian use and Restricted service which may be encrypted for authorised user like for military.

PROVIDES INDIA WITH ASSURED NAVIGATION SERVICE FOR VITAL CIVILIAN & MILITARY APPLICATIONS WITHOUT HAVING TO DEPEND ON ANOTHER COUNTRY; FIRST SATELLITE TO BE LAUNCHED ON JULY 1; REMAINING 6 BY 2015

IRNSS: INDIAN REGIONAL NAVIGATION SATELLITE SYSTEM

7 SATELLITES

3 GEOSTATIONARY

4 GEOSYNCHRONOUS

ORBIT ALTITUDE 36,000 KM

COST ₹1,420 CRORES

Covers India and up to **1,500** km beyond its borders

3 extremely accurate rubidium atomic clocks in each satellite

GPS receivers will not work; need special receivers (yet to be developed)

IRNSS provides Standard Positioning Service

Open to all users

Accuracy better than 20 metres

4 satellites in geosynchronous orbit – in pairs, move in two inclined orbits – appear from ground to travel in figure '8' – assist in accurate position determination

3 satellites in geostationary orbit – appear from ground to be at fixed positions in the sky

➤ **Applications of IRNSS:**

- Terrestrial, Aerial and Marine Navigation.
- Disaster Management.
- Vehicle tracking and fleet management.
- Integration with mobile phones.
- Precise Timing.
- Mapping and Geodetic data capture.
- Terrestrial navigation aid for hikers and travelers.
- Visual and voice navigation for drivers.

➤ **Other navigation systems**

- *Global Positioning System (GPS)* of the U.S.A.
- *Galileo* from the European Union
- Russian *GLONASS*
- China's *Beidou*

39. International Mobile Equipment Identity (IMEI)

In News

The government has amended the Prevention of Tampering of the *Mobile Device Equipment Identification Number, Rules, 2017*, in which it is making it mandatory for mobile manufacturers to register International Mobile Equipment Identity number (IMEI) for every handset made in India with the government. Importers, too, will have to register with the government the IMEI number of each phone before importing it.

Need of the Amendment

- The new rules are to curb the rising cases of cloning and theft of mobile phones. allowing access to the network.

➤ **About International Mobile Equipment Identity (IMEI)**

- It is a unique number that is used to identify a device on a mobile network. It has *15 digits and is like a phone's unique identity*.
- The number is used to verify the identity of a device when a user uses the Internet or places a call through it.
- Phones with a dual-SIM option has *two IMEI numbers*, one for each SIM.

➤ **Benefits:** It helps in identifying the manufacturer of the phone and finding out if it was ever stolen. A stolen or *lost device can be tracked using this number even if the SIM card has been removed*. These numbers can also help in blacklisting devices, which will stop them from functioning.

➤ The Communications Ministry had earlier rolled out a Central Equipment Identity Register (CIER), which categorises mobile phones based on their IMEI status in three lists – *white, grey and black*.

- Mobile phones with IMEI numbers on the ***white list*** are permitted for use
- The ***blacklist*** are the ones that are reported stolen or lost and are not allowed to access the network.
- Devices with IMEI numbers in the ***greylist*** do not conform to standards but are permitted to connect under supervision. The register also allows the DoT to carry out IMEI-based lawful interception.

- Prevention of Tampering: In 2017, the government had notified rules to prevent tampering with IMEI numbers of phones by making it a punishable offence which could also attract a jail term.

40. LVM3 M2 / OneWeb India-1 Mission

In News

ISRO's LVM3 to launch 36 OneWeb satellites on Oct. 23.

About Launch Vehicle Mark 3 (LVM3)

- The *Geosynchronous Satellite Launch Vehicle Mark III* (GSLV Mk III), *also referred to as the Launch Vehicle Mark 3 (LVM3)* is a three-stage medium-lift launch vehicle developed by the Indian Space Research Organisation (ISRO).
 - LVM3 is the heaviest launcher designed by ISRO.
 - The LVM-3 is 43.5 meters in height with a 4-meter diameter and is capable of lifting off with 640 tonnes of payload.
 - The cryogenic stage of the vehicle allows it to place heavy payloads into Low Earth Orbits of 600 km altitude.
 - It can place four-tonne class satellites of the GSAT series into Geosynchronous Transfer Orbits.
 - The L110 liquid stage is powered by two Vikas engines designed and developed at the Liquid Propulsion Systems Centre.
- **About OneWeb**
 - OneWeb is a global communications network, powered from space, enabling connectivity for governments, businesses, and communities.
 - It is implementing a constellation of Low Earth Orbit satellites.
 - India's Bharti serves as a major investor and shareholder in OneWeb.
 - The OneWeb satellites operate in Low Earth orbit (LEO) at an altitude of 1,200 kilometres.

LVM3-M2 OneWeb India-1 Mission



Why in news?

- ISRO launches 36 satellites of U.K based OneWeb satellite communications company.
- Launched from Sriharikota, Andhra Pradesh.

LVM3-M2 OneWeb India-1 Mission

- Lift vehicle—GSLV MkIII — renamed for this mission as Launch Vehicle Mark-3 (LVM3-M2).
 - The GSLV MkIII is a three-stage rocket with the first stage fired by solid fuel, the second by liquid fuel and the third is the cryogenic engine.
- It is the first dedicated commercial satellite mission of New Space India Ltd (NSIL).
- It is a set of 36 satellites belonging to Network Access Associated Ltd (OneWeb).
 - OneWeb is a joint venture between India's Bharti Global and the UK government.



Many firsts of the mission

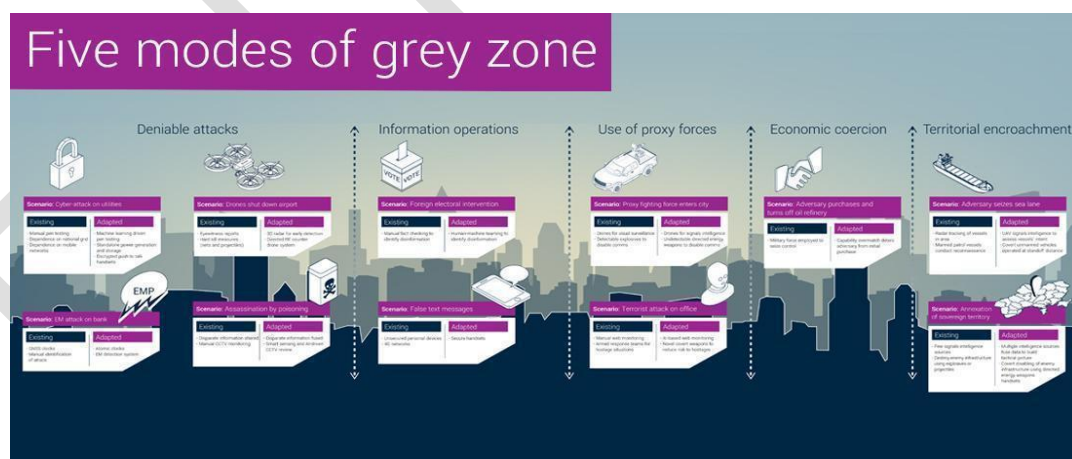
- First Commercial Mission of LVM3.
- First Multi-Satellite mission with 36 OneWeb Satellites onboard.
- First launch of LVM3 to Low Earth Orbit.
- First Indian rocket with six ton payload.
- First NSIL Mission with LVM3.
- First OneWeb Mission with NSIL/DoS.



41. Grey Zone Operation

About Grey Zone

- The Grey Zone describes a set of activities that occur between peace (or cooperation) and war (or armed conflict).
- A multitude of activities fall into this are nefarious economic activities, influence operations, and cyberattacks to mercenary operations, assassinations, and disinformation campaigns.
- It is considered as a gradualist campaign by state and non-state actors that combine non-military and quasi-military tools and fall below the threshold of armed conflict.



