

CURRENT AFFAIRS

WEEKLY

WEEK: 2

JULY
2022

MAINS

GS-II

- INDIA-TAJIKISTAN BILATERAL RELATIONS
- INDIA NEEDS TO SCALE UP DIRECT NUTRITION INTERVENTIONS
- ELECTION TO THE OFFICE OF THE VICE-PRESIDENT OF INDIA

GS-III

- FIVE YEARS OF GST IN INDIA
- REVERSE MIGRATION AND ITS IMPACTS ON INDIAN ECONOMY
- GLOBAL LIVEABILITY INDEX, AN ASSESSMENT OF REQUIRED INFRASTRUCTURE
- NEW AUTONOMOUS FLYING WING TECHNOLOGY DEMONSTRATOR
- THE NEED FOR SPACE SUSTAINABILITY
- LARGE HADRON COLLIDER: ADVANCEMENT IN THE FIELD OF PARTICLE PHYSICS

PRELIMS

HISTORY

- The legend of Alluri Sitharama Raju, and the political significance of his legacy
- Nadaprabhu Kempegowda

GEOGRAPHY

- Nigeria's latest lithium find

INTERNATIONAL RELATIONS

- Who are the Karakalpaks, residents of an unrest-hit Uzbekistan province?
- What are critical minerals, the centerpiece of a new India-Australia collaboration?

ECONOMY

- India's gig workforce to reach 2.35 crore by 2030: NITI Aayog

ENVIRONMENT

- Restoring Banni grasslands, Gujarat battles invasive tree species
- Carnivorous plant catches prey underground, found in Indonesia: Study
- Saving Chenkurinji from climate change

- India adds 540 species to faunal database

SCIENCE & TECHNOLOGY

- The three new 'exotic' sub-atomic particles discovered at CERN
- What is the Fields Medal, so-called 'Mathematics Nobel' awarded to Ukrainian professor and three others?
- What are Nairobi flies, which are causing disease in Sikkim?
- New material discovered can convert infrared light to renewable energy
- Xiaomi unveils 'Cyberdog', and with it explores robotics
- With GI tag, Mayurbhanj's superfood 'ant chutney' set to find more tables
- What is Anthrax, the infectious disease found in Kerala?
- India is ripe for the sodium-ion battery revolution
- CAPSTONE
- Earth's top 7 asteroid defences

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The current affairs articles are segregated from prelims and mains perspective, such separation is maintained in terms of structure of articles. Mains articles have more focus on analysis and prelims articles have more focus on facts.

However, this doesn't mean that Mains articles don't cover facts and PT articles can't have analysis. You are suggested to read all of them for all stages of examination.

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SECTION: A
(MAINS)

CURRENT AFFAIRS

INDIA-TAJIKISTAN BILATERAL RELATIONS

CONTEXT:

India's Union Minister for Science and Technology and Earth Sciences Dr. Jitendra Singh held a bilateral meeting with the Minister for Climate and Environment of Norway Mr Espen Barth Eide on the side-lines of the UN Ocean Conference in Lisbon, Portugal and discussed several issues of mutual interest.

◎ BACKGROUND

- India and Tajikistan diplomatic relations were established on 28 August 1992, since then regular high level visits between the two countries cemented the bilateral ties.
 - ▶ India was one of the first countries to recognize independence of Tajikistan and set up diplomatic relations. **Indian embassy** was opened in **Dushanbe** in **1994**.
- Both the countries are celebrating 30 years of diplomatic ties

The country profile

- Tajikistan is one of the five Central Asian Republics (CARs), which became independent in 1991 as a result of the Soviet disintegration.
- Tajikistan is in India's extended neighborhood, and can be called India's 'Gateway to Central Asia'.
- Almost 93% of Tajikistan's territory is rough, remote and mountainous; only exception being the Ferghana Valley, which is fertile and densely populated.
- Hilly regions of Tajikistan are source to number of rivers, like Syr Darya, Zerafshan, Panj and Vakhsh.
- Tajikistan is part of several multilateral regional forums like
 - ▶ Collective Security Treaty Organization (CSTO)
 - ▶ Shanghai Cooperation Organization (SCO)
 - ▶ Heart of Asia

global water action and climate resistance on **Water for sustainable Development**.

- Agendas of the 11th meeting of the Intergovernmental Commission of Tajikistan and India on trade-economic, scientific and technical cooperation in 2020 were discussed that included industry, agriculture, education etc.
- The Eight MoUs/agreements that were signed in 2018 between the two nations were revisited.
- Those were in the areas of **Peaceful Use of Space Technology, Disaster Management, Renewable Energy, and Agricultural Research and Education** to name important ones.

India recently hosted the first meeting of the **India-Central Asia Summit** with the participation of the Presidents of Tajikistan, Kazakhstan, Kyrgyz Republic, Turkmenistan and Uzbekistan.

Mapping the historical ties:

- India's relations with Tajikistan have been recorded in the **Buddhist annals** which means around **2500 years BC**.
- The excavations in **Panjikent** in modern Tajikistan are dependable record in this connection.
- In medieval times, two streams of relations were there-
 - ▶ flow of Buddhist missionaries from India to Central Asia via Tajikistan
 - ▶ trade and commerce carried along these links
- In the Mughal period, Central Asian Sufi ideas, tomb architecture, Farsi literature became popular in India.
- Their mother tongue – **Tajik** – is a branch of **Irano-Aryan group** of languages and hence drawing extensively from Sanskrit.

Relation in today's era

- **Cooperation in International Forums/ initiatives**

◎ ANALYSIS

Key highlights of the recent meeting:

- **Water resource & energy:** The discussion revolved around water resources research, with special focus on Glaciers and their monitoring and understanding, Non-conventional Energy, etc.
- Tajikistan Minister requested India to support

- In 2020, Tajikistan extended support for India's candidature for a non-permanent seat in UNSC for the term 2021-22.
- Tajikistan has publicly supported India's bid for **UNSC permanent membership** during the state visit of President Shri Ram Nath Kovind (in 2018).
- Tajikistan strongly supported **SCO Member status** for India.
- India supported Tajikistan's accession to WTO in March 2013.
- India also supported Tajikistan's candidature to **ECOSOC**.

• **Development & Aid Partnership**

Since Tajikistan's independence in 1991, India has played the role of a development and aid partner for Tajikistan.

▶ **Developmental Project Assistance:**

- With a grant of about USD 0.75 million India set up a Modern Engineering Workshop and commissioned it on 02 June 2011. The project is running successfully.
- A project for setting up of computer labs in 37 schools in Tajikistan (announced during Prime Minister Shri Narendra Modi's visit in July 2015) was completed and delivered in August 2016 at a cost of USD 6,02,701/-.
- India has commenced the construction of phase-I of a 8-lane highway project from Chortut village to Ayni roundabout in Dushanbe at a cost of approximately USD 17.54 million.
- India provided USD 2 million financial assistance to Tajikistan to help conduct SCO Head of State Summit in Dushanbe in September 2021.

▶ **Humanitarian Assistance:**

- After the outbreak of Polio in southwest Tajikistan, India provided doses of oral polio vaccine through UNICEF in November 2010.
- In September 2015, India granted USD 100,000 as humanitarian assistance to Tajikistan for providing relief to the **flood and mudslide-affected people of GBAO (Pamir) and Rasht valley**.
- India also help the country during the outbreak of Covid19.

• **Connectivity, Trade & Economic Relation:**

- ▶ Trade and Economy is the weakest link in India-Tajikistan's relationship.
- ▶ **Reason:** lack of reliable land connectivity between the two countries.

Indian exports to Tajikistan	Tajikistan exports to India
<p>In 2020-2021, 53.45 million USD</p> <ul style="list-style-type: none"> • Consist of pharmaceuticals, medical preparations, cane or beet sugar, tea, handicraft and machinery. • Indian pharmaceutical products occupy approximately 25% of Tajik market. 	<p>In 2020-2021, 1.06 million USD</p> <ul style="list-style-type: none"> • Different types of ores, slag and ash, aluminum, organic chemicals, herbal oils, dried fruits and cotton.

• **Cultural & People-to-People Relation:**

India and Tajikistan share strong historical, cultural and linguistic ties. There is great liking for Indian culture and films and TV serials dubbed in Russian language are routinely shown on local TV channels.

▶ **Swami Vivekananda Cultural Centre in Dushanbe** offers courses in Kathak&Tabla through teachers deployed by ICCR from India.

▶ From Tajikistan a 20-member art and cultural troupe participated in **Surajkund International Crafts Mela** in 2017, 2018, 2019 and in 2020.

▶ In 2019, under an MEA sponsored program, a Tajik national visited India to witness and participate in the cultural traditions of **KumbhMela**.

▶ A **Hindi-Urdu Chair** was established in the Tajik State University and since January 2019 a Professor has been deployed by ICCR at the university.

▶ **Yoga** is very popular among local people in Tajikistan.

• **Defense Cooperation:**

▶ India has gifted military liveries for two brigades, aviation suits, computers, language training material, military jeeps and trucks and **two Mi-8 helicopters** along with spare parts and consumables.

▶ As a component of officers training, batches of young military cadets from Tajikistan are undergoing training at the **National Defense Academy [NDA] at Khadakwasla**.

▶ The **Tajik Ministry of Defense** will receive a grant of US\$ 0.5 million to renovate and upgrade the Tajik Military Institute.



How India's interaction is increasing with Central Asia?

- **Kazakhstan, Kyrgyzstan and Tajikistan** share common borders with **China**
- **Turkmenistan, Uzbekistan and Tajikistan** share borders with **Afghanistan**
- **Tajikistan and Uzbekistan** are proximate to **India**

Central Asia is home to the world's biggest untapped resources of oil, gas and minerals. It is also a key gateway for connectivity with Russia, the Middle East and Europe. India's relations with CA countries have acquired a strategic dimension.

- **Attractive hydrocarbon deposits:** **Kazakhstan, Turkmenistan and Uzbekistan** have emerged as important suppliers of uranium to fuel India's nuclear power plants.
- **Strategic location:** Tajikistan and Kyrgyzstan have considerable strategic importance.

Tajikistan's strategic location

Tajikistan's geographic location in the center of Central Asia is of significant strategic interest to India.

Its southeastern border sits just north of **Afghanistan's eastern Wakhan Corridor peninsula**, a geostrategic strip of land that borders China to the east and Pakistan-administered Kashmir to the south.

But since the 1947 partition with Pakistan, India has not had direct land access to the region, and so has set up its only foreign military base in Tajikistan, operated in collaboration with the **Tajik Air Force**.

Tajikistan provided critical help in the evacuation of Indians from Afghanistan.

It will be in India's interest to augment its linkages with these countries to reduce their dependence on China.

© CONCLUSION:

Tajikistan holds huge significance for fulfilling India's broader interests in the Central Asian region especially its 'Connect Central Asia' policy. More importantly, stronger India-Tajikistan partnership is of key importance for India to amplify its goodwill in the region as well as to add stability to Afghanistan and meet India's future energy demands.

INDIA NEEDS TO SCALE UP DIRECT NUTRITION INTERVENTIONS

CONTEXT:

Even after seven decades of Independence, India is afflicted by public health issues such as child malnutrition (35.5% stunted, 67.1% anemic) attributing to 68.2% of under-five child mortality.

- Therefore government is giving a push to National Nutrition Mission (NNM) or POSHAN Abhiyan, an overarching scheme for Holistic Nutrition.

◎ BACKGROUND:

- Back in the 1970s, India had launched the National Nutritional Anemia Prophylaxis Programme (NNAPP) to fight the deficiency.
- POSHAN (Prime Minister's Holistic Nutrition Scheme) Abhiyaan was launched in 2018 to improve the effects of healthy eating on children, pregnant women, women, and breastfeeding mothers.
 - POSHAN Abhiyaan aims to make India a world without malnutrition by 2022. Abhiyaan aims to reduce stunting in children from 38.4 percent to 25 percent by 2022.
- In 2019, it rolled out the Anemia Mukh Bharat campaign.
- Despite several schemes and programmes, the problem still exists in a large segment of the population.
 - India continues to host the highest number of malnourished children in the world.
 - Over 33 lakh children in India are malnourished and more than half of them fall in the severely malnourished category with Maharashtra, Bihar, and Gujarat topping the list according to Ministry of Women and Child Development.

◎ ANALYSIS

Mapping child nutrition in India

- Data from the National Family Health Survey (NFHS)-5 2019-21, as compared to NFHS-4 2015-16, reveals a substantial improvement in a period of four to five years in several proxy indicators of women's empowerment, such as:
 - There is a substantial increase in antenatal service attendance (58.6 to 70.0%)
 - Women having their own saving bank accounts (63.0 to 78.6%)
 - Women owning mobile phones that they

themselves use (45.9 % to 54.0%)

- Women married before 18 years of age (26.8 % to 23.3 %)
- Women with 10 or more years of schooling (35.7% to 41.0%)
- Access to clean fuel for cooking (43.8 % to 68.6%).

But the country has not progressed well in terms of direct nutrition interventions, Preconception nutrition, maternal nutrition, and appropriate infant and child feeding remain to be effectively addressed.

- India has 20% to 30% undernutrition even in the first six months of life when exclusive breastfeeding is the only nourishment required.
- Despite a policy on infant and young child feeding, and a ban on sale of commercial milk for infant feeding, there has only been a marginal improvement in the practice of exclusive breastfeeding (EBF)
- NFHS-5 also confirms a gap in another nutrition intervention - complementary feeding practices i.e., complementing semi-solid feeding with continuation of breast milk from six months onwards.
- Poor complementary feeding is often due to a lack of awareness to start feeding at six to eight months, what and how to feed appropriately family food items, how frequently, and in what quantity.
- The fact that 20% of children in higher socio-economic groups are also stunted indicates poor knowledge in food selection and feeding practices and a child's ability to swallow mashed feed.
- Poor nutrition not only adversely impacts health and survival but also leads to diminished learning capacity, and poor school performance. And in adulthood, it means reduced earnings and increased risks of chronic diseases such as diabetes, hypertension, and obesity.

According to the Global Nutrition Report 2020, India is among the 88 countries that are likely to lose the standards of healthy eating in the world by 2025.

What factors are responsible for nutrition deficiency?

The most common nutritional deficiencies are due to inadequate consumption of proteins, vitamin D, iron, vitamin B12 and folate.

- **Interlinked issues:** The issues of poor food safety, food insecurity, and unsustainable food systems are closely interlinked and responsible for undernutrition.
- **Early marriage:** Significant incidence of early marriage and childbearing have been found as amongst the important causes of nutrition issues facing the country today.
- **Use of agrochemicals:** Agrochemicals comes at a perilous cost. Chemical contamination changes the biochemical composition of food, and can lead to a range of diseases.
- **Climate change:** Climate change also affects food safety, with both abiotic and biotic agricultural contributing factors.
 - ▶ **Abiotic factors** such as air pollution, nutrition deficiencies, and extreme changes in temperature impact soil quality and the health and productivity of crops.
 - ▶ **Biotic ones**-e.g., insects, pests, and soil-are equally affected.
- **Other major reasons include:**
 - ▶ disruptions in food supply chains
 - ▶ loss of income and livelihoods
 - ▶ widening inequalities across gender, class, caste, and disparities
 - ▶ fluctuations in food prices

Impact of Malnutrition:

- **Deprived brain growth:** The effects of malnourishment in a small child are not merely physical. A developing brain that is deprived of nutrients does not reach its full mental potential.
- **Structural damages:** Under nutrition can affect cognitive development by causing direct structural damage to the brain and by impairing infant motor development.

Micronutrients

- The World Health Organization (WHO) defines 'Micronutrients' as compounds required in very smaller amounts, <100 mg/d.
- Micronutrients include vitamins and minerals.
- They are vital for the production of hormones, enzymes and other substances that manage growth and development.
- **Diseases caused by deficiencies of**
 - ▶ **Iron** (anaemia)
 - ▶ **Iodine:** iodine deficiency (IDD) disorders such as goitre and hypothyroidism
 - ▶ **Vitamin A:** vitamin A deficiency (VAD) disorders such as blindness, measles and diarrheal diseases.

- ▶ This in turn affects the child's ability to learn at school, leading to a lifetime of poverty and lack of opportunity.
- ▶ These disadvantaged children are likely to do poorly in school and subsequently have low incomes, high fertility, and provide poor care for their children, thus contributing to the intergenerational transmission of poverty.
- **Impact on vulnerable section:** Food insecurity and food safety issues disproportionately affect women.
- **Increased gender inequalities:** Gender inequalities are further exacerbated as food systems workers and unpaid care workers, women experienced additional burdens.

International Institutions and Protocols

- The FO is the primary international organisation responsible for monitoring different dimensions of the food chain, from farm to fork.
- It partners with the World Health Organization (WHO) to enforce mandates for enhancing food safety and improving the health of populations across the globe.
- While WHO deals predominantly with the public health sector, the FAO is concerned with food safety issues along the food value chain.

Example

- One example of collaboration between the two is the FAO/WHO Codex Alimentarius Commission.

- It is responsible for implementing the Joint Food Standards Programme and the Codex Alimentarius or "Food Code", a collection of standards, guidelines, and codes related to food safety practices.

Challenges

- Poverty, unemployment, lack of education
- Lack of infrastructure to integrate nutrition into health care.
- Lack of awareness pertaining to importance of nutrition.
- Lack of monitoring and evaluation of programs to address systemic.

The Granular Solution

- **Investment:** There is a greater need now to increase investment in women and children's health and nutrition to ensure their sustainable development and improved quality of life.
- **Reaching to individuals:** There is need to fight malnutrition through a micro-level approach with needs-based additions in order to reach and influence each individual.
- **Focusing on right technique of breastfeeding:** Promoting the technique of appropriate holding, latching and manually emptying the breast are crucial for the optimal transfer of breast milk to a baby.
- **Awareness regarding special care:** Creating awareness at the right time with the right tools and techniques regarding special care in the first 1,000 days deserves very high priority.
- **Focus on effective implementation:** There is a pressing need to revisit the system spearheading POSHAN 2.0 and overhaul it to remove any flaws in its implementation.

- ▶ There is need for systematically reviewing the status, and develop and test a new system that would combine the human resource of ICDS and health from village to the district and State levels.

- **Real-time monitoring:** Real-time monitoring of the Public Distribution System (PDS) would go a long way in ensuring food at the family level.
- **More awareness:** Moreover, mass media or TV shows could organize discourses on care in the first 1,000 days to reach mothers outside the public health system.

Important nutrients along with their sources:

- **Proteins:** Chicken, milk, eggs, pulses
- **Vitamin D:** Exposure to sunlight, egg yolk, fortified foods, fish
- **Vitamin B12:** Shellfish, salmon, liver, trout
- **Folate:** Citrus fruits, peas, tomato juice
- **Vitamin A:** Grapefruit, cantaloupe, pumpkins
- **Iron:** Organ meat, shellfish, red meat, kidney beans
- **Iodine:** Egg dairy, fish, seaweed

Way Forward:

It is time to think out of the box, and overcome systemic flaws and our dependence on the antiquated system of the 1970s that is slowing down the processes. The pandemic has shown us that the only way forward is to work together and not in isolation. There is a need for the same recognition of the nutrition crisis that faces everyone, in every country. The need to prioritize and invest in nutrition has never been greater. Poor diets and malnutrition should be addressed holistically and sustainably to create a healthy future for all.

ELECTION TO THE OFFICE OF THE VICE-PRESIDENT OF INDIA

CONTEXT:

The process of filing nominations for the August 6 vice-presidential polls will start from Tuesday and go on till July 19. The term of incumbent Vice President M Venkaiah Naidu ends on August 10.

◎ BACKGROUND:

- The Vice-President occupies the second highest office in the country. He is accorded a rank next to the President in the official warrant of precedence.
- This office is modelled on the lines of the American Vice-President.
- The first vice president of India, Sarvepalli Radhakrishnan, took oath at Rashtrapati Bhavan on 13 May 1952.

Qualifications for the office of vice President:

- He should be a citizen of India.
- He should have completed 35 years of age.
- He should be qualified for election as a member of the Rajya Sabha.
- He should not hold any office of profit under the Union government or any state government or any local authority or any other public authority.

Conditions of Office:

The Constitution lays down the following two conditions of the Vice-President's office:

- He should not be a member of either House of Parliament or a House of the state legislature. If any such person is elected Vice-President, he is deemed to have vacated his seat in that House on the date on which he enters upon his office as Vice-President.
- He should not hold any other office of profit.

Vacancy in Office:

A vacancy in the Vice-President's office can occur in any of the following ways:

- On the expiry of his tenure of five years
- By his resignation
- On his removal
- By his death
- Otherwise, for example, when he becomes disqualified to hold office or when his election is

declared void

As per **Article 68** of the Constitution, the election to fill the vacancy caused by the expiration of the term of office of the outgoing vice-president is required to be completed before the expiration of the term.

Election procedure:

- Article 324 of the Constitution read with the Presidential and Vice-Presidential Elections Act, 1952 and the Presidential and Vice-Presidential Elections Rules, 1974, vests the superintendence, direction and control of the conduct of election to the office of the Vice President of India in the Election Commission of India.
- The Vice-President is elected by the members of an electoral college consisting of the members of both Houses of Parliament.
 - ▶ The electoral college consists of both elected and nominated members of the Parliament (in the case of president, only elected members).
 - ▶ It does not include the members of the state legislative assemblies (in the case of President, the elected members of the state legislative assemblies are included).
- The Vice-President's election held in accordance with the system of proportional representation by means of the single transferable vote and the voting is by secret ballot.
- All doubts and disputes in connection with election of the Vice President are inquired into and decided by the Supreme Court whose decision is final.
- The election of a person as Vice-President cannot be challenged on the ground that the electoral college was incomplete (i.e., existence of any vacancy among the members of electoral college).
- If the election of a person as Vice President is declared void by the Supreme Court, acts done by him before the date of such declaration of the Supreme Court are not invalidated (i.e., they continue to remain in force).

Powers and functions of Vice President:

- He acts as the ex-officio Chairman of Rajya Sabha.

In this capacity, his powers and functions are similar to those of the Speaker of Lok Sabha.

- He acts as President when a vacancy occurs in the office of the President due to his resignation, impeachment, death or otherwise.
 - ▶ He can act as President only for a maximum period of six months within which a new President has to be elected.
 - ▶ Further, when the sitting President is unable to discharge his functions due to absence, illness or any other cause, the Vice-President discharges his functions until the President resumes his office.
- While acting as President or discharging the functions of President, the Vice-President does not perform the duties of the office of the chairman of Rajya Sabha. During this period, those duties are performed by the Deputy Chairman of Rajya Sabha.

Constitutional articles related to Vice President of India

- The Vice-President of India
- The Vice-President to be ex-officio Chairman of the Council of States
- The Vice-President to act as President or to discharge his functions during casual vacancies in the office, or during the absence, of President
- Election of Vice-President
- Term of office of Vice-President
- Time of holding election to fill vacancy in the office of Vice-President and the term of office of person elected to fill casual vacancy
- Oath or affirmation by the Vice-President
- Discharge of President's functions in other contingencies

FIVE YEARS OF GST IN INDIA

CONTEXT

Recently, the completion of five years of the Goods and Services Tax (GST) has been observed. The GST had suffered several ups and downs since its inception.

- Let us evaluate its journey.

◎ BACKGROUND

- In India, the idea of adopting GST was first suggested by the Atal Bihari Vajpayee Government in 2000.
- The state finance ministers formed an **Empowered Committee (EC)** to create a structure for GST, based on their experience in designing State VAT.
- In 2002, the Vajpayee government formed a task force under **Vijay Kelkar** to recommend tax reforms.
- In 2005, the **Kelkar committee** recommended rolling out GST as suggested by the 12th Finance Commission.

- It is essentially a consumption tax and is levied at the **final consumption point**.

Tax structure under GST:

- Central GST** to cover Excise duty, Service tax etc.
- State GST** to cover VAT, luxury tax etc.
- Integrated GST (IGST)** to cover inter-state trade.
 - IGST per se is not a tax but a system to coordinate state and union taxes.
- It has a **4-tier tax structure** for all goods and services under the slabs- **5%, 12%, 18% and 28%**.

◎ ANALYSIS

What is GST?

- GST was introduced through the **101st Constitution Amendment Act, 2016**.
- It is one of the **biggest indirect tax** reforms in the country.
- It was introduced with the slogan of '**One Nation One Tax**'.
- Objectives:**
 - To mitigate the **double taxation**, cascading effect of taxes, multiplicity of taxes, classification issues etc., and has led to a common national market.
 - The GST that a merchant pays to procure goods or services (i.e. on inputs) can be set off later against the tax applicable on supply of final goods and services.
 - The set off tax is called **input tax credit**.
 - The GST avoids the cascading effect or tax on tax which increases the tax burden on the end consumer.
- Levied on:**
 - The GST has subsumed indirect taxes like **excise duty, Value Added Tax (VAT), service tax, luxury tax etc.**

What is the Significance of GST?

- Create a Unified Common Market:** Help to create a unified common national market for India. It will also give a boost to foreign investment and "**Make in India**" campaign.
- Streamline Taxation:** It will harmonize the laws, procedures and rates of tax between Centre and States and across States.
- Increase Tax Compliance:** Provide improved environment for compliance as all returns are to be filed online, input credits to be verified online, encouraging more paper trail of transactions at each level of supply chain;
- Discourage Tax evasion:** Uniform SGST and IGST rates will reduce the incentive for evasion by eliminating rate arbitrage between neighbouring States and that between intra and inter-state sales.
- Reduce Corruption:** Greater use of IT will reduce human interface between the taxpayer and the tax administration, which will go a long way in reducing corruption.
- Boost Secondary Sector:** It will boost export and manufacturing activity, generate more employment and thus increase GDP (Gross Domestic Product) with gainful employment leading to substantive

economic growth.

What are the issues associated with GST?

- **Multiple Tax Rates:** Unlike many other economies which have implemented this tax regime, India has multiple tax rates. This hampers the progress of a single indirect tax rate for all the goods and services in the country.
- **New Cesses crop up:** While GST scrapped multiplicity of taxes and cesses, a new levy in the form of compensation cess was introduced for luxury and sin goods. This was later expanded to include automobiles.
- **Trust Deficit:** The Union government's authority to levy and appropriate cess revenues for it without sharing them with the states has lent credence to the wisdom of guaranteed compensation for states.
 - ▶ It turned out to be prescient as GST failed to live up to its economic promises and states' revenues were protected through this guarantee.
- **Economy outside GST purview:** Nearly half the economy remains outside GST. E.g. petroleum, real estate, electricity duties remain outside GST purview.
- **The complexity of tax filings:** The GST legislation requires the filing of the GST annual returns by specified categories of taxpayers along with a GST audit. But, filing annual returns is a complex and confusing one for the taxpayers. Apart from that, the annual filing also includes many details that are waived in the monthly and quarterly filings.
- **Higher Tax Rates:** Though rates are rationalised, there is still **50 % of items** are under the **18 % bracket**.
 - ▶ Apart from that, there are certain essential items to tackle the pandemic that was also taxed higher.
 - ▶ For example, the **12% tax on oxygen concentrators, 5% on vaccines, and on relief supplies from abroad.**

Role of GST Council

- The GST Council is a joint forum of the **Centre and the states**.
- It was set up by the President as per **Article 279A (1)** of the amended Constitution

• Members:

- ▶ The members of the Council include the **Union Finance Minister (chairperson)**, the Union Minister of State (Finance) from the Centre.
- ▶ **Each state can nominate a minister in-charge** of finance or taxation or any other minister as a member.