➤ **Grey Zone conflict is characterised by**

- Staying below the threshold to pre-empt a military response.
- It unfolds gradually over time rather than in bold, all- encompassing actions drawn out over years or even decades to preclude decisive response from the adversary.

- It lacks attribution.
 - In cases, where attribution is overt, use of extensive legal and political justifications often grounded in historical claims supported with documentation forms part of the conflict obfuscation.
- The Grey Zone campaigns typically stop short of threatening the defender's vital or existential interests.
- Even though it seeks to remain below key thresholds, it employs the risk of escalation to coercive advantage.
- Grey zone campaigns are typically built around non-military tools. They employ diplomatic, informational, cyber, historical half-truths, quasi-military forces, militias, and other tools and techniques to avoid the impression of a military aggression
- Grey zone campaigns target specific vulnerabilities in the targeted countries.
- Grey Zone Warfare' is set to become the predominant paradigm for the remainder of the century.

42. Compressed Bio-Gas

About Compress Bio-Gas

- Waste / Bio-mass sources produce bio-gas through the process of ***anaerobic decomposition***. The biogas is purified to remove *hydrogen sulphide (H₂S)*, *carbon dioxide (CO₂)*, *water vapour* and compressed as Compressed Bio Gas (CBG).
 - The CBG has *methane (CH₄)* content of more than 90%.
 - *CBG has calorific value and other properties similar to CNG* and hence can be utilized as green renewable automotive fuel.
 - It can replace CNG in automotive, industrial and commercial areas, given the abundance biomass availability within the country.
- Conversion of agricultural residue, cattle dung and municipal solid waste (MSW) into CBG in a commercial scale has various benefits:
- Import of natural gas and crude oil can be reduced.
 - Reduction in emissions and pollution.
 - Help to fulfillment of National commitments in achieving climate change goals.
 - Providing a buffer against energy security concerns and crude/gas price fluctuations.

- Contribute towards Swachh Bharat Mission through responsible waste management
 - Providing additional source of revenue to the farmers and increase rural employment.
- Asia's largest Compressed Bio Gas (CBG) plant has started functioning in Lehragaga, Sangrur, Punjab.

Compressed Bio Gas (CBG)



Why in news?

- Union Minister of Petroleum and Natural Gas and Housing and Urban Affairs inaugurated Asia's largest Compressed Bio Gas (CBG) plant in Lehragaga, Sangrur, Punjab.
- The Compressed Bio Gas (CBG) plant inaugurated in Sangrur is a step in achieving objectives of the Sustainable Alternative Towards Affordable Transportation (SATAT) scheme.

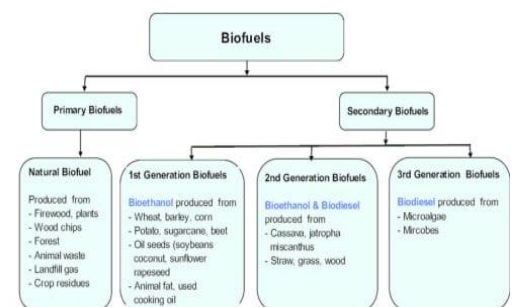
Compressed Bio Gas (CBG)

- Compressed Bio Gas (CBG) means the mixture of hydrocarbon gases and vapours consisting mainly of Methane in gaseous form, which has been produced by the decomposition of animal and plant waste, purified and compressed for use as an automotive fuel and industrial application.
- Biogas can be compressed after removal of carbon dioxide and hydrogen sulphide, the same way as natural gas is compressed to CNG, and used to power motor vehicles.
- Its solid by-products can be used as bio-manure.
- CBG and its by-products hold the chance for a circular economic growth.



Sustainable Alternative Towards Affordable Transportation (SATAT) scheme

- Scheme was launched by Government of India in October 2018 to establish an ecosystem for production of Compressed Bio Gas (CBG) from various waste/ biomass sources in the country.
- The scheme aims to
 - Empower and unleash the rural economy by supporting farmers,
 - Increase India's domestic energy production and self-sufficiency
 - Reduce the air pollution
 - Help India lead the world toward a clean energy transition.



43. Pillars of Creation

In News

All about the Pillars of Creation, recently pictured by the *James Webb Space Telescope*.

About Pillars of Creation

- The Pillars of Creation were first made famous when NASA's *Hubble Space Telescope* captured an image of them in 1995.
- The National Aeronautics and Space Administration (NASA) released a new detailed images of the Pillars of Creation taken by the Near Infrared Camera (NIRCam) of the James Webb Space Telescope (JWST).
- These pillars appear like rock formations, three towers of gas and dust which are more permeable than they look.

- They are part of the *Eagle Nebula*, also known as *Messier 16*.
- The pillars resemble buttes in the desert.
- They are very dense clouds of molecular hydrogen gas and dust that have survived longer than their surroundings.
- The hot new-born stars in the vicinity throw ultraviolet light in their direction.
- The phenomenon of Photo-evaporation causes the pillars to erode slowly,
- It exposes small globules of even denser gas buried within them. These globules are called evaporating gaseous globules (EGGs).

James Webb Space Telescope

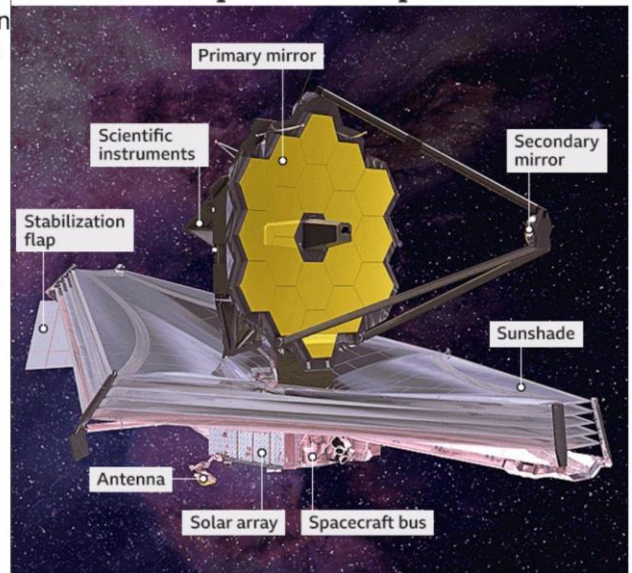


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James Webb Space Telescope

- Space Agencies Involved -NASA, the European Space Agency (ESA) and the Canadian Space Agency.
- It's the successor to Hubble Telescope.
- Webb was formerly known as the "Next Generation Space Telescope" (NGST).
- It will be a large infrared telescope with an approximately 6.5 meter primary mirror.
- Objectives and Functions of the Telescope:
 - It will look deeper into the cosmos – and thus further back in time
 - It will do this with a much bigger mirror (6.5m in diameter versus 2.4m) and instruments that are tuned to the infrared.
 - Scientists hope this set-up can detect the light from the very first population of stars in the Universe to switch on more than 13.5 billion years ago.

James Webb Space Telescope



44. Genetic Engineering Appraisal Committee (GEAC)

In News

GEAC gives its nod for commercial cultivation of GM mustard yet again.

About GEAC

- **Ministry:** Ministry of Environment, Forest and Climate Change (MoEF&CC)
 - It is India's apex biotech regulatory committee
 - It functions as a statutory body under the Environment Protection Act 1986.
- The **functions** of GEAC as prescribed in the Rules 1989 are as follows:
- To appraise activities involving large scale use of hazardous microorganisms and recombinants in research and industrial production from the environmental angle.

- To appraise proposals relating to release of genetically engineered organisms and products into the environment including experimental field trials.
- The committee or any persons authorized by it has powers to take punitive action under the Environment Protection Act.
- GEAC is chaired by the Special Secretary/Additional Secretary of MoEF&CC and co-chaired by a representative from the Department of Biotechnology (DBT).