• Functions:

- ▶ The Council, is meant to "make recommendations to the Union and the states on important issues related to GST, like the goods and services that may be subjected or exempted from GST, model GST Laws".
- ▶ **It also decides on various rate slabs of GST.**

◎ REQUIRED MEASURES

- **Appointing a decision making authority:** The consultative and consensual nature of decision-making that has helped guide the Council's decisions so far must be adhered to.
- **Maintain balance between Centre and states:** Addressing the contentious issues will, first and foremost, require bridging the trust deficit between the Centre and states.
- **State's compensation on Time:** The trust deficit can be bridged only through acts of good faith. The Union government should commit to the states that it will not resort to cesses and surcharges that are outside the shareable pool of revenues.

◎ CONCLUSION

Democratically elected state governments in India do not have sole powers for both direct and indirect taxation, which is unheard in any other federal democracy. GST is centralised I indirect taxation in India. It is time to start a national discussion on reversing the course, moving towards decentralisation by giving states powers for direct taxation. A commitment to initiate such discussions by the Union government will be a healthy signal for states' confidence and fiscal freedom.

REVERSE MIGRATION AND ITS IMPACTS ON INDIAN ECONOMY

CONTEXT

The Fourth Periodic Labour Force Survey (PLFS) data released by the National Statistical Office (NSO), uncovers the much-awaited official statistics on 'migration'.

◎ BACKGROUND

- A significant number of migrants had a harrowing time when the first ever lockdown was imposed on March 24, 2020, to restrain the Covid-19 pandemic.
- Among the vulnerable population, migrant workers had been the most exposed to unemployment and starvation as they suddenly lost their livelihood.
- Stranded in other States and metro cities with no work and income, they suffered economic problems and psychological trauma.
- Thus far, much has been said of the plight of migrants and reverse migration due to lockdown in the absence of official statistics.
- This PLFS data was collected during the July 2020 to June 2021 period, hence exhibiting significant statistics on the impact of lockdown on migrants using a cut-off point March 2020.
- Out of total migrants in India (that is, 28.9 per cent of total population), 3.14 per cent had migrated

after 'March 2020' as shown in the report.

- Further, the unit level data of PLFS reported that during 2020-21, the 'reverse migrant or returned migrant' estimated to be 11.1 per cent of the total migrants.
- The returned migrants are those who moved to their earlier UPR (where they have resided any time in the past) from their last UPR. However, this reverse migration found to be as high as 53 per cent after the cut-off point 'March 2020'.

◎ ANALYSIS

Types of Migration:

- Rural to rural
- Rural to urban
- Urban to rural
- Urban to urban



What does Migration and reverse migration means?

- **Migration:** Migration is defined as the movement of people over some distance (or at least from one "migration-defining area" to another) and from one "usual place of residence" to another.
- **Reverse Migration:** *Reverse migration* is defined as the movement of people from a place of employment to their native homes.

- ▶ loss of job/closure of unit/lack of employment opportunities (19.35 per cent),
- ▶ health (14 per cent),
- ▶ migration of parent/earning member of the family

Migration Rate: The migration rate is the percentage of migrants in the total population.

Status of migration in India

- Migration rate in the country is 28.9 per cent
- **Gender based migration:**
 - ▶ Female migration rate is 81.1%
 - ▶ Male migration rate is 18.8%
 - ▶ The main reason behind higher female migration is 'marriage'.
- Migration based on educational levels:
 - ▶ The highest percentage of migration was found to be among illiterates, i.e., 33%
 - ▶ Migration rate for primary educated is 19%,
 - ▶ Migration rate for secondary and senior secondary 18%
 - ▶ Rate for middle (17 per cent) and
 - ▶ Rate for graduate and above (11 per cent)
- **Migration during lockdown:** The main reasons for COVID-induced migration after 'March 2020' are;

How migration is beneficial?

- Bridges the gap of labor demand and supply.
- Skill development and knowledge enhancement.
- Improves the scope of employment, ensuring a better standard of living.
- Serves as the source of economic remittances.
- Providing a sustainable base for cultural exchange and social remittances.

How reverse migration impacts the economy?

- **Rise in WPR:** Reverse migration during the pandemic has raised the **Worker-population ratio** in the village areas.
- **Increase in share of employment:** Reverse migration has also increased the share of employment in the rural sectors.
- **Shortfall of labour:** On the other hand urban economy is facing a distinguished problem of shortfall of various skilled and unskilled labours,



impacting the economic viability of the secondary sector.

- **Technological deficit:** Absence of technological development in the secondary sector might result into a severe shock to the industrial activity.

What are the major concerns over migration and reverse migration?

- The people who are economically successful and socially accepted broadly find it relatively easy to relocate and get easily accepted into other societies. This poses problems for the marginalized sections of society.
- In contrast, it is harder for those who are poor or from a marginalized group to enter many of these countries, and even if they do, they might not be able to mix.
- Socio- and Psychological Aspects: Migrants are frequently not readily accepted by their host countries and always treated as second-class citizens. As a result, interaction confidence is also impacted.

- Any person moving to a new country encounters numerous difficulties, such as homesickness and loneliness as well as difficulties adjusting to the local culture and language.
- Exclusion from Social Benefits and Political Rights: Migrant workers are denied numerous opportunities to exercise their political rights, such as the ability to vote.
- In addition, they are prevented from accessing assistance programs and policies by the requirement to present evidence of address, ration cards, voter identification, and Aadhaar cards, which is challenging given the turbulence of their existence.

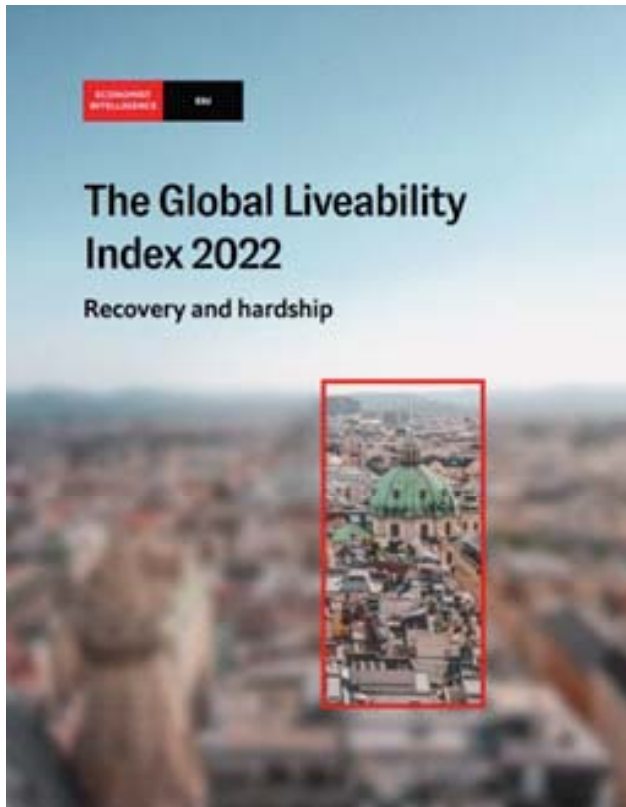
◎ CONCLUSION

Migration creates a positive impact in the functioning of the economy with better skilled development and supporting a strong base for skilled and unskilled labour supply. Reverse migration faced by Indian economy during the pandemic has severely impacted both the rural and urban economy.

GLOBAL LIVEABILITY INDEX, AN ASSESSMENT OF REQUIRED INFRASTRUCTURE

CONTEXT

The European Intelligence Unit (EUI) recently released the Global Liveability Index 2022.



ANALYSIS

Parameters of the Index

- It ranked **173 cities** on the basis of their liveability or living conditions.
- When ranking, out of the five factors, the EUI attaches the highest weightage to stability and culture and environment. Summing all accounts for **25% each**.
- It is followed by **Healthcare and infrastructure** with 20% each and **Education** with 10%.
- The list, for the first time, included five Indian cities; Delhi, Mumbai, Chennai, Ahmedabad, and Bangalore.
- Rank of Indian Cities:** All five scored poorly, ranked between 140 and 146.
 - Delhi: 140
 - Mumbai: 141
 - Chennai: 142
 - Ahmedabad: 143
 - Bangalore: 146

Key findings

- Bangalore received a score of 46.4, out of 100, in infrastructure.
- Pakistan's largest city Karachi was one of the five least livable cities in the world in the index, but it has still scored better than Bangalore in terms of infrastructure.
- The infrastructure score is based on the quality of roads, public transportation system, international links, energy provision, telecommunications, water, and availability of good quality housing.
- The most livable city according to the index is Vienna.
- The Syrian capital, Damascus is the least livable city in the world.
- Kiev (Ukraine)** had to be left out of the poll, and Moscow and St. Petersburg (Russia) suffered a decline in rankings.

BACKGROUND

- Since last year, the average liveability index has significantly improved, reflecting improvements in healthcare, education, and culture across most cities as a result of the removal of COVID-related restrictions.
- The score, however, is still below pre-pandemic levels as a result of the deterioration of stability in several eastern European towns as a result of Russia's invasion of Ukraine.
- As scores for culture and environment, education, and healthcare increase globally, the average index has recovered to 73.6 (out of 100), up from 69.1 a year ago.
- The index, nevertheless, is still below the pre-pandemic average of 75.9, which was recorded.

What are the reasons for India's weak performance?

- According to the index, the major reason evaluated is **Lack of proper Infrastructure** in major cities.
 - ▶ Road Connectivity
 - ▶ Public transportation system
 - ▶ Energy provision
 - ▶ Telecommunications
 - ▶ Water and Sanitation
 - ▶ Availability of Housing Infrastructure

Challenges associated

- **Revenue Shortfall:** Slippage in revenue estimates may not be ruled out on account of the realization of lower than anticipated increases in nominal GDP growth, direct tax buoyancy, and disinvestment targets.
- **Lesser Funds with States:** The Union government has accepted the **15th Finance Commission** report recommendation, according to which vertical share of tax devolution from the center to states has been reduced **42% to 41%**.
 - ▶ Moreover, the central government increasingly resort to the imposition of cesses which are almost permanent have reduced the shareable pool.
- **Issues Associated With Burgeoning Fiscal Deficit:** Infrastructure development in India will be funded by fiscal stimulus.
 - ▶ However, the rising fiscal deficit can cause macro-economic stability issues like high inflation, crowding out, a downgrade of international ratings, etc.
- **Issues Associated With Bad Bank:** Finding buyers for bad assets in a pandemic hit economy will be a

challenge, especially when governments are facing the issue of containing the fiscal deficit.

- ▶ Also, the bad bank idea is like shifting loans from one government pocket (the public sector banks) to another (the bad bank).
- **Structural Problems:** Due to land acquisition delays and litigation issues, the rate of implementation of projects is very slow on global standards.
 - ▶ Further, getting approvals are very difficult in terms of land access, environmental clearances; impending litigation in court delays the infrastructure projects.

What more can be done?

- Road infrastructure and connectivity needs to be improved.
- Technological integrated traffic management system.
- Waste management system should improve.
- Waste water system must be improved to secure safe drinking water.
- Housing infrastructure with and urban planning needs focus upon.
- Urban planning and disaster resilient infrastructure model for urbanization.

Important Government Initiatives focusing on infrastructure

- PM Gati Shakti Yojana
- PM Awas Yojana
- Smart City Mission (RURBAN)
- Swacch Bharat Mission

NEW AUTONOMOUS FLYING WING TECHNOLOGY DEMONSTRATOR

CONTEXT

Recently, Defence Research and Development Organisation (DRDO) carried out the maiden test flight of a new unmanned Aerial Vehicle, an Autonomous Flying Wing Technology Demonstrator.

◎ BACKGROUND

- Overdependence on the Soviet Union, brought about a change in India's approach to defence industrialisation from licence based production to production based on indigenous design.
- From the mid-1980s, the government pumped resources into R&D to enable the DRDO to undertake high profile projects.
- A significant beginning in defence indigenisation was made in 1983, when the government sanctioned the Integrated Guided Missile Development Programme (IGMDP) to develop **five missile systems**:
 - ▶ Prithvi (surface-to-surface)
 - ▶ Akash (surface-to-air)
 - ▶ Trishul (the naval version of Prithvi)
 - ▶ Nag (anti-tank)
 - ▶ Agni Ballistic missiles with different ranges, i.e. Agni (1,2,3,4,5)
- However, the indigenous efforts were not adequate to meet the requirements of the armed forces. This resulted in the shift of focus towards co-development and co-production in partnership with foreign companies.
- A beginning was made in 1998, when India and Russia signed an inter-governmental agreement to jointly produce Brahmos supersonic cruise missile.
- Apart from Russia, India has also partnered with other countries such as Israel and France for a number of projects.

◎ ANALYSIS

What is Autonomous Flying Wing Technology Demonstrator?

- The **Autonomous Flying Wing Technology Demonstrator** is a precursor to an **autonomous stealthy unmanned aerial combat vehicles (UCAV)** being developed by the DRDO's Aeronautical Development Establishment (ADE), primarily for **the Indian Air Force**.

- The UCAV will be capable of launching missiles and precision-guided munitions.
- The **unmanned aerial vehicle (UAV)** is powered by a **small turbofan engine**.
- It is a **reduced sized autonomous aircraft**.
- The engine used is **Russian TRDD-50MT** originally designed for cruise missiles.
- **Developed by:** Assembled, designed and developed by Aeronautical Development Establishment (ADE), Bengaluru.
- The airframe, undercarriage and entire flight control and avionics systems used for the aircraft had been developed indigenously.



What is the need?

- To address the immediate requirement of the Armed Forces, India had procured UAVs from the US under an emergency procurement lease but government has adopted a **no-import policy of UAVs**.
- This has spurred the effort towards **indigenization** where DRDO and industry have demonstrated advanced capabilities.

◎ SIGNIFICANCE

- The flight marks a major breakthrough in developing autonomous technology demonstration under its unmanned combat aerial vehicle (UCAV) programme.
- **Indigenization:** It is a significant step towards self-reliance in such strategic defence technologies.
- This is the crucial step for **the stealth wing flying** test bed.
- **SWiFT UAV** is targeted to showcase the capability in developing stealth technology and high-speed landing technology.

What is Autonomous Flying Wing Technology?

- It's an **Unmanned Combat Aerial Vehicle (UCAV)** or a combat drone that is a flying wing type.
- It refers to a tailless fixed-wing aircraft that houses its payload and fuel in its main wings and does not have a defined fuselage-like structure found in conventional aircraft.
- The design has the potential to deliver high fuel efficiency and stability if executed with precision.

Applications

- Mapping of Landslide Affected Area
- Infested Crop Damage Assessment
- Large Scale Mapping

- Traffic Monitoring and Management
- Logistics support

Why Indigenisation?

- **Reducing Fiscal Deficit:** India is the second largest arms importer in the world (after Saudi Arabia).
 - ▶ Higher import dependency leads to increase in the **fiscal deficit**.
 - ▶ Despite having the **fifth largest defence budget in the world**, India procures 60% of its weapon systems from foreign markets.
- **Security Imperative:** Indigenisation is needed in order to avert the threats associated with the frequent ceasefire violations like that of the Uri, Pathankot and Pulwama attacks.
 - ▶ India being surrounded by porous borders and hostile neighbours needs to be self-sufficient and self-reliant in defence production.
- **Employment generation:** defence manufacturing will lead to the generation of satellites industries that in turn will pave the way for generation of employment opportunities.
 - ▶ As per government estimates, a reduction in 20-25% in defence related imports could directly create an additional 100,000 to 120,000 highly skilled jobs in India.
- **Strategic Capability:** self-sufficient and self-reliant defence industry will place India among the top global powers.

Boosting India's Defence Production Capabilities

- Focus on indigenising high technology weapon systems like artillery guns, assault rifles, corvettes, sonar systems, transport aircrafts, and light combat helicopters
- 10,929** items, which were earlier imported, have been displayed on the SRIJAN portal for indigenisation
- The Indian industry has shown interest for **2,890** displayed items so far
- 1,776** components & spares were indigenised in 2020-21

(Source: Written reply by Minister of State for Defence in Rajya Sabha on July 19, 2021)

- ▶ Nationalism and Patriotism can increase with indigenous production of defence equipment that in turn will not only boost the trust and confidence of the Indian forces but will also strengthen a sense of integrity and sovereignty in them.

Present developments in Defence sector

- **INS Vikrant**, also known as Indigenous Aircraft Carrier 1 (IAC-1), is the first aircraft carrier to be built in India for the Navy.
- **Tejas aircraft**: DRDO is not able to develop its indigenous Kaveri engine due to restricted access to high-end defence technology by countries such as USA, JAPAN etc.
- **Project75**: Indian Navy in 2017 initiated submarine programme called Project-75 (India), the “**mother of all underwater defence deals**” with France,

Germany, Russia, Sweden, Spain and Japan to build six advanced stealth submarines.

- ▶ Project 75 Submarines **INS Kalvari, INS Khanderi, INS Vela, S53, S54 and S55** are constructed by Mazagon Dock Limited and designed by French company DCNS in Mumbai.
- **Long-range artillery gun “Dhanush”**: first indigenous long-range artillery gun also called the “desi Bofors”.
- **Arihant**: first indigenous nuclear submarine was developed in association with BARC and DRDO.
- **The Pinaka Multi Barrel Rocket Launcher**: was developed by armament Research Development Establishment (Pune).
- **Supersonic Cruise Missile BRAHMOS**: is a Joint Venture between India and the Russian federation.

THE NEED FOR SPACE SUSTAINABILITY

CONTEXT

Focusing on U.K. National Space Strategy, the fourth summit for Space Sustainability in London was hosted in collaboration with the Secure World Foundation.

◎ BACKGROUND

- Space sustainability comes into play to address the pressing current state of near-Earth orbits and its high amounts of orbital debris.
- Spacecraft collisions with orbital debris, space weather, overcrowding in **low earth orbit** (LEO) makes spacecraft susceptible to higher rates of failure.
- The current end-of-life protocol for spacecraft exacerbates the space sustainability crisis; many spacecraft are not properly disposed, which increasing the likelihood of further collisions.

Key highlights of the Summit

- A new plan has been announced as '**Plan for Space Sustainability.**'
- This plan aims to set a global commercial framework for the **insurability, the licensing and the regulation of commercial satellites.**
- It also aims to reduce the cost for those who comply with the best sustainability standards and thus encourages a thriving ecosystem for the industry.

◎ ANALYSIS

What does space sustainability means?

- Long-term sustainability looks toward space research and development of technology to ensure the reuse and recycling of satellites at every stage is known as **Space sustainability.**

How does the plan propose to achieve space sustainability?

- The U.K. calls for an "**Astro Carta**" for space sustainability, based on the Artemis Accords model for sustainable space exploration.
- The plan proposes:
 - Active **debris removal** and in-orbit servicing,
 - Encouraging space research** and the **development of technology** to ensure the reuse and;

- **Recycling of satellites** at every stage.

Need for considering Space sustainability

- Increasing number of satellites:** With the emergence of large constellations and complex satellites, there is a risk of collisions and interference with radio frequencies.
- Security challenges:** As more countries integrate space into their national military capabilities and rely on space-based information for national security, there is an increased chance that any interference with satellites.
- Expansion of private sector:** The expansion of private sector space activities poses new challenges to maintaining a safe operational environment in space, while offering opportunities to expand access to the benefits of space applications on Earth.

What are the challenges in achieving space sustainability?

- Orbital crowding poses a big threat to space sustainability. This poses a direct threat to the operations and safety of a mission and is likely to cause legal and insurance-related conflicts.
- Space debris: After the completion of a mission, an 'end-of-life protocol' requires space objects to be moved to the graveyard orbit or to a low altitude. Neither of the options is sustainable in the long run.
- Solar and magnetic storms:** These storms can potentially damage communication systems. Such space weather threats need to be addressed along with the efforts to identify the terrestrial carbon footprint of outer space missions.

Where does India stand on space sustainability?

India has always emphasised cost-effective and efficient missions with problem-solving applications. For example, India's debris footprint is minuscule; India has 114 debris among the 25,182 pieces of sizes larger than 10 cm in the lower earth orbits. Apart from that, the recent activities of India on space sustainability are;

- **Project NETRA:** The Indian Space Research Organisation (ISRO) has initiated 'Project NETRA' to monitor space debris,
- Earlier this year, India and the U.S. signed a new pact for monitoring space objects at the 2+2 dialogue,
- **Increased private participation:** With **Indian National Space Promotion and Authorisation Centre (In-SPACe)**, India expects an increased role of the private sector in India's space activities, and
- **SPADEX:** ISRO is developing a docking experiment to provide in-orbit servicing named SPADEX. It looks at docking a satellite on an existing satellite, offering support in re-fuelling and other in-orbit services while enhancing the capability of a satellite.
 - ▶ Hence, the SPADEX can increase the longevity of a mission and also provide a futuristic option to combine missions/experiments.

Global Initiatives

- **COPUOS:** As the outer space is considered a shared natural resource, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) in 2019 adopted a set of 21 voluntary, non-binding guidelines to ensure the long-term sustainability of outer space activities.
- **The U.K. Space Sustainability plan:** It mentions four primary elements:
 - ▶ To review the regulatory framework of the U.K.'s orbital activity;

- ▶ To emphasise international engagement on space sustainability;
- ▶ To try and develop safety and quality-related metrics that quantify the sustainability of activities; and,
- ▶ To induce additional funding for active debris removal.

Required measures

- **Global Cooperation:** A **collective effort by all space players**, with the active role of the UN COPUOS or the United Nations Office for Outer Space Affairs (UNOOSA), is needed to set equitable standards for the ease of activities,
- **Conservation of resources:** Many of the measures for sustainability are resource-consuming and expensive for medium-and-small space programs. Hence, there is a need for **addressing the principles and rules that guide the activities** in outer space with better clarity, and
- **Proper Guidelines: Encourage the private sector with a set of sustainability guidelines** to ensure optimum utilisation of resources and increase the safety and productivity of missions.

© CONCLUSION

Our duty is to ensure that all humanity can continue to use outer space for peaceful purposes and socioeconomic benefit now and in the long term. This will require international cooperation, discussion, and agreements designed to ensure that outer space is safe, secure, and peaceful.

LARGE HADRON COLLIDER: ADVANCEMENT IN THE FIELD OF PARTICLE PHYSICS

CONTEXT

The Large Hadron Collider, used to detect atomic particles by squeezing them under high speed collision is started operating for future researches for exploring particle physics.

◎ BACKGROUND

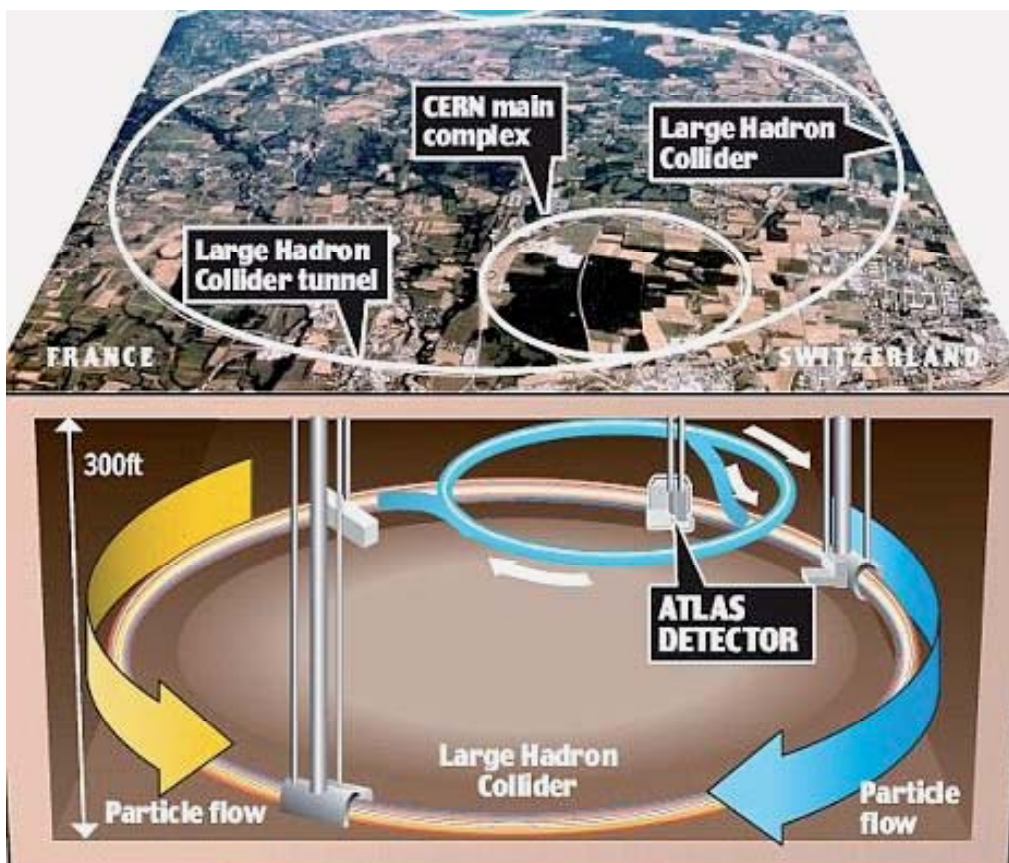
- In 2012, scientists at CERN had discovered the **Higgs boson** or the '**God Particle**' during the LHC's first run.
- The discovery concluded the decades-long mystery for '**force-carrying**' subatomic particle, and proved the existence of the Higgs mechanism, a theory put forth in the **mid-sixties**.
- The Higgs boson and its related energy field are believed to have played a vital role in the **creation of the universe**.
- The LHC's second run (Run 2) began in 2015 and lasted till **2018**.
- **Three years** after it shut down for maintenance and upgrades, the collider was switched back on this April 2022.

Higgs Boson Theory

- The standard model of particle physics hypothesized about Higgs Boson in 1964.
- The discovery was **monumental** because it appears to confirm the existence of the **Higgs field**, which is pivotal to the Standard Model and other theories within particle physics.
- Discovery of **Higgs field** would explain why some fundamental particles have mass when the symmetries controlling their interactions should require them to be massless

◎ ANALYSIS

- The **Large Hadron Collider (LHC)** is a giant, complex machine built to study particles that are the smallest known building blocks of all things.



- **Large Hadron Collider (LHC)** was built to figure out what the Higgs field is (or Higgs fields are), how it works (or they work), and whether it is (or they are) elementary or composite.
- In-fact LHC was built to do much more than discover the Higgs Boson, such as;
 - Identify dark matter
 - ▶ Search for extra dimensions of space and microscopic black holes
 - ▶ Look for signs of unification of fundamental forces
 - ▶ Find “evidence” for string theory
 - ▶ Find the Higgs Boson
 - ▶ Understand antimatter
 - It is a **27-km-long** track-loop buried structure, **100 metres** underground on the **Swiss-French border**.
 - **Functions:**
 - ▶ 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.
 - ▶ 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.
 - ▶ Prior to collision, another type of magnet is used to ‘squeeze’ the particles closer together to increase the chances of collisions.
 - **Requirements:**
 - ▶ 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.
 - ▶ The LHC uses a distribution system of **liquid helium** to keep its critical components ultra-cold at **minus 271.3 degrees** Celsius.

Interesting Fact:

- LHC’s powerful electromagnets carry almost as much current as a bolt of lightning.
- The temperature inside the tunnel remains colder than interstellar space.

Working

- It will operate round-the-clock for **four years** at given energy of **13 tera electron volts**.
- An electron volt is the energy given to an electron by accelerating it through 1 volt of electric potential difference.

- **A TeV is 100 billion, or 10-to-the-power-of-12, electron volts.**

CERN- ‘Conseil européen pour la recherche nucléaire’ Organisation

- The **European Organization for Nuclear Research** known as **CERN** is a European research organization that operates the largest particle physics laboratory in the world.
- Established in 1954, the organization is based in a northwest suburb of Geneva on the Franco-Swiss border and has 23 member states.
- Israel is the only non-European country granted full membership.
- CERN is an official **United Nations Observer**.
- **Function:** CERN’s main function is to provide the **particle accelerators** and other infrastructure needed for high-energy physics research – as a result, numerous experiments have been constructed at CERN through international collaborations.
- **Location:** CERN is the site of the Large Hadron Collider (LHC), the world’s largest and highest-energy particle collider.