45. Overhauser (OVH) Magnetometer

In News

India's first indigenous Overhauser Magnetometer developed.

About OVH Magnetometer

- OVH magnetometers is for performing geomagnetic field measurements.
 - One of the most accurate magnetometers extensively used by all magnetic observatories around the world.
- **Developed by** - Indian Institute of Geomagnetism (IIG)
 - IIG is an autonomous research institution under DST, Ministry of Science and Technology, Government of India.
- **Magnetometer** - Instrument for measuring the strength and the direction of magnetic fields.
- It reduce the cost of sampling and sensing experiments essential for geomagnetic sampling.
 - It has higher accuracy, higher sensitivity, and efficient power consumption.
 - It is used in international space programs.
 - The performance of this indigenously made magnetometer is at par with a commercial OVH sensor.
 - The understanding of the mechanism of Dynamic Nuclear Polarization (DNP) will help to develop a sensitive magnetic resonance imaging (MRI) instrument.
 - The sensor installed at Alibag Magnetic Observatory (MO) can use the new OVH Magnetometers
- **Alibag Magnetic Observatory**
 - The first geomagnetic observatory of India was set up in Alibag.
 - Established in 1904.

- This observatory is one of its kinds in the entire Asia
- There are only 13 similar observatories in the World.
- It is under the administration of the Indian Institute of Geomagnetism.
- The buildings are made of non-magnetic and hand-picked Porbandar sandstone
- The main magnetic room has a temperature controlled at 10°C or less for 24 hours.

46. India's first private satellite vehicle

In News

India's first privately developed launch vehicle made its maiden flight from Indian Space Research Organisation's (ISRO) launchpad at Sriharikota.

About

- ***Name of Launch Vehicle:*** Vikram
- ***Name of the Mission:*** Prarambh (the beginning)
 - The mission of Hyderabad-based Skyroot Aerospace will carry two Indian and one foreign customer payloads on the launch vehicle

Vikram-S rocket

- It is a single-stage sub-orbital launch vehicle.
 - Sub-orbital flight are those vehicles which are travelling slower than the orbital velocity, meaning it is fast enough to reach outer space but not fast enough to stay in an orbit around the Earth.
 - It is roughly defined as a distance of more than 80 km from the Earth's mean sea level.
 - Examples: the ones undertaken by Jeff Bezos and Richard Branson.
 - Vikram-I can carry 480 kilograms of payload to Low Earth Orbit. It will be powered by a Kalam-100 rocket.
 - Tribute to Vikram Sarabhai Skyroot's launch vehicles are named 'Vikram' as a tribute to the founder of the Indian space programme and renowned scientist Vikram Sarabhai.



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47. NASA's CAPSTONE Mission

In News

NASA's CAPSTONE mission reached the Moon, becoming the first spacecraft to enter into a special elongate orbit that could support future space missions. The microwave oven-sized satellite weighs just around 25 kilograms and also become the *first CubeSat to fly and operate on the Moon.*

The CAPSTONE Mission

- CAPSTONE stands for *Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment.*
- The mission's CubeSat was sent into space to test a unique lunar orbit called a near *rectilinear halo orbit*, (NRHO) which is very elongated and is located at a precise balance point between the gravities of the Earth and the Moon.
- This route is called a ballistic lunar transfer and it follows the gravitational contours in space to help the spacecraft reach its destination while spending very little energy.

48. Photonic crystals

In News

Graphene-stabilised tunable photonic crystal can make more durable & better reflective display and lasers devices.

Photonic crystals

- *Photonic crystals are optical nanostructures in which the refractive index changes periodically.*
- Photonic crystals occur in nature in the form of structural coloration and animal reflectors.
- It is found in nature including opal, butterfly wings, peacock feathers etc. which exhibit distinct iridescent colours.
- It affects the propagation of light in the same way that the structure of natural crystals gives rise to X-ray diffraction.
- The atomic lattices (crystal structure) of semiconductors affect their conductivity of electrons.

➤ About Artificial Photonic Crystals

- Artificial photonic applications - ranges from reflection coatings to optical computers.
- They enable the PCs to exhibit structural colours in the visible spectral regime

- Liquid crystalline (LC) are attracting significant attention for tuning of advanced photonic materials and devices.
- LC is a material that exhibits self-organization, phase transition, and molecular orientation behaviours in response to external stimuli.
- **Blue phase (BP)**
 - Blue phase (BP) is a unique thermodynamic phase of liquid crystals.
 - It is a 3D photonic crystal by virtue of the combination of a cubic lattice structure and fluidity.
 - It has a lattice spacing of a few hundred nanometers.
 - The cubic BP exhibits selective reflection of colours in the visible spectrum.
- **Drawbacks Blue phase (BP) suffers**
 - Difficulty in fabrication
 - The low thermal stability and polycrystalline nature of BP limit achieving vivid colours over a large area for device applications.
- **Recent Achievement**
 - Centre for Nano and Soft Sciences (CeNS) has developed a BP system
 - BP is attained between a pair of graphene substrates.
 - It was achieved using an easy-to-fabricate cost-effective technique, hence the process is highly suitable for large-scale applications.

49. The Square Kilometer Array Observatory (SKAO)

In News

Construction of the SKA-Mid array, to be located in the *Karoo desert in South Africa*, and the SKA-Low array, in *Western Australia north of Perth*, has begun after 30 years of preparations and a year and a half of preconstruction work

Square Kilometer Array (SKA) Telescope:

- **Location:** The telescope, proposed to be the largest radio telescope in the world, will be located in Africa and Australia.
- ***Some of the questions that scientists hope to address using this telescope:***
 - The beginning of the universe.
 - How and when the first stars were born.
 - The life-cycle of a galaxy.

- Exploring the possibility of detecting technologically-active civilisations elsewhere in our galaxy.
- Understanding where gravitational waves come from
- **Function:** As per NASA, the telescope will accomplish its scientific goals by measuring neutral hydrogen over cosmic time, accurately timing the signals from pulsars in the Milky Way, and detecting millions of galaxies out to high redshifts.
 - The SKA-Mid array in Karoo will scan the sky for sources of radio waves in the middle frequency range from 350 MHz to 15.4 GHz using 197 dishes, each 50 feet (15 meters) in diameter.
 - The SKA-Low array in Australia will rely on 131,072 dipole antennas to detect radio waves of frequencies between 50 to 350 MHz.
 - The first four SKA-Mid dishes and six SKA-Low stations will be able to work together as a single telescope
 - The telescopes, which will have a total collecting area of one square kilometer, as their name suggests, will be completed by the end of this decade
- Due to the extreme sensitivity of the antennas, the *arrays need to be located in remote locations where the use of conventional radio receivers is prohibited* in order to avoid signal disturbance
- **Radio Telescopes:**
 - Radio telescope, astronomical instrument consisting of a radio receiver and an antenna system that is used to detect radio-frequency radiation between wavelengths of about 10 metres (30 megahertz [MHz]) and 1 mm (300 gigahertz [GHz]) emitted by extraterrestrial sources, such as stars, galaxies, and quasars.
 - Radio waves, which have *much longer wavelengths than visible light, penetrate through dust and debris*, allowing astronomers to peer into regions of space that are obscured from other types of observatories.
 - Since the first radio signals were detected in the 1930s, astronomers have used radio telescopes to detect radio waves emitted by different objects in the universe and explore it.

50. Base Editing

In News

Scientists in the United Kingdom testing a new form of cancer therapy, gene therapy that relied on a new technique called ‘base editing’, reported success in a teenage girl, Alyssia, with a form of cancer called T-cell acute lymphoblastic leukaemia.

Base Editing

- A person's genetic code is several permutations of **four bases: Adenine (A), Guanin (G), cytosine (C), and thymine (T)**.
 - Sequences of these bases, akin to letters in the alphabet, spell out genes that are instructions to produce the wide array of proteins necessary for the body's functions.
 - With advances in genetic technology, scientists have been able to zoom into a precise part of the genetic code to alter the molecular structure of just one base, effectively changing its genetic instructions.

51. HPV vaccine

In News

Union Health Ministry holds meeting on HPV vaccine.

What is HPV?

- ***Human papillomavirus (HPV) is a viral infection that's passed between people through skin-to-skin contact.***
 - There are over 100 varieties of HPV, more than 40 of which are passed through sexual contact and can affect your genitals, mouth, or throat.
 - HPV is the most common sexually transmitted infection (STI).
 - 90 percent of HPV infections go away on their own within two years.
 - Some types of HPV can lead to the development of genital warts and even cancers of the cervix, anus, and throat.
- **HPV Vaccine**
 - Human papillomavirus (HPV) vaccines are vaccines that prevent infection by certain types of human papillomavirus (HPV).
 - The World Health Organization (WHO) recommends HPV vaccines as part of routine vaccinations in all countries.
 - It is estimated that HPV vaccines may prevent 70% of cervical cancer, 80% of anal cancer, 60% of vaginal cancer and 40% of vulvar cancer.

52. MATSYA 6000

In News

Samudrayaan Mission is aimed at sending three personnel to 6000-metre depth in a vehicle called '**MATSYA 6000**'.

About MATSYA 6000

- **Ministry:** Ministry of Earth Sciences
- Matsya 6000 is an Indian crewed deep-submergence vehicle.
- Three personnel will be send to 6000-metre depth in this vehicle.
- It comes under deep ocean mission.
- It is intended to be utilised for deep-sea exploration of rare minerals.
- It is being designed and developed by National Institute of Ocean Technology (NIOT)

➤ **Samudrayaan Mission**

- It is India’s first manned mission to send humans 6,000 metres deep in the ocean.
- It will send three people to a depth of 6000 metres in the sea in a manned submersible vehicle MATSYA 6000

Samudrayaan Mission								
<p>Why in news?</p> <ul style="list-style-type: none"> • According to the Ministry of Earth Science, the Samudrayaan Mission is expected to be realised by year 2026. <p>Samudrayaan Mission</p> <ul style="list-style-type: none"> • The mission is aimed at sending three personnel to 6000-metre depth in a vehicle called 'MATSYA 6000' for the exploration of deep-sea resources like minerals. • 'MATSYA 6000' vehicle is being designed and developed by National Institute of Ocean Technology (NIOT), Chennai under Ministry of Earth Sciences. • It is India's first unique manned ocean mission and is a part of the Rs 6000-crores Deep Ocean Mission. • It will also boost the Central government's vision of 'New India' that highlights the Blue Economy as one of the ten core dimensions of growth. 	<table border="1"> <thead> <tr> <th colspan="2" style="text-align: center;">DEEP OCEAN MISSION</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ➤ Deep Sea Mining through 'Underwater Vehicles' and 'Underwater Robotics' ➤ Asserting exclusive rights to explore polymetallic nodules from seabed over 75,000 sq km of areas in international water ➤ Estimated polymetallic nodules resource potential: 380 million tonnes (MT) </td> <td style="vertical-align: top;"> <p>THESE POLYMETALLIC NODULES CONTAIN</p> <p>Manganese 92.6 MT</p> <p>Nickel 4.7</p> <p>Copper 4.3</p> <p>Cobalt 1</p> <p>(*figures are rounded off)</p> </td> </tr> <tr> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ➤ Development of ocean climate change advisory services ➤ Technology for sustainable utilisation of marine bio-resources </td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ➤ Deep ocean survey and exploration ➤ Energy from the ocean and offshore-based desalination ➤ Krill fishery from southern ocean </td> </tr> </tbody> </table>		DEEP OCEAN MISSION		<ul style="list-style-type: none"> ➤ Deep Sea Mining through 'Underwater Vehicles' and 'Underwater Robotics' ➤ Asserting exclusive rights to explore polymetallic nodules from seabed over 75,000 sq km of areas in international water ➤ Estimated polymetallic nodules resource potential: 380 million tonnes (MT) 	<p>THESE POLYMETALLIC NODULES CONTAIN</p> <p>Manganese 92.6 MT</p> <p>Nickel 4.7</p> <p>Copper 4.3</p> <p>Cobalt 1</p> <p>(*figures are rounded off)</p>	<ul style="list-style-type: none"> ➤ Development of ocean climate change advisory services ➤ Technology for sustainable utilisation of marine bio-resources 	<ul style="list-style-type: none"> ➤ Deep ocean survey and exploration ➤ Energy from the ocean and offshore-based desalination ➤ Krill fishery from southern ocean
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➤ **Advantages of the Mission**

- Helps in scientific research and technological empowerment
- Helps in underwater engineering innovations in asset inspection, tourism and promotion of ocean literacy.

53. Gaganyaan

In News

India’s maiden human space flight “Gaganyaan” is targeted to be launched in the fourth quarter of 2024.

About Gaganyaan

- It is the demonstration of human spaceflight capability by launching a crew of 3 members to an orbit of 400 km for a 3 days mission and bringing them back safely to earth, by landing in Indian sea waters.
- The first uncrewed flight, named Gaganyaan 1 (G1), is targeted to launch in the last quarter of 2023.
- The second uncrewed 'G2' mission in the second quarter of 2024.
- The final human space flight 'H1' mission in the fourth quarter of 2024.
- The Gaganyaan is part of the *Indian Human Spaceflight Programme* (IHSP)
- **The pre-requisites for the mission are:**
 - Development of many critical technologies including human rated launch vehicle for carrying crew safely to space,
 - Life Support System to provide an earth like environment to crew in space.
 - Crew emergency escape provision.
 - Evolving crew management aspects for training, recovery and rehabilitation of crew.
- The astronaut designates for human space flight mission are identified.
- First semester of Astronaut training has been completed. The second semester of crew training is currently in progress.

54. Sepsis

In News

Sepsis is one of the most expensive medical conditions in the world – new research clarifies how it can lead to cell death.

About Sepsis

- Sepsis is a life-threatening condition arising from the body's overreactive response against an infection, leading it to injure its own tissues and organs.
- The first known reference to "sepsis" dates back more than 2,700 years
- It affects nearly 50 million people globally each year.
- Sepsis accounted for 11 million deaths worldwide in 2017.
- **How it works?**
 - The body's response to infection by releasing molecules like cytokines that help eliminate the infection.

- Cytokines are a broad group of small proteins that recruit other immune cells to the site of infection or injury.
- Uncontrolled cytokine production can lead to a dangerous cytokine storm associated with sepsis.
- This uncontrolled immune response can lead to multi-organ failure and death.
- The cytokines tumour necrosis factor, or TNF, stands tall as the most potent and the most studied for nearly the past 50 years.

55. Kala Azar

In News

The Union Health Ministry reported that India is committed to eliminating Kalaa-azar from the country by 2023.

About Kala Azar

- Kala-Azar or Visceral Leishmaniasis is a slow-progressing indigenous condition that is *caused by a protozoan parasite*.
 - One of the most lethal and *neglected tropical diseases* (NTDs) and the Second deadliest parasitic killer in the world after Malaria.
 - The parasite infects the reticuloendothelial system and may be found in abundance in bone marrow, spleen, and liver.
- **Distribution:**
- Global: About 90% of global cases of Kala-azar were reported from eight countries: Brazil, Eritrea, Ethiopia, India, Kenya, Somalia, South Sudan and Sudan in 2021.
 - India: Contributing 11.5% of total cases reported globally.
- **Government Efforts:**
- WHO has set the target to eliminate Kala-azar by 2017.
 - Government of India (GOI) launched a centrally sponsored Kala-azar control programme in the endemic states in the year 1990-91.
 - India is committed to eliminating Kalaa-Azar from the country by 2023
 - Elimination is defined as reducing the annual incidence of Kala Azar (KA) to less than 1 case per 10,000 people at the sub-district level
- **Progress:** 98.7 per cent decline in cases of Kala-azar (2007 to 2022) in India.
- **Kala Azar endemic states:** Bihar, Uttar Pradesh, Jharkhand and West Bengal.