Similar initiatives like LHCs:

- **ATLAS** is the largest general purpose particle detector experiment at the LHC;
- **The Compact Muon Solenoid (CMS)** experiment is one of the largest international scientific collaborations in history, with the same goals as ATLAS, but which uses different magnet-system design.

India’s Contributions at CERN

- **Behind Famous theory:** Higgs Boson is a particle that is theoretically the reason why all matter in the universe has mass.
 - ▶ It is **Satyendra Nath Bose** after whom the sub-atomic particle boson was named.
- **Partner to projects:** India is like a historic father of the project named **Paolo Giubellino** at CERN.
- **Contribution of Indian Minds:** The CERN runs a number of experimental projects and over 100 Indian scientists are working round the clock.
- **Contribution by Kolkata Institute:** The **Saha Institute of Nuclear Physics (SINP)** in Kolkata and its scientists had made significant contributions to the development of the **CMS experiments** at CERN.

SECTION: B

(PRELIMS)

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THE LEGEND OF ALLURI SITHARAMA RAJU, AND THE POLITICAL SIGNIFICANCE OF HIS LEGACY

◎ CONTEXT:

Prime Minister unveiled a 30-foot-tall bronze statue of Alluri Sitharama Raju at Bhimavaram in Andhra Pradesh as the year-long celebrations of the freedom fighter's 125th birth anniversary.

Alluri Sitharama Raju:

- Raju is believed to have been **born in present-day Andhra Pradesh in 1897 or 1898**.
- He is said to have become a **sanyasi at the age of 18**.
- He gained a **mystical aura** among **the hill and tribal peoples** with his austerity, knowledge of astrology and medicine, and his ability to tame wild animals.
- He channelled the discontent of the hill people in **Ganjam, Visakhapatnam, and Godavari** into a highly effective guerrilla resistance against the British.
- Colonial rule threatened the tribals' traditional podu (shifting) cultivation, as the government sought to secure forest lands.
 - The Forest Act of 1882 banned the collection of minor forest produce such as roots and leaves, and tribal people were forced into labour for the colonial government.
 - While the tribals were subjected to exploitation by muttadars, village headmen commissioned by the colonial government to extract rent, the new laws and systems threatened their way of life itself.
- The Rampa or Manyam Rebellion continued in the form of a guerrilla war until May 1924, when Raju, the charismatic 'Manyam Veerudu' or Hero of Jungle, was finally captured and executed.



Recognition:

- In **1986**, the Indian Postal Department issued a **stamp in honour of Raju** and his contribution to India's struggle for Independence.
- In **July 2019**, on the occasion of Raju's 122nd birth anniversary, the government of Andhra Pradesh announced the naming of a district after the legendary freedom fighter, acceding to a long-standing demand of the tribal population of Andhra Pradesh.
 - The district of Alluri Sitharama Raju came into being in April 2022, made up of Paderu and Rampachodavaram of the existing districts of Visakhapatnam and East Godavari respectively.
 - These two areas have tribal populations of 10.4 per cent and 4.1 per cent.

NADAPRABHU KEMPEGOWDA

◎ CONTEXT:

A bronze statue of Nadaprabhu Kempegowda, credited to be the founder of Bengaluru, will be unveiled soon at the premises of the Kempegowda International Airport (KIA).

About Nadaprabhu Kempegowda:

- Nadaprabhu Kempegowda was a **16th century** chieftain of the **Vijayanagara Empire**, is credited as the **founder of Bengaluru**.
- He approached the Vijayanagara kings for the requisite permission and laid the foundations for what would become Bangalore City in **1532**.
- Kempegowda is also known to have developed **around 1,000 lakes in the city** to cater to drinking and agricultural needs.
- He was from the **dominant agricultural Vokkaliga community** in south Karnataka.
- Kempe Gowda was a **patron of the arts and authored 'Ganga-Gouri Sallapamu' in Telugu**.

Nadaprabhu Kempegowda Statue:

- Marking the 511th birth anniversary of Kempegowda, former CM BS Yediyurappa had laid the foundation for the project in June 2020.
- The 108-ft bronze statue is being constructed in a 23-acre heritage park on the airport premises.
- It has a 4,000 kg sword.



Vokkaliga Community:

- The Vokkaliga caste originates in the **Indian state of Karnataka**.
- In the **former princely state of Mysore**, the Vokkaligas were the **largest community**.
- As a community of **warriors and cultivators**, they have historically wielded tremendous demographic, political, and **economic dominance in Old Mysore**.
- The term Vokkaliga comes from the **word Vokku**, which means to **thresh grains from crops**.
- **In 1906, the Vokkaligara Sangha** was founded in Bangalore.
- **T.Byanna was the Sangha's first president**, and the Maharaja of Mysore, Krishnaraja Wodeyar IV, and Diwan V.P.Madhava Rao were the association's patron and vice-patron, respectively.

NIGERIA'S LATEST LITHIUM FIND

© **CONTEXT:** **High-grade lithium has been discovered in Nigeria.**

High-grade lithium:

- The Geological Agency described the lithium as high grade because what's been found has between 1-13 per cent oxide content.
 - Normally exploration begins at levels as low as 0.4 percent.
- Grade (in per cent) is a measure of concentration of the lithium in the minerals and or rocks that contains it.
 - Therefore, the higher the grade the more the economic viability. Higher grades are very rare for metals like lithium.

About Lithium:

- Lithium is a chemical element with symbol Li **and atomic number 3**.
- It is a soft, silvery-white alkali metal.
- Under standard conditions, it is the lightest metal and the **lightest solid element**.
- Lithium is highly reactive and flammable, and is stored in mineral oil.
- It never occurs freely in nature, but only in (usually ionic) compounds, such as pegmatitic minerals, which were once the main source of lithium.
- Due to its solubility as an ion, it is present in ocean water and is commonly obtained from brines.
- Lithium metal is isolated electrolytically from a mixture of lithium chloride and potassium chloride.
- Lithium is a key component used in Electric Vehicle batteries. And India, through its Rs. 18,100- crore PLI scheme is offering incentives for companies to build battery cells locally.
- China and Hong Kong are the biggest lithium battery suppliers to India.

Lithium Triangle:

- Lithium Triangle is an intersection of **Chile, Bolivia and Argentina**, known for high quality salt flats.
- Salar de Uyuni in Bolivia, Salar de Atacama in Chile and Salar de Arizaro in Argentina contains over 45% of known global lithium reserves.
- Beneath Salar de Uyuni, the world's largest salt flat lays the world's greatest lithium deposits.
- Bolivia, one of South America's poorest countries, envisions development by harvesting lithium on an industrial scale from underground saltwater brines.
- It can be mined from rock or processed from brine.
- Lithium dissolved in underground saline aquifers called "brine", pumped to surface by wells and then allowed to evaporate in vast knee-deep ponds.

**Lithium-ion batteries:**

Lithium-ion batteries are generally more expensive but have better performance and are becoming the preferred technology. The different types are:

- **Lithium-cobalt oxide battery:** It is used in consumer electronics and is finding application in electric vehicles. It is relatively cheap.

- **Lithium-nickel-manganese-cobalt** is a newer, higher performing range of battery chemistry. It is mainly developed for the electronic vehicle market but is finding a wider use because of its increasing cost effectiveness.
- **Lithium iron phosphate**, the safest technology with relatively high performance but relatively expensive. It is very popular in China but is likely to become overtaken by Lithium-nickel-manganese-cobalt over the longer term; and
- **Lithium-nickel-cobalt-aluminium oxide** developed to reduce cobalt consumption and is known as a solid performer and of reasonable cost. It is also becoming popular outside China.

Global Lithium Production:

- Greenbushes mine in Western Australia is the largest hard-rock lithium mine in the world.
- Global lithium mine production hit a record high of 100,000 tonnes in 2021, a 21 per cent increase over 2020.
- According to 2020 data, three countries, Australia (40,000 tonnes), Chile (20,600 tonnes) and China (14,000 tonnes) mine about 86 per cent of the world's lithium.
- Others are Argentina (6,200 tonnes), Brazil (1,900 tonnes), Zimbabwe (1,200 tonnes), USA (900 tonnes) and Portugal (900 tonnes).

Lithium in Nigeria:

- In Nigeria, lithium minerals (spodumene and lepidolite) are known to be associated with cassiterite, columbite-tantalite (coltan) and others in the extensive belt of rare metal-bearing rock types called pegmatite.

WHO ARE THE KARAKALPAKS, RESIDENTS OF AN UNREST-HIT UZBEKISTAN PROVINCE?

◎ CONTEXT:

Several killed in crackdown on protests in Uzbekistan's autonomous province of Karakalpakstan. The protests had broken out in response to the government's plan to restrict the region's long-held autonomy.

Who are the Karakalpaks?

- The name Karakalpakstan is derived from the Karakalpak people, an ethnic minority group of around 2 million.
- Karakalpak translates to 'black hat', referring to their traditional headgear.
- The Karakalpaks consider themselves to be a distinct cultural group in Uzbekistan.
 - Their Turkic language – Karakalpak – is closely related to Kazak and is one of the 7 languages of instruction in Uzbekistan's public schools.
 - Their separate language is a crucial aspect of their cultural identity.
- In their genealogical narrative, the Karakalpaks claim to share a common point of origin with the neighbouring **Kazakhs, Uzbeks and Turkmen**.
- The Karakalpaks, who live south of the Aral Sea also face **serious health problems**, such as increased rates of throat cancer, kidney problems and the highest infant mortality rate in the world.

- This is because the fertilisers and pesticides that were used for cotton farming saturated the surrounding land and were carried across the region by wind blowing across the exposed seabed.



What is the region's history?

- The Karakalpak people settled around the Amu Darya (a river that feeds into the Aral Sea) in the 18th century.
- Karakalpakstan was formally recognized as an autonomous republic in Uzbekistan's constitution of 1992, and has the right to secede from on the basis of a nation-wide referendum.
- Violent protests broke out in the impoverished Karakalpakstan after President Shavkat Mirziyoev, who has been in power since 2016, published a draft amendment to the Uzbek constitution recently, which removed the region's right to secede Uzbekistan by a referendum.

WHAT ARE CRITICAL MINERALS, THE CENTERPIECE OF A NEW INDIA-AUSTRALIA COLLABORATION?

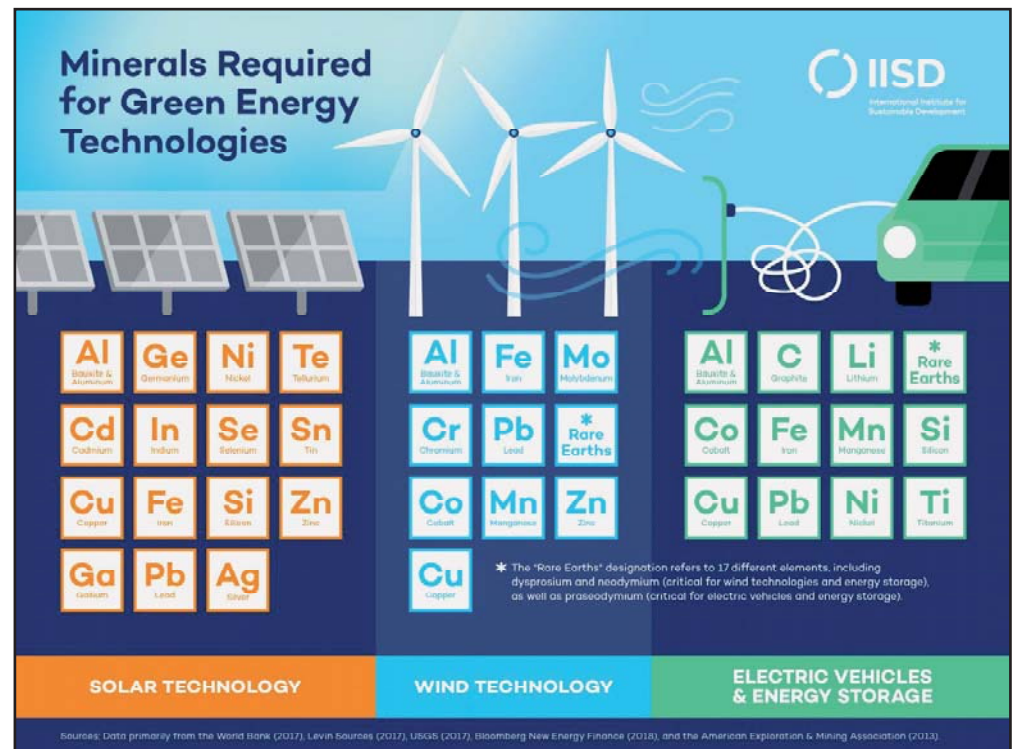
© **CONTEXT:** India and Australia Monday decided to strengthen their partnership in the field of projects and supply chains for critical minerals.

- **Australia will commit \$5.8 million to the three-year India-Australia Critical Minerals Investment Partnership.**

What are critical minerals?

- Critical minerals are elements that are the **building blocks of essential modern-day technologies, and are at risk of supply chain disruptions.**
- These minerals are now **used everywhere from making mobile phones, computers to 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.**

- However, such lists mostly include graphite, lithium and cobalt, which are used for making EV batteries; rare earths that are used for making magnets and silicon which is a key mineral for making computer chips and solar panels.
- Aerospace, communications and defence industries 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?

- As countries around the world scale up their transition towards clean energy and digital economy, these critical resources are **key to the ecosystem that fuels this change**.
- Any supply shock can severely imperil the economy and strategic autonomy of a country over-dependent on others to **procure critical minerals**.
- They are critical as the world is fast shifting from a fossil fuel-intensive to a mineral-intensive energy system.

Steps taken by India:

- 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".
- While KABIL would ensure mineral security of the nation, it would also help in realizing the overall objective of import substitution.
- Australia's Critical Minerals Facilitation Office (CMFO) and KABIL had recently signed an MoU aimed at ensuring reliable supply of critical minerals to India.