56. Local Bubbles

In News

Researchers from the Center for Astrophysics (CfA) | Harvard & Smithsonian have generated a 3D magnetic map of the cavity called Local Bubble.

About

- ***The Local Bubble is a 1,000-light-year-wide cavity or a superbubble.***
 - The Local Bubble is a large, low-density region in the interstellar medium (ISM) of our galaxy, the Milky Way.
 - Other super bubbles also exist in the Milky Way.
 - The interstellar medium is the material which fills the space between the stars.
 - It's a cavity that is thought to have been created by a series of supernovae explosions that occurred about 30 to 50 million years ago.
 - Space is full of these superbubbles that trigger the formation of new stars and planets and influence the overall shapes of galaxies.
- **Supernova**
 - A supernova is a powerful and luminous explosion that occurs at the end of the life of a massive star.
 - It is caused by the collapse of the core of the star, which can trigger a massive release of energy.

57. Doppler Weather Radar Network

In News

Entire Country will be covered by Doppler Weather Radar Network by 2025 to predict extreme weather events more accurately.

About Doppler Weather Radar Network

- A Doppler radar network is a system of multiple radar station that work together to provide comprehensive coverage of a specific area.
 - The system uses the Doppler effect to detect and track moving objects, such as weather systems, aircraft, and vehicles.
- **How it works?**
 - Each station in the network includes a radar transmitter and a radar receiver, for sending out and detecting the reflected signal.
 - The transmitter and receiver are typically located at the same site, but they can also be separated by a significant distance.

- The radar signal reflects off any moving objects in its path.
- *The change in frequency of the signal due to the Doppler effect is used to determine the speed and direction of the moving object.*

➤ **Applications of Doppler radar network**

- It is widely used for weather forecasting and severe weather warning, tracking of aircraft and vehicles, and also used in meteorology and atmospheric sciences.
- It provide detailed information about storm systems, including the location, size, and movement of thunderstorms, tornadoes, and other severe weather events.
- They can also be used for tracking of aircraft and vehicles, and also used in meteorology and atmospheric sciences.

58. ChatGPT

What is it?

- *ChatGPT* is a large language model chatbot developed by **OpenAI** based on GPT-3.5.
- ChatGPT was created by San Francisco-based artificial intelligence company OpenAI.
 - In ChatGPT large language models perform the task of predicting the next word in a series of words.
 - **Reinforcement Learning with Human Feedback** (RLHF) is an additional layer of training that uses human feedback to help ChatGPT learn the ability to follow directions and generate responses.

ChatGPT

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Why in news?

- Cyber Security experts have sent out warnings about the potential use of ChatGPT to write phishing emails, malicious code easily and at a much larger scale.

ChatGPT

- ChatGPT (Generative Pre-trained Transformer) is a chatbot launched by OpenAI in November 2022.
- It is built on top of OpenAI's GPT-3 family of large language models.
- It is a type of artificial intelligence that can understand and generate natural language text.
- It is trained on large amounts of text data and uses an algorithm called a transformer to learn how to generate text that is similar to human conversation.

Uses

- The application is beneficial for presenting information and responding to queries in a way similar to what would occur in a normal conversation because it has been educated by artificial intelligence and machine learning.



➤ Features of ChatGPT

- ChatGPT is versatile.

- ChatGPT's training data includes man pages and information about Internet phenomena and programming languages.
- ChatGPT attempts to reduce harmful and deceitful responses.
- ChatGPT remembers previous prompts given to it in the same conversation.

➤ **Limitations of ChatGPT**


- It sometimes writes plausible-sounding but incorrect or nonsensical answers.
- It is designed around human oversight, can be over-optimized and thus hinder performance
- ChatGPT has limited knowledge of events that occurred after 2021.
- It suffers from algorithmic bias, which may be revealed when ChatGPT responds to prompts including descriptors of people.

59. BharOS

About BharOS


- *The 'BharOS' is a Made In India mobile operating system developed by IIT Madras.*
- It aims to reduce the dependence on foreign OS in smartphones and promote the use of locally developed technology.
- It a new mobile operating system focused on privacy and security.
- It is a successful step towards data privacy.
- It is an Indian government-funded project to develop a free and open-source operating system (OS) for use in government and public systems.
- The OS can be installed on commercial off-the-shelf handsets.
- The poor people of the country will be the main beneficiary of a strong, indigenous, dependable & self-reliant digital infrastructure.
- It has a No Default Apps (NDA) setting, meaning that users do not have to keep or use pre-installed apps in this mobile operating system
- It would offer Native Over The Air (NOTA) updates, ie. the security updates and bug fixes will be automatically installed.

BharOS



BharOS

- BharOS is a mobile operating system similar to Android or iOS
- It is based on an AOSP (Android Open Source Project) operating system and does not use any Google apps or services.
- It would support Native Over The Air (NOTA) updates as well as No Default Apps (NDA).
- It has a minimalistic home screen with the Indian flag, a list of app categories, and a selection of apps that have passed the OS's trust and security standards.
- It will employ the Private App Store Services (PASS) system to examine and curate apps that are safe for users.
- These systems enable smartphone users to interact with their devices and access their features while also ensuring their safety.
- Current status: The current version of BharOS includes third-party apps such as DuckDuckGo and Signal by default.



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60. Scandium Nitride

In News

Artificial synapse developed for brain-like computing with industry-compatible Nitride Semiconductors.

About Scandium Nitride (ScN)

- It is a binary III-V indirect bandgap semiconductor.
- It is composed of the scandium cation and the nitride anion.
- It forms crystals that can be grown on tungsten foil through sublimation and recondensation.
- It is also an effective gate for semiconductors on a silicon dioxide (SiO₂) or hafnium dioxide (HfO₂) substrate.
- It is a semiconducting material with supreme stability and Complementary Metal-Oxide-Semiconductor (CMOS) compatibility.

➤ **Application of ScN**

- The scandium nitride (ScN) was used to develop brain-like computing.

- ScN was used to develop a device mimicking a synapse that controls the signal transmission as well as remembers the signal.
- ScN is more stable, CMOS compatible, and can be seamlessly integrated with existing Si technology.
- It can act as a platform for both excitatory and inhibitory functions.

61. Aditya-L1

In News

India's first mission to study the sun to begin by June-July 2023.

Scientific Objectives of Aditya-L1

- Study of Solar upper atmospheric (chromosphere and corona) dynamics.
- Study of chromospheric and coronal heating, physics of the partially ionized plasma, initiation of the coronal mass ejections, and flares
- Observe the in-situ particle and plasma environment providing data for the study of particle dynamics from the Sun.
- Physics of solar corona and its heating mechanism.
- Diagnostics of the coronal and coronal loops plasma: Temperature, velocity and density.
- Development, dynamics and origin of CMEs.
- Identify the sequence of processes that occur at multiple layers (chromosphere, base and extended corona) which eventually leads to solar eruptive events.
- Magnetic field topology and magnetic field measurements in the solar corona.
- Drivers for space weather (origin, composition and dynamics of solar wind).

➤ About Aditya-L1 mission

- Aditya L1 will be the first space based Indian mission to study the Sun.
- The spacecraft carries seven payloads to observe the photosphere, chromosphere and the outermost layers of the Sun (the corona).
- Four payloads carry out remote sensing of the Sun and three of them carry in-situ observation.
- It uses electromagnetic and particle and magnetic field detectors.
- The instruments of Aditya-L1 are tuned to observe the solar atmosphere mainly the chromosphere and corona.



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I owe the largest share of my success to the tireless and constant support of the Enlite IAS academy team. Being part of such a committed group of Individuals has truly been an enriching and rewarding experience. I am deeply indebted to Mahesh sir and Abhilash sir, both of whom exemplify the true spirit of Enlite. They have been pillars of support throughout the entire process, helping me navigate and overcome every obstacle that this journey has thrown at me.

PRASAD KRISHNAN IRS
UPSC2020 Rank 209



I joined Enlite PCM batch in 2018 and since then the institute has guided me throughout my journey. Be it the classes, mentorship sessions, mocks, Interview guidance or peer group discussions, Enlite IAS has translated my efforts to the maximum output possible. Special thanks to Mahesh sir, Abhilash sir and Abu sir for all the help.

MANOJ MADHAV S IFS
Third Secretary (EP)
Embassy of India – Brussels, Belgium
UPSC2019 Rank : 105



Team Enlite has played a quintessential role in helping me clear the Civil Services Examination. The mentorship under Mahesh Sir throughout all the stages of the exam is something I owe my success largely to. Quality guidance from faculties like Abu Sir and Abhilash Sir was helpful in improving my overall performance as well. Thank you Team Enlite!

AMITH MP IAS
Asst. Collector - Tindivanam,
Villupuram Dist, Tamil Nadu
UPSC2018 Rank 405



I attended philosophy optional enrichment program @ ENLITE IAS. The unique insights I got during the course played a vital role in my success in the civil service examination. Also 90% of the questions in the exam directly appeared from the class room sessions. It helped in tuning my Interview preparation to an optimum level.

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- The spacecraft will be placed in a halo orbit around the Lagrange point 1 (L1) of the Sun-Earth system.

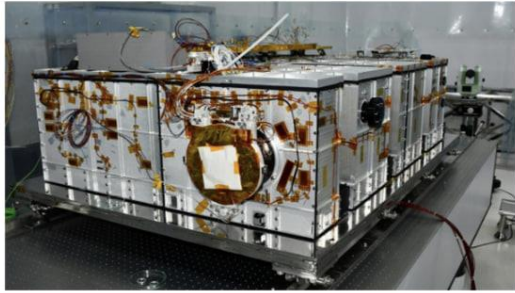
Visible Emission Line Coronagraph (VELC)

Why in news?

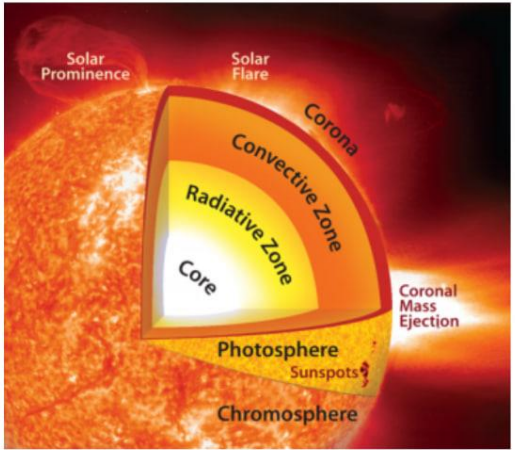
- The handover ceremony of the Visible Emission Line Coronagraph (VELC) which is the primary payload of Aditya-L1 Mission was held recently.

Visible Emission Line Coronagraph (VELC)

- It is the largest payload that would fly on the Aditya-L1 mission.
- It is an internally occulted solar coronagraph capable of simultaneous imaging, spectroscopy and spectro-polarimetry close to the solar limb.
- The VELC consists of a coronagraph, spectrograph, polarimetry module and detectors, aside from auxiliary optics.
- It is built by the Indian Institute of Astrophysics (IIA) at its CREST (Centre for Research and Education in Science and Technology) campus at Hosakote, Karnataka.
- Purpose:
 - It will observe the solar corona, which is the tenuous, outermost layer of the solar atmosphere.
 - It will analyze the coronal temperature, plasma velocity, density, etc.
 - It will also study Coronal Mass Ejections (CMEs) and the solar wind.



Layers of Sun



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➤ **Advantages of Lagrange point 1 (L1)**

- A satellite placed in the halo orbit around the L1 point can continuously view the Sun without any occultation/eclipses.
- This will provide a greater advantage of observing the solar activities and its effect on space weather in real time.

62. iNCOVACC

In News

Union Health Minister unveils world's *first intranasal COVID19 vaccine, iNCOVACC.*

Intranasal Vaccine

- It is a vaccine administered to a person via the nose and does not require a needle.

- It induces immunity through the inner surface of the nose, a surface that naturally comes in contact with many airborne microbes.
- Administering a vaccine via the nose is painless, non-invasive and easier to perform than using a needle.

➤ **About iNCOVACC**

- iNCOVACC is the world's first intranasal COVID19 vaccine to receive approval for the primary 2-dose schedule.
- It can use as a heterologous booster dose.
- It is developed by Bharat Biotech International Limited (BBIL) in collaboration with Biotechnology Industry Research Assistance (BIRAC).
- It is a cost effective Covid vaccine which does not require syringes, needles, alcohol wipes and bandage.
- It utilizes a vector-based platform, which can be easily updated with emerging variants leading to large scale production.

63. Neglected Tropical Diseases

In News

The World Health Organization(WHO) has released a Global report on Neglected Tropical Diseases (NTD) 2023, which states that NTD continues to disproportionately impact the most impoverished members of the international community.

About NTD

- *NTDs are a group of infections that are most common among marginalized communities in the developing regions of Africa, Asia and the Americas.*
- They are caused by a variety of pathogens such as viruses, bacteria, protozoa and parasitic worms.
 - **Virus:** Rabies , Dengue, Chikungunya
 - **Bacteria :** Buruli Ulcer, Leprosy ,Trachoma ,Yaws
 - **Protozoa:** Chagas Disease,Leishmaniasis, Human African trypanosomiasis
 - **Helminth (Parasitic worms):** Cysticercosis , lymphatic filariasis, soil transmitted Helminthiasis ,river blindness etc..
- NTDs are especially common in tropical areas where people do not have access to clean water or safe ways to dispose of human waste.
- These diseases generally receive less funding for research and treatment than malaises like tuberculosis, HIV-AIDS and malaria.

- India has the world's largest absolute burden of at least 10 major NTDs, including hookworm, dengue, lymphatic filariasis, leprosy, visceral leishmaniasis or kala-azar and rabies.

64. Sickle Cell Anaemia

In News

Finance Minister announced the government's plan to launch a mission to eliminate Sickle Cell Anaemia by 2047

About

- ***It is a group of inherited red blood cell disorders that is genetic in nature.***
 - Red blood carries oxygen to all parts of the body. Healthy red blood cells are round, and they move through small blood vessels to carry oxygen to all parts of the body.
 - In someone who has SCD, the haemoglobin is abnormal, which causes the red blood cells to become hard and sticky and look like a C-shaped farm tool called a "sickle."
 - The sickle cells die early, which causes a constant shortage of red blood cells.
- **Causes:** SCD is a genetic condition that is present at birth. It is inherited when a child receives two genes—one from each parent—that code for abnormal haemoglobin.
- **Diagnosis :**A blood test can determine whether one has SCD or sickle cell trait
- **Treatment :**SCD can only be cured by bone marrow or stem cell transplantation
- **Initiatives:**
 - The **Unmukt Project** is being implemented by the Central Government to strengthen screening and timely management of Sickle Cell Anaemia.
 - The Tribal Affairs Ministry established the **National Council on Sickle Cell Disease and Tribal Health Cell**, which would coordinate with the Ministry of Health and State Government

65. E20 Fuel

In News

During the India Energy Week 2023 event, Indian Prime Minister launched the E20 fuel.