KABIL

- The Mines Ministry has created a joint venture (JV) company — Khanij Bidesh India (KABIL) — with participating interest from National Aluminium Company (NALCO), Hindustan Copper (HCL) and Mineral Exploration Corporation (MECL).
- The equity participation is 40:30:30, respectively.

AUSTRALIA-INDIA PARTNERSHIP IN CRITICAL MINERALS

At the virtual summit, Prime Ministers Scott Morrison and Narendra Modi welcomed the signing of a Memorandum of Understanding between Khanij Bidesh India Ltd (KABIL), India and Critical Minerals Facilitation Office (CMFO), Australia for joint cooperation on critical minerals projects.

The MoU, signed on 10th March 2022, aims to:

- provide a collaborative framework for building an Australia - India partnership in critical mineral eco-system;
- support strategic national interest and commercial investment in Australian critical mineral projects; &
- develop a robust and commercially viable critical minerals supply chain with the purpose to foster innovation.



75 AUSTRALIA
CELEBRATES
INDIA

#Outcomes #AusIndSummit

AUSTRALIA

INDIA'S GIG WORKFORCE TO REACH 2.35 CRORE BY 2030: NITI AAYOG**© CONTEXT:**

According to the study released by NITI Aayog recently, the number of workers engaged in the gig economy is expected to grow to 2.35 crore by 2029-30.

About:

In the report titled 'India's Booming Gig and Platform Economy', NITI Aayog has made observations on labour force participation of women and persons with disabilities, and made recommendations to companies.

What is gig economy?

- As per the World Economic Forum (WEF), gig economy is defined by its focus on workforce participation and income generation via "gigs", single projects or tasks for which a worker is hired.
- Gig economy includes all platforms that hire independent workers across sectors like e-commerce, technology, food & beverages, home services among others.
- Gig workers are typically hired by companies on a contractual basis and are not considered employees. They do not receive some of the benefits that on-roll staffs do.

Key highlights of the study:

- As per NITI Aayog, the number of workers engaged in the gig economy is estimated to be **77 lakh in 2020-21**.
- At present, about **47% of gig work** is in medium skilled jobs, about **22% in high skilled**, and about **31% in low skilled jobs**.
 - The trend shows the concentration of workers in medium skills is gradually declining and that of the low skilled and high skilled is increasing.
- While in 2020-21, the gig workforce constituted **2.6% of the non-agricultural workforce** or **1.5% of the total workforce** in India, by 2029-30, gig workers are expected to form 6.7% of the non-agricultural workforce or 4.1% of the total livelihood workforce in India.

Need of social security:

- India requires a framework that balances the flexibility offered by platforms while also ensuring social security of workers.
- The consequent platformisation of work has given rise to a new classification of labour, "platform labour", falling outside of the purview of the traditional dichotomy of formal and informal labour.

Classification of gig-workers:

The report broadly classifies gig workers those engaged in livelihoods outside the traditional employer-employee arrangement into:

- platform and
- non-platform based workers

■ **Platform workers are those whose work is based on online software applications or digital platforms.**

■ **Non-platform gig workers are generally casual wage workers and own-account workers in the conventional sectors, working part-time or full time.**

Recommendations:

- Introducing a '**Platform India initiative**', on the lines of the 'Startup India initiative', built on the pillars of accelerating platformisation by simplification and handholding, funding support and incentives, skill development, and social financial inclusion.
- **Self-employed individuals** engaged in the business of selling regional and rural cuisine, street food, etc., may also be **linked to platforms** so that they can sell their produce to wider markets in towns and cities.
- Measures should be taken to **provide social security**, including paid leave, occupational disease and work accident insurance, and support during irregularity of work and pension plans for the gig workforce in the country.

- **Improving women participation in gig-economy:** Fiscal incentives such as tax-breaks or startup grants may be provided for businesses that provide livelihood opportunities where women constitute a substantial portion (say, 30 per cent) of their workers.

RESTORING BANNI GRASSLANDS, GUJARAT BATTLES INVASIVE TREE SPECIES

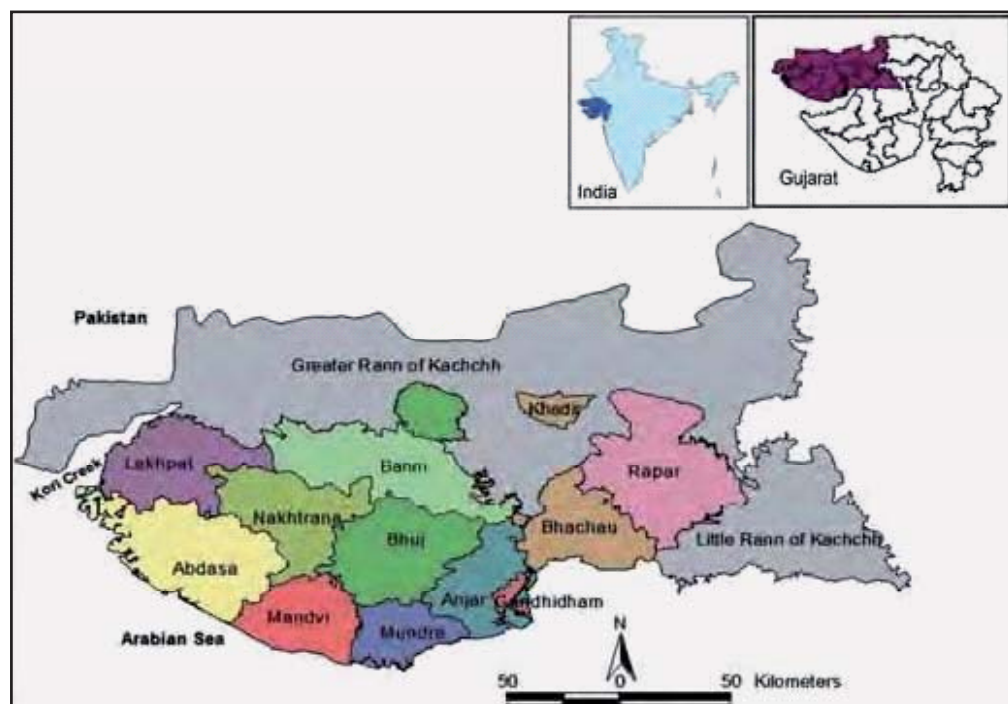
© **CONTEXT:** The Gujarat forest department plans to restore 10,000 hectares of the Banni grasslands in the coming year.

About:

- Gujarat is planning to restore at least 76,000 hectares of this (banni grassland) 2,497 sq. km grassland.
- It has already restore 10,000 hectares over the past couple of years.
- This grassland is a high-biodiversity area.
- The grasslands of Gujarat constitute about 4.33 per cent (8,490 sq km) of the total geographical area.

About Banni Grasslands:

- Banni Grassland is situated near the Great Rann of Kutch in Gujarat. It is considered to be the largest Grassland in Asia.
- The grassland spreads over 2,618 kilometers and accounts for almost 45% of the pastures in Gujarat.
- **Formation:** The word 'Banni' comes from the Hindi word 'banai', meaning made. The land here was formed from the sediments that were deposited by the Indus and other rivers over thousands of years.
- **Ecosystem:** Two ecosystems, wetlands and grasslands are juxtaposed in Banni.



■ Vegetation:

- The vegetation in Banni is sparse and highly dependent on rainfall.
- It is dominated by low-growing forbs and graminoids, many of which are halophiles (salt-tolerant), as well as scattered tree cover and scrub.
- The grasslands were traditionally managed by a system of rotational grazing.
- **Flora and Fauna:** The area is rich in flora and fauna with 192 species of plants, 262 species of birds, several species of mammals, reptiles, and amphibians.
- **Reserve Forest:** In 1955, the court notified the grassland will be a reserve forest. In, 2019, the NGT ordered to demarcate the boundaries of the Banni grassland and restricted non-forest activities.

CARNIVOROUS PLANT CATCHES PREY UNDERGROUND, FOUND IN INDONESIA: STUDY

◎ CONTEXT:

A first-of-its-kind carnivorous plant that traps prey underground has been found on Indonesia's Borneo Island in the country's North Kalimantan province.

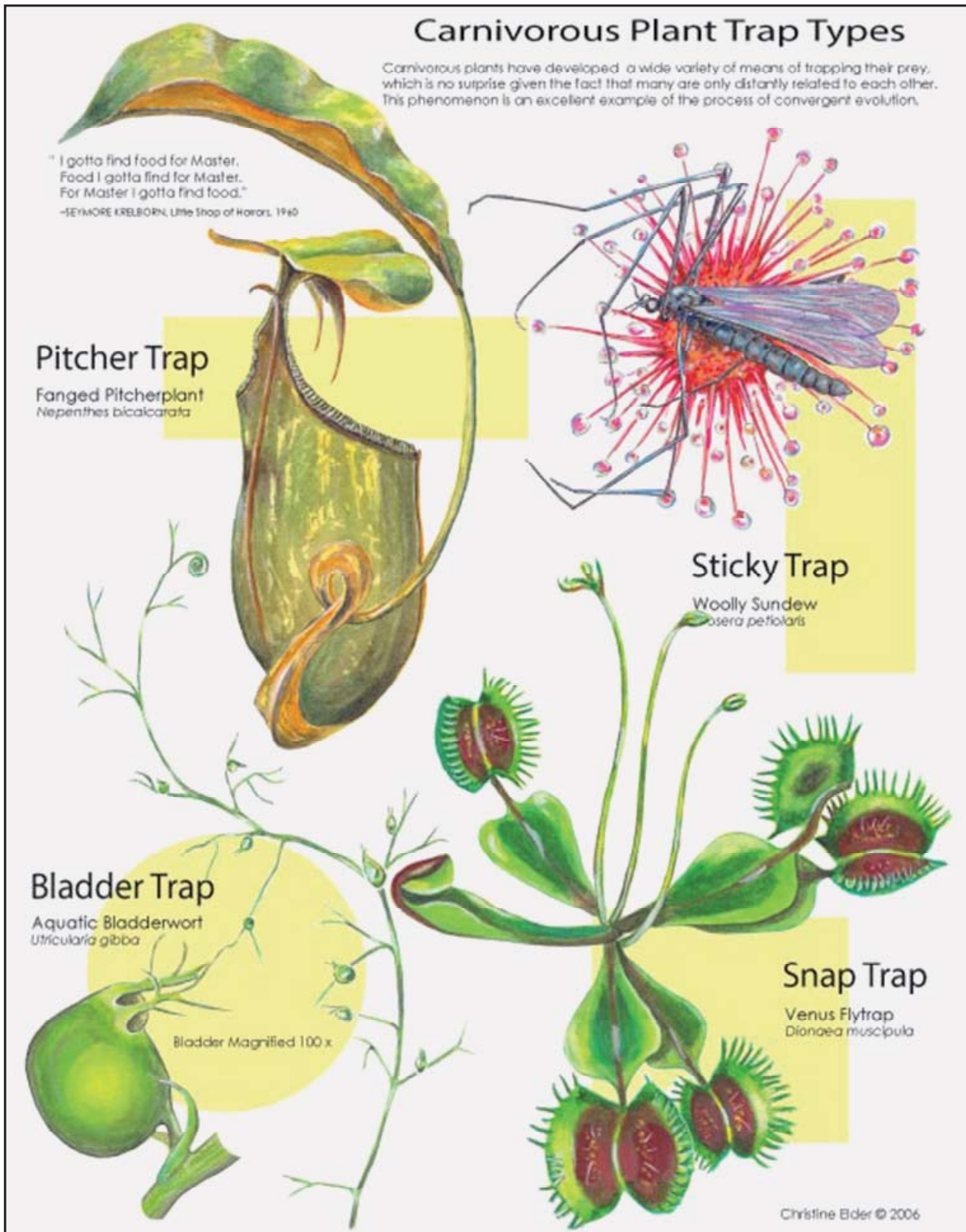
About the new species:

- The newly found species of pitcher plant was **unearthed in the Indonesian province of North Kalimantan, on the island of Borneo.**
- ***Nepenthes pudica*** has modified leaves, known as **pitfall traps or pitchers** that its prey falls into before being consumed.
- **No other species of pitcher plant known to science catches its prey underground.**
- The plant forms specialized underground shoots with **small, white, chlorophyll-free leaves.**
- The pitchers are much **larger than the leaves and have a reddish color.**
- This species places its up-to-11-cm-long (4.3-inch-long) pitchers underground, where they are formed in cavities or directly in the soil and trap animals living underground, usually ants, mites and beetles.



Carnivorous plants:

- Carnivorous **plants attract, trap and digest animals** for the nutrients they contain.
- There are currently around 630 species of carnivorous plant known to science.
- Although **most meat-eating plants consume insects, larger plants are capable of digesting reptiles and small mammals.**
- Smaller carnivorous plants specialise in **single-celled organisms** (such as bacteria and protozoa) and aquatic examples also eat crustaceans, mosquito larvae and small fish.



SAVING CHENKURINJI FROM CLIMATE CHANGE

◎ **CONTEXT:** The Shendurney Wildlife Sanctuary derives its name Chenkurinji (*Gluta travancorica*), a species endemic to the Agasthyamala Biosphere Reserve.

Chenkurinji:

- Chenkurinji (*Gluta travancorica*) is a species **endemic** to the **Agasthyamala Biosphere Reserve**.
- Belonging to the **Anacardiaceae family**, the tree was once abundant in the hills on the southern parts of the **Aryankavu Pass** in Kerala's Kollam district.
- The **Shendurney Wildlife Sanctuary** derives its name Chenkurinji (*Gluta travancorica*), a species endemic to the Agasthyamala Biosphere Reserve.

■ Threats:

- Chenkurinji is very **susceptible to climate change** and the present condition of the species is quite bad with low regeneration performance.
- Though there are seemingly enough trees, **most are not productive**, generating a negative trend in its population.
- Moreover, the majority of the **trees are old with poor flowering and fruiting rates**.
- **Significance of Chenkurinji:** It is reported to have **medicinal properties** and is **used to lower blood pressure and treat arthritis**.