What is it?

- ***E20 Fuel is a blend of 20% ethanol and 80% petrol.***

- An ethanol blend is a blended motor fuel containing ethyl alcohol (99% pure) blended exclusively with gasoline.
- Apart from sugarcane-based raw material, ethanol production from surplus rice with FCI and Maize is allowed.
- India has already met its E10 target in 2022, so petrol used in the country has 10% ethanol in it.
- The government now aims to achieve a complete 20% blending of ethanol by 2025(advanced from 2030)

66. Deepfakes Voice

In News

A social media platform used speech synthesis to make deep fakes of celebrities.

About Deepfakes

- *Deep fake is a type of Artificial Intelligence (AI) used to create convincing images, audio, and video hoaxes.*
- Deepfakes use deep learning AI to replace the likeness of one person with another in video and other digital media.
- The most common method relies on the use of deep neural networks involving autoencoders that employ a face-swapping technique.
- Although deepfakes could be used in positive ways, such as in art, expression, accessibility, and business, it has mainly been weaponized for malicious purposes.
- Deepfakes can harm individuals, businesses, society, and democracy, and can accelerate the already declining trust in the media.

➤ Deepfake voice:

- Deepfake voice, also called a synthetic voice, uses AI to generate a clone of a person's voice.
- The voice can accurately replicate the tone, and accents, of the target person.

67. NISAR Mission

Key Facts about NISAR

- NISAR, *NASA-ISRO Synthetic Aperture Radar*, is an Earth-observation satellite.
- **Developed by:** Jointly developed NASA and ISRO under a partnership agreement signed in 2014.

- **Function:** It will scan the globe every 12 days over the course of its three-year mission of imaging the Earth
 - It will spot warning signs of natural disasters, measure groundwater levels, track flow rates of glaciers and ice sheets, and monitor the planet's forest and agricultural regions, which can improve our understanding of carbon exchange

➤ **Features:**

- The 2,800-kilogram satellite is a dual-frequency imaging radar satellite.
- **Synthetic aperture radar** (SAR), will produce high-resolution images and is capable of penetrating clouds. Therefore can collect data day and night regardless of the weather conditions
- NASA provides the L-band radar, GPS, a high-capacity solid-state recorder to store data, and a payload data subsystem,
- ISRO provides the S-band radar, the GSLV launch system and spacecraft.

68. CAR T-cell Therapy

In News

Oncologists explain the importance of CAR T-cell technology in curing people with leukaemia and lymphomas.

About

- **Leukaemia** is a type of cancer that affects the blood and bone marrow, while **lymphoma** is a type of cancer that starts in the cells of the lymphatic system, which is part of the immune system.
- ***At present, there are three major forms of treatment for any cancer viz.,***
- Surgery: removing the cancer
 - Radiotherapy: delivering ionising radiation to the tumour
 - Systemic therapy: administering medicines that act on the tumour
- **Systemic therapy Types**
- **Chemotherapy**, preferentially acts on cancer cells but has modest response rates and significant side-effects.
 - **Immunotherapy**, drugs bind to specific targets on cancer cells, has fewer side-effects but is effective only against certain tumours
 - **Chimeric antigen receptor (CAR) T-cell therapy**

- Unlike chemotherapy or immunotherapy which involve taking drugs, CAR T-cell therapies use a patient's own cells.

➤ ***Chimeric antigen receptor (CAR) T-cell therapy***

- T cells are taken from a patient's blood and then the gene for a special receptor that binds to a certain protein on the patient's cancer cells is added to the T cells in the laboratory.
- The special receptor is called a chimeric antigen receptor (CAR).
- CAR T-cell therapies are even more specific than targeted agents and directly stimulate the patient's immune system to fight cancer, leading to greater clinical efficacy.
- That's why they're referred to as "living drugs".

69. Diyodar Meteorite

In News

Scientists from Physical Research Laboratory (PRL), Ahmedabad, are claiming that the meteorite that crashed in two villages in Banaskantha, Gujarat has been identified as an aubrite.

Aubrite meteorite

- *Aubrite meteorite is a coarse-grained igneous rock that formed in oxygen-poor conditions.*
- They are rare and unique, contains exotic minerals not found on Earth.
- **Source of origin:** Scientists are not yet sure of their origin, but some signs indicate that they could be from the asteroid 3103 Eger or from the planet Mercury.
- This is the second recorded crash of an aubrite in India, after 175 years (1852 in Basti, Uttar Pradesh.).
- The meteorite has been named the Diyodar meteorite after the taluka in which the villages are located.

➤ **Meteor, Meteorite and Meteoroid**

- The difference between a meteor, meteorite and meteoroid is nothing but where the object is.
- **Meteoroids** are objects in space that range in size from dust grains to small asteroids.
- But when meteoroids enter the Earth's atmosphere, they are called **meteors**.

- But if a meteoroid enters the Earth's atmosphere and hits the ground, it is called a *meteorite*.

70. Lab-Grown Diamonds (LGD)

About LGD

- Laboratory-grown diamonds were made by humans in a lab or factory rather than by nature.
- They have essentially the *same chemical composition and crystal structure as diamonds created by nature*.
- They are created using sophisticated mechanical processes that mimic the conditions under which genuine diamonds are generated.
- They can be used in *extreme environments due to their potential to operate at higher speeds*
- **Lab grown diamonds are produced through 2 technologies:**
 - High-Pressure High Temperature (HPHT)
 - Chemical Vapour Deposition (CVD).
- *India is one of the leading producers of lab grown diamonds using CVD technology.*
 - India depends on other countries for the supply of critical machinery components and 'seeds',
 - India's share in global trade of LGD in the financial year 2021-22 was 25.8
- **Uses of LGD**
 - Lab-grown diamonds are used in computer chips, satellites, 5G networks.
 - LGD has vast application in field of defence, optics, jewellery, thermal & medical industry.
 - They use less power than silicon-based chips.

71. India's First DNA Vaccine for Dengue

In News

Researchers at India's National Centre for Biological Sciences, in collaboration with nine other institutions in India, Africa, and the US, have developed *India's first and only DNA vaccine candidate for dengue fever*.

DNA Vaccine

- A DNA vaccine is a type of vaccine that uses a small piece of DNA that codes for a specific antigen (a molecule that triggers an immune response) from a pathogen, such as a virus or bacterium, to stimulate an immune response.
 - The DNA is injected directly into the body's cells, where it instructs the cells to produce the antigen.
 - The immune system then recognizes the antigen as foreign and mounts an immune response against it, which helps to develop immunity to the pathogen.
 - ***DNA vaccines are third-generation vaccines.***
- The **ZyCoV-D** is the world's first and India's indigenously developed DNA based vaccine for COVID-19.