Agasthyamalai Biosphere Reserve (ABR)

- Located in the Western Ghats
- The Agasthyamalai Biosphere Reserve (ABR) was established in 2001 and straddles the border of Kollam and Thiruvananthapuram Districts in Kerala and Tirunelveli and Kanyakumari Districts in Tamil Nadu, South India at the southern end of the Western Ghats.
- It consisting mostly of tropical forests
- It is also a unique genetic reservoir of cultivated plants especially cardamom, jamune, nutmeg, pepper and plantain
- Three wildlife sanctuaries, Shendurney, Peppara, Neyyar and Kalakad Mundanthurai Tiger reserve are included in the site.
- Agasthyamalai is also home to the Kanikaran, one of the oldest surviving ancient tribes in the world.

INDIA ADDS 540 SPECIES TO FAUNAL DATABASE

◎ **CONTEXT:** India added 540 species to its faunal database in 2021 taking the total number of animal species to 1,03,258.

- The country also added 315 taxa to the Indian flora during 2021, taking the number of floral taxa in the country to 55,048.

New updates:

- Of the 540 faunal species, 406 are new discoveries and 134 new records to India.
- Thirteen new genera were also discovered in 2021.
- Among the new species discovered is one species from mammal, 35 reptiles and 19 species of pisces.
- The new mammal species discovered is *Crocidura narcondamica*, a white-toothed shrew, from Narcondam Island of the Andaman and Nicobar group of islands.
- Among the reptiles discovered in 2021, notable is *Boiga whitakeri*, or Whitaker's cat snake, from the Western Ghats in Tamil Nadu.
- The most number of new discoveries was from the faunal group Hymenoptera, an order of insects, comprising the sawflies, wasps, bees, and ants, in which 80 species, including one new genus, were discovered.
- The scientists from the Zoological Survey of India (ZSI) had contributed to 68% of the animal discoveries in 2021.
- With 1.03 lakh species of fauna, India contributes to 6.1% of faunal diversity in the world.
- Forty-three per cent novelties published in various national and international journals are of vascular plants; the rest are non-vascular in nature.
- Regions such as the Western Ghats and the northeastern regions have contributed 28% of the total discoveries.
- In State-wise analysis, the most number of discoveries were made from Kerala with 51 taxa followed by Maharashtra and Arunachal Pradesh.
- In 2021, the floral discoveries include wild relatives of many potential horticultural, agricultural, medicinal, and ornamental plants such as begonia, impatiens (Balsams), legumes, zingibers and orchids.



Zoological Survey of India (ZSI)

- The Zoological Survey of India (ZSI) is the premier taxonomic research organization in India.
- It was established on 1 July **1916** to promote surveys, exploration and research leading to advancement of our knowledge of various aspects of the exceptionally rich animal life of India.
- The ZSI had its genesis as the Zoological Section of the **Indian Museum at Calcutta in 1875**.
- Since its inception, the ZSI has been documenting the diversity and distribution of the fauna of India towards carrying out its mandate of **conducting exploration-cum-taxonomic-research programmes**.
- The ZSI has published an extremely large amount of information on all animal taxa, from Protozoa to Mammalia. This information is a boon to researchers, students, conservation managers and amateur naturalists.

THE THREE NEW 'EXOTIC' SUB-ATOMIC PARTICLES DISCOVERED AT CERN

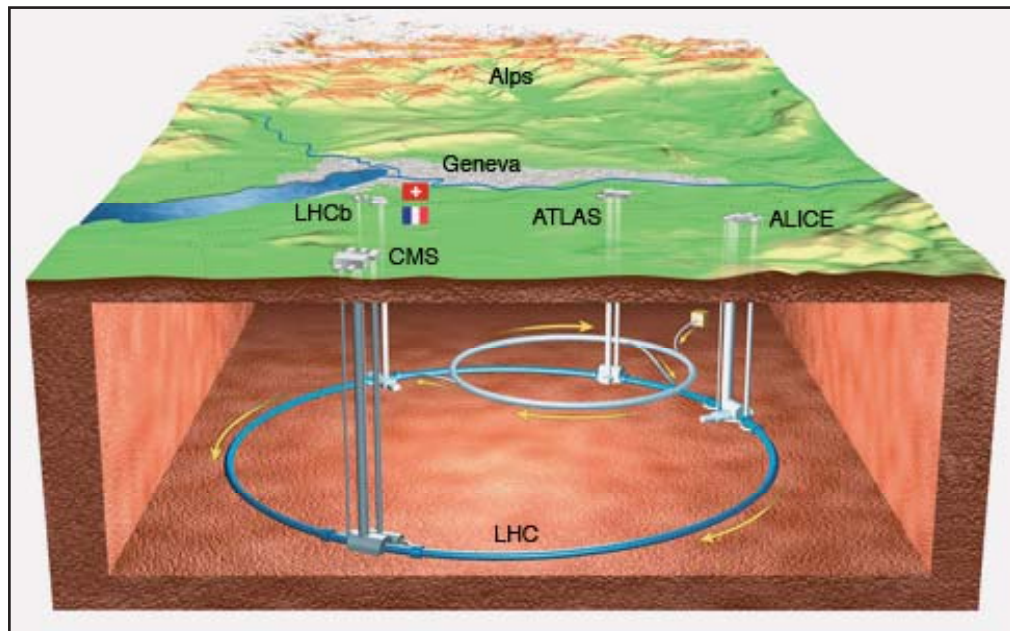
◎ CONTEXT:

The Large Hadron Collider beauty (LHCb) experiment — which is investigating the slight differences between matter and antimatter by studying a type of particle called the “beauty quark”, or “b quark” — has observed three never-before-seen particles.

Large Hadron Collider beauty (LHCb) experiment

- The Large Hadron Collider beauty (LHCb) experiment specializes in investigating the slight differences between matter and antimatter by studying a type of particle called the “beauty quark”, or “b quark”.

- Instead of surrounding the entire collision point with an enclosed detector as do ATLAS and CMS, the LHCb experiment uses a series of subdetectors to detect mainly forward particles – those thrown forwards by the collision in one direction.
- The first subdetector is mounted close to the collision point, with the others following one behind the other over a length of 20 metres.
- The LHCb experiment is situated at one of the four points around CERN's Large Hadron Collider where beams of protons are smashed together, producing an array of different particles.

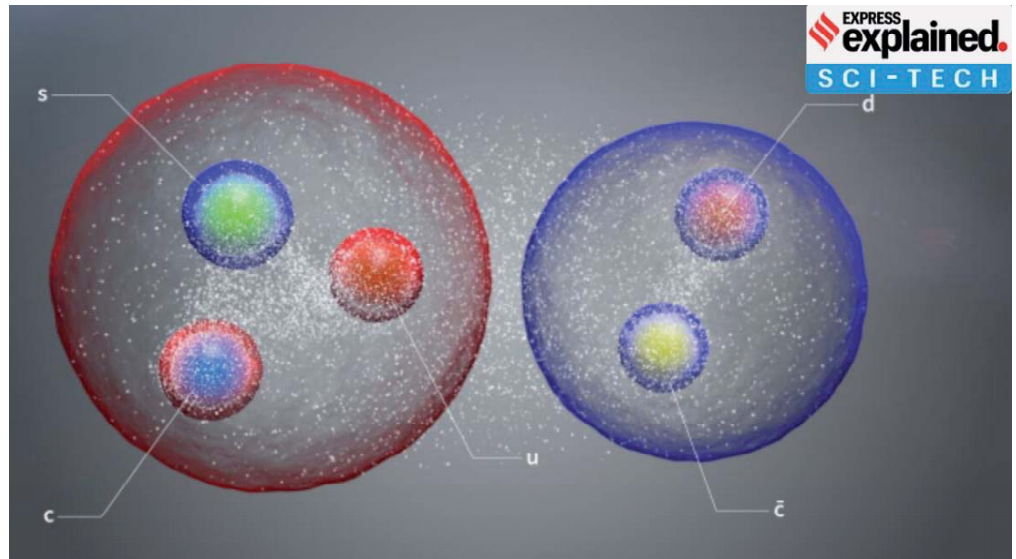


How does it work?

- The aim of the LHCb experiment is to record the decay of particles containing b and anti-b quarks, collectively known as 'B mesons'.
- Rather than flying out in all directions, B mesons formed by the colliding proton beams (and the particles they decay into) stay close to the line of the beam pipe, and this is reflected in the design of the detector.

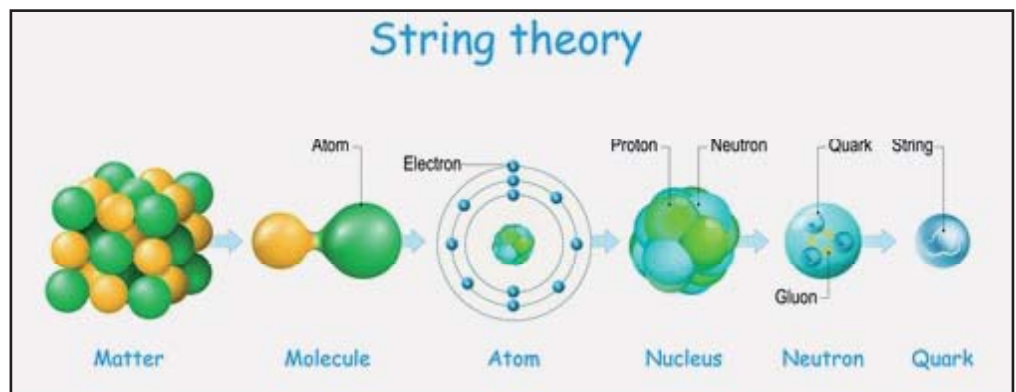
New Finding:

- The three "exotic" additions, a new kind of "pentaquark" and the first-ever pair of "tetraquarks", to the growing list of new hadrons found at the LHC will help physicists better understand how quarks bind together into these composite particles.
- The first kind was observed in an analysis of "decays" of negatively charged B mesons.
 - It is a pentaquark made up of a charm quark and a charm antiquark, and an up, a down, and a strange quark.
 - It is the first pentaquark found to contain a strange quark.
- The second kind is a doubly electrically charged tetraquark.
 - It is an open-charm tetraquark composed of a charm quark, a strange antiquark, and an up quark and a down antiquark.
 - It was spotted together with its neutral counterpart in a joint analysis of decays of positively charged and neutral B mesons.



What are quarks?

- Quarks are elementary particles that come in six “flavours”: up, down, charm, strange, top, and bottom.
- They usually combine together in groups of twos and threes to form hadrons such as the protons and neutrons that make up atomic nuclei.
- But they can also combine into four-quark and five-quark particles, called tetraquarks and pentaquarks.
- These exotic hadrons were predicted by theorists about six decades ago, around the same time as conventional hadrons but they have been observed by LHCb and other experiments only in the past 20 years.



About CERN

- CERN began in the 1950s as the **European Organization for Nuclear Research**.
- Today it is also known as the **European Laboratory for Particle Physics**.
- It is one of the world’s most prestigious research centres.
- Its business is fundamental physics—finding out what makes our Universe work, where it came from and where it is going.
- At CERN, some of the world’s biggest and most complex machines are used to study nature’s tiniest building blocks, the fundamental particles.

- By colliding these minute particles of matter physicists unravel the basic laws of nature.
- The organisation is the world's largest nuclear and particle physics laboratory, where scientists and engineers are probing the fundamental structure of the Universe using the most sophisticated scientific instruments and advanced computing systems.
- Presently **CERN has 22 member states, four associate member states, and the observer status is given to four states and three International Organisations.**
- **India is an associate member** of the European Organisation for Nuclear Research (CERN).

WHAT IS THE FIELDS MEDAL, SO-CALLED 'MATHEMATICS NOBEL' AWARDED TO UKRAINIAN PROFESSOR AND THREE OTHERS?

◎ CONTEXT:

Ukrainian mathematician Maryna Viazovska was recently named as one of four recipients of the 2022 Fields Medal, an honour that is often described the Nobel Prize in mathematics.

- The other winners were French mathematician Hugo Duminil-Copin of the University of Geneva; Korean-American June Huh of Princeton; and Briton James Maynard of the University of Oxford.

Fields Medal

- The Fields Medal is awarded by the **International Mathematical Union (IMU)**, an international non-governmental and non-profit scientific organisation that aims to promote international cooperation in mathematics.
- The Fields Medal is **awarded every four years** to one or more **mathematicians under the age of 40** in recognition of "**outstanding mathematical achievement for existing work and for the promise of future achievement**".
- The honour carries a physical medal of **14K gold**, 63.5 mm in diameter and weighing 169 g, and with a unit price of approximately 5,500 Canadian dollars. There is also a **cash award of CAD 15,000**.



History of the Medal

- The 1924 ICM in Toronto adopted a resolution that at each conference, two gold medals would be awarded to recognise outstanding mathematical achievement.
- The Canadian mathematician Prof J C Fields, who was secretary of the 1924 Congress, later donated funds to establish the medals, which were named in his honour.
- In 1966, it was agreed that, in light of the great expansion of mathematical research, up to four medals could be awarded at each Congress.
- The Fields Medals were first awarded in 1936 in Oslo, Norway. The Fields medals were conceived by John Charles Fields, a Canadian mathematician.
- The winners are announced at the International Congress of Mathematicians (ICM), which was supposed to be held in Russia this year, but was moved to Helsinki.

Indian-origin winners

- Among the more than 60 mathematicians who have been awarded the Fields Medal since 1936, there are two of Indian origin —
 - **Akshay Venkatesh** of the Institute for Advanced Study at Princeton, who won in 2018, the last time the honour was announced
 - **Manjul Bhargava** of the Department of Mathematics at Princeton University, in 2014.
- **Venkatesh** was awarded the Medal “for his synthesis of **analytic number theory, homogeneous dynamics, topology, and representation theory, which has resolved long-standing problems in areas such as the equi-distribution of arithmetic objects**”.
- **Bhargava** was honoured for “developing powerful **new methods in the geometry of numbers**, which he applied to count rings of small rank and to bound the average rank of elliptic curves”.