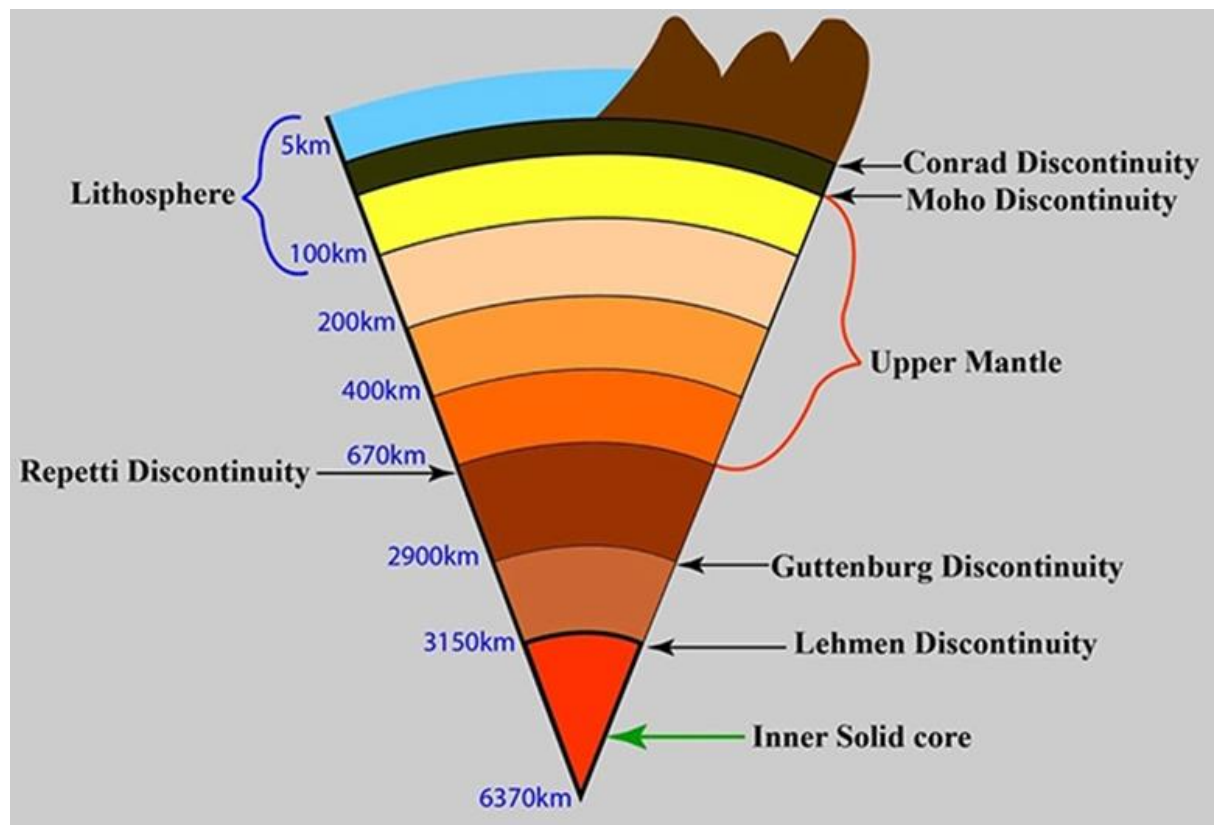
72. Earth's 5th Layer

In News

Scientists confirm a fifth layer inside the Earth's core

What is it?

- Scientists, in a new study, have confirmed the existence of a 5th new layer - ***the innermost inner core*** (apart from the 4 layers: crust, mantle, outer liquid and inner solid core)
 - The innermost inner core is assumed to have a radius of around 650 Km (inner core radius (whole) - 1,221 km).
 - This 5th layer is made of the same material as the inner core (iron and nickel) and the main difference between the two is the way the atoms are arranged to form a solid.
 - The idea that the Earth could hold a 5th layer was proposed in 2002.
- Scientists rely on seismic waves to study earth's interiors. These waves behave differently as they pass through diverse materials .
- According to the analysis done, the innermost inner core slows down the seismic waves at a point between the rotation axis (from pole to pole) and the equatorial plane (perpendicular to the poles). In contrast, the outer shell of the inner core slows down the waves only in the equatorial plane



73. Multi-Angle Imager for Aerosols mission

In News

NASA announced that it is partnering with the Italian Space Agency ASI (Agenzia Spaziale Italiana) to build and launch the MAIA mission.

About Multi-Angle Imager for Aerosols mission

- A joint mission between NASA and the Italian Space Agency ASI.
- This will investigate the health impacts of air pollution in the world's most populated cities.
- Its primary goal is to benefit societal health.
- It will consist of the PLATiNO-2 satellite, which will be provided by ASI, and a science instrument that will be built at NASA's Jet Propulsion Laboratory (JPL).
- The MAIA mission will collect and analyse data from the observatory, sensors on the ground and atmospheric models.

74. Goldilocks star

In News

A 'Goldilocks' star reveals hidden step in how water gets to planets like Earth.

About Goldilocks

- *The habitable zone is the region around a star where an orbiting planet could host liquid water and, therefore, possibly support life.*
 - It is also known as the Goldilocks zone because planets orbiting at that just right distance from a star are not too hot or too cold to host liquid water.
 - The distance Earth orbits the Sun is just right for water to remain a liquid.
- **How Goldilocks help to detect water?**
- To determine where the water on planets comes from, it is necessary to find a Goldilocks proto-planetary disk – one that is just the right temperature and size to allow observations of water.
 - A breakthrough came in 2016 while studying proto-planetary disks around a rare type of young star called FU Orionis stars.
 - FU Orionis stars are unique because they consume matter about 100 times faster than typical young stars and emit hundreds of times more energy.
 - The proto-planetary disks around FU Orionis stars are heated to much higher temperatures, turning ice into water vapor out to large distances from the star.

75. South Atlantic Anomaly (SAA)

In News

NASA Is Tracking a Huge, Growing Anomaly in Earth's Magnetic Field.

About SAA

- The South Atlantic Anomaly (SAA) is an area where Earth's *inner Van Allen radiation belt comes closest to Earth's surface*, dipping down to an altitude of 200 kilometres.
- *The SAA is the near-Earth region where Earth's magnetic field is weakest relative to an idealized Earth-centered dipole field.*
- The area of the SAA is confined by the intensity of Earth's magnetic field at less than 32,000 nanoteslas at sea level.
- SAA appeared to be dividing into two distinct cells, each representing a separate centre of minimum magnetic intensity within the greater anomaly.

- The anomaly is not a new appearance but a recurrent magnetic event that may have affected Earth as far back as 11 million years ago.
- The space agency's satellites and spacecraft are particularly vulnerable to the weakened magnetic field strength within the anomaly.
- It will results in exposure to charged particles from the Sun.
- The technological systems onboard satellites can short-circuit and malfunction if they become struck by high-energy protons emanating from the Sun.
- Radiation from the SAA has affected spacecraft, sometimes leading to their doom.

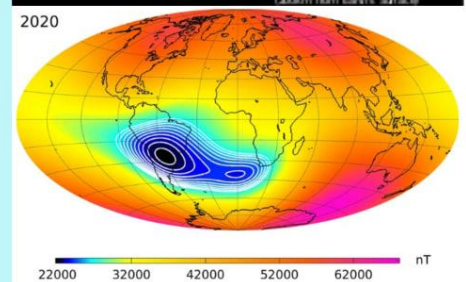
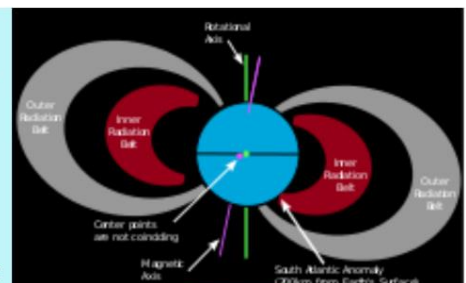
South Atlantic Anomaly (SAA)



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South Atlantic Anomaly (SAA)

- It is a region at the Earth's surface where the intensity of the magnetic field is particularly low.
- It stretches out between South America and southwest Africa.
- Why it occurs?
 - Earth's magnetic field acts like a protective shield around the planet, repelling and trapping charged particles from the Sun.
 - SAA exists because the Earth's inner Van Allen radiation belt comes closest to the planet's surface, causing an increased flux of energetic particles.
 - This leads to the penetration of solar energetic particles deep into Earth's atmosphere, posing severe problems for airplanes and ships' positioning systems as well as spacecraft electronic systems.



📞 7994058393

🌐 www.enliteias.com ✉ enliteias@gmail.com