Fields Medal 2022 Awardee:

■ **Maryna Viazovska, Ukraine:**

- The IMU recognised Viazovska’s work on the **sphere-packing problem** in 8 and 24 dimensions. Previously, the problem had been solved for only three dimensions or fewer.
- She is only the **second female Fields Medalist**, after the **Iranian Maryam Mirzakhani** in 2014.
- **Briton James Maynard of the University of Oxford:** Maynard’s work involved understanding the gaps between prime numbers.
- **Hugo Duminil-Copi, France:** His contribution was in the theory of phase transitions – such as water turning to ice, or evaporating into steam – in statistical physics.
- **Korean-American June Huh:** He is recognised for a range of work including the innovative use of geometry in the field of combinatorics, the mathematics of counting and arranging.

WHAT ARE NAIROBI FLIES, WHICH ARE CAUSING DISEASE IN SIKKIM?

◎ **CONTEXT:**

Around 100 students of an engineering college in East Sikkim have reported skin infections after coming in contact with Nairobi flies.

What are Nairobi flies?

- Nairobi flies, also called Kenyan flies or dragon bugs, are small, beetle-like insects that belong to two species, *Paederus eximius* and *Paederus sabaeus*.
- They are orange and black in colour, and thrive in areas with high rainfall, as has been witnessed in Sikkim in the past few weeks.
- Like most insects, the beetles are attracted by bright light.



Affecting Humans:

- These flies do not bite, but if disturbed while sitting on anyone's skin, they release a potent acidic substance that causes burns.
- This substance is called **pederin**, and can cause irritation if it comes in contact with the skin, leading to lesions or unusual marks or colouring on the skin.
- The skin begins to heal in a week or two, but some secondary infections can occur, especially if the victim scratches the irritated skin.

Preventative measures:

- The main preventative measures to reduce contact with *Paederus* rove beetles include the use of bed nets, long-sleeve clothing and avoiding sitting under lights at night.
- If a beetle does land on your skin it should be blown or gently brushed off and not crushed. If your skin does come into contact with juices from the beetles, wash the affected area with soap and water.
- If they are squelched and end up leaving toxic fluids on the skin, care should be taken that unwashed hands do not touch any other part of the body, particularly the eyes.

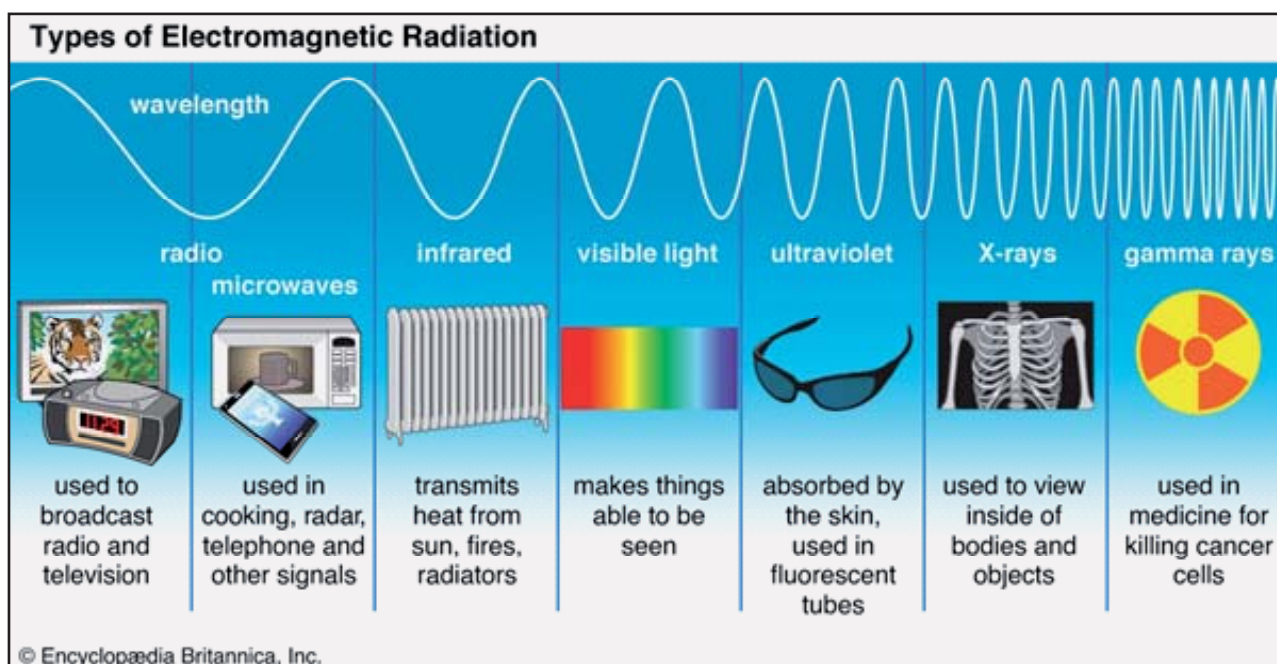
NEW MATERIAL DISCOVERED CAN CONVERT INFRARED LIGHT TO RENEWABLE ENERGY

© CONTEXT:

In a significant development, researchers have discovered a novel material called single-crystalline Scandium Nitride that can emit, detect, and modulate infrared light with high efficiencies making it useful for solar and thermal energy harvesting and for optical communication devices.

About:

- **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** -- in dimensions that are thousands of times smaller than the human hair, using specialised materials.
- Infrared light is **difficult to detect and modulate**.
 - For infrared light applications, intelligent and cutting-edge materials are required which can enable excitation, modulation, and detection at desired spectral range with high efficiencies.
 - Only a few existing materials can serve as hosts for light-matter interactions in the infrared spectral range



About the new Research:

- Researchers have utilised a scientific phenomenon called **polariton** excitations that occur in tailored materials when **light couples with either the collective free electron oscillations or polar lattice vibrations**.
- They have carefully **controlled material properties to excite polaritons** (a quasi-particle) and achieve strong light-matter interactions in **single-crystalline scandium nitride (ScN) using infrared light**.
- These exotic polaritons in the ScN can be utilised for solar and thermal energy harvesting.
- Also belonging to the same family of materials as gallium nitride (GaN), scandium nitride is compatible with modern complementary-metal-oxide-semiconductor (CMOS) or Si-chip technology and, therefore, could be easily integrated for on-chip optical communication devices.

Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)

- Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) is an autonomous institution.

- It was established in 1989 by the Department of Science and Technology, Govt to commemorate the birth centenary year of Pandit Jawaharlal Nehru.
- Bharat Ratna Prof. C. N. R. Rao was the founding President.
- JNCASR is now one of the leading Centres of scientific research with growing capability in translational activities, with a strong commitment to its outreach activities for the promotion of science in the country.

XIAOMI UNVEILS 'CYBERDOG', AND WITH IT EXPLORES ROBOTICS

◎ CONTEXT:

Xiaomi recently unveiled the 'Cyberdog', a robotic quadruped resembling an actual dog.

- According to Xiaomi, the CyberDog will be on show in Mi Homes in Delhi, Mumbai, Bangalore, Chennai, Kolkata, and Ahmedabad.

About Xiaomi's CyberDog:

- It is an experimental, open-source machine that developers can build upon.
- **Powered by:** CyberDog, Xiaomi's entry into the limitless field of quadruped robots, is equipped with 128GB of SSD storage and is powered by Nvidia's Jetson Xavier NX AI Supercomputer for Embedded Edge Systems.
- **Sensors:** The CyberDog is quick and adapts well to difficult terrain.
 - It is the ideal companion for an assisted living since it has 11 high-precision sensors that provide quick input to direct its movements.
 - CyberDog's capacity to detect its surroundings has improved thanks to Xiaomi's smartphone photography technology.
 - It has a variety of camera sensors, including AI interactive cameras, fisheye binocular cameras, and an Intel RealSense™ D450 depth module, and its computer vision algorithm can be taught.

■ Skills:

- The CyberDog has the ability to develop navigational maps, calculate its course, evaluate its surroundings in real-time, and avoid impediments.
- When combined with tracking of facial recognition and human posture, CyberDog is able to build navigational maps in real-time while avoiding obstacles.
- By establishing a wake word, users may utilize voice assistants to command and manage CyberDog, as well as the companion remote and smartphone app.
- It can be used for even the most unusual jobs, and the interactions with it have limitless potential.
- With three USB Type-C ports and an HDMI connector, the robot may be further customized by developers to investigate and include a variety of cutting-edge and imaginative hardware add-ons or software systems, like a searchlight, panoramic camera, motion camera, LiDAR, and more.



WITH GI TAG, MAYURBHANJ'S SUPERFOOD 'ANT CHUTNEY' SET TO FIND MORE TABLES

◎ **CONTEXT:** Odisha has applied for the geographical indications (GI) registry of Kai Chutney under food category.

About Kai Chutney:

- The chutney is **prepared by mixing and grinding salt, ginger, garlic and chilly** and is sold by tribals in rural markets.
- This savoury food item, **rich in valuable proteins, calcium, zinc, vitamin B-12, iron, magnesium, potassium, sodium, copper, fiber and 18 amino acids**, is known to boost the immune system and keep diseases at bay.

■ The process is herculean.

- First, they collect the red ants from the hives in branches, leaves or the tree trunks in forests, and boil the ants to turn it into a paste.
- A combination of grounded green chillies, ginger, garlic, onion and salt is then mixed with the boiled red ants, and the end result of the mixture is 'kai' chutney.
- It is often **served with 'Pakhala', finger millet (mandia)**, and whoever has savoured it will never forget the taste

Medicinal and bio-control uses:

- The tribes of Mayurbhanj consume Kai chutney or soup to get rid of flu, common cold, whooping cough, to increase appetite, enhance vision and eyesight naturally without corrective eye wear and to treat joints pain, stomach diseases, essentials for the development of a healthy brain and the nervous system.
- The tribal healers also prepare **medicinal oil** by dipping the collected Kais in pure mustard oil.
 - After 30 days, this oil is used as baby oil and externally used to cure rheumatism, gout, ringworm and other skin diseases.

- Kais (Weaver ants) are **bio-control agents**.
 - They are aggressive and prey on most arthropods entering their territory.
 - Due to their predatory habit, Kais are recognized as biological control agents in tropical crops as they are able to protect a variety of crops against many different insect pests.
 - In this way, they are utilized indirectly as an alternative to the chemical insecticides,

About Weaver ants:

- Weaver ants, scientifically called **Oecophylla smaragdina**, are abundantly found in Mayurbhanj throughout the year.
- Red Weaver Ants are known for their **unique nest building behaviour** where workers construct nests by weaving together leaves using larval silk.
- There is a division of labour, which is associated with the size difference between workers, whereby major workers ants forage, defend and maintain the ant colony and the minor ants stay within the nests to care of the newly hatched ants.



Geographical Indication (GI)

- A geographical indication (GI) is a sign used on products that have a specific geographical origin and possess qualities or a reputation that are due to that origin.
- A geographical indication right enables those who have the right to use the indication to prevent its use by a third party whose product does not conform to the applicable standards.
- However, a protected geographical indication does not enable the holder to prevent someone from making a product using the same techniques as those set out in the standards for that indication.
- Protection for a geographical indication is usually obtained by acquiring a right over the sign that constitutes the indication.

- Geographical indications are typically used for agricultural products, foodstuffs, wine and spirit drinks, handicrafts, and industrial products.
- A GI tag acts as a certificate and ensures that similar products from elsewhere cannot be sold under this name.
- The tag is valid for a decade, after which it can be renewed for another 10 years.

WHAT IS ANTHRAX, THE INFECTIOUS DISEASE FOUND IN KERALA?

◎ **CONTEXT:** After finding several carcasses of wild boar, Kerala health officials recently confirmed the presence of anthrax in Thrissur district.

What is Anthrax?

- Anthrax, also known as malignant pustule or **wool sorter's disease**.
- It is a rare but serious disease caused by the **rod-shaped bacteria** known as **Bacillus anthracis**.
- It occurs **naturally in soil**.
- According to the WHO, it is primarily a **disease of herbivores**, with both domestic and wild animals being affected by it.
- Anthrax is a **zoonotic disease**, meaning that it is naturally transmissible from animals (usually vertebrates) to humans.
- People can get the disease through contact with **infected animals or animal products that are contaminated with bacteria**.
- According to the WHO, **Anthrax is generally regarded as non-contagious**.
 - There have been instances of person-to-person transmission, however, such instances are extremely rare.

How do humans get infected?

- Humans almost always contract the disease **directly or indirectly from animals or animal products**.
- According to the Centres for Disease Control and Prevention (CDC), people get infected with anthrax when spores enter the body, through breathing, eating contaminated food or drinking contaminated water, or through cuts or scrapes in the skin.
- The spores then get "activated" and multiply, spreading across the body, producing toxins and causing severe illness.

Symptoms:

- A group of small blisters or bumps that may itch
- Swelling can occur around the sore
- A painless skin sore (ulcer) with a black center that appears after the small blisters or bumps. Most often the sore will be on the face, neck, arms, or hands.

Types of Anthrax

- **Cutaneous:** Most common form of anthrax infection, and is considered to be the least dangerous. Infection usually develops from 1 to 7 days after exposure.

- **Inhalation:** Inhalation anthrax is considered to be the most deadly form of anthrax. Infection usually develops within a week after exposure, but it can take up to 2 months
- **Gastrointestinal:** Gastrointestinal anthrax has rarely been reported. Infection usually develops from 1 to 7 days after exposure.
- **Injection:** This type of infection has never been reported.

Prevention

- Antibiotics can prevent anthrax from developing in people who have been exposed but have not developed symptoms.
- **Ciprofloxacin and doxycycline** are two of the antibiotics that could be used to prevent anthrax.
- People who have been exposed to anthrax must take antibiotics for 60 days. This will protect them from any anthrax spores in their body when the spores are activated.

INDIA IS RIPE FOR THE SODIUM-ION BATTERY REVOLUTION

◎ **CONTEXT:**

The Indian off-grid energy storage market is expected to expand exponentially as the country aims to fulfil 50 per cent of its energy demands from renewable sources by 2030, resulting in high demand for storage batteries.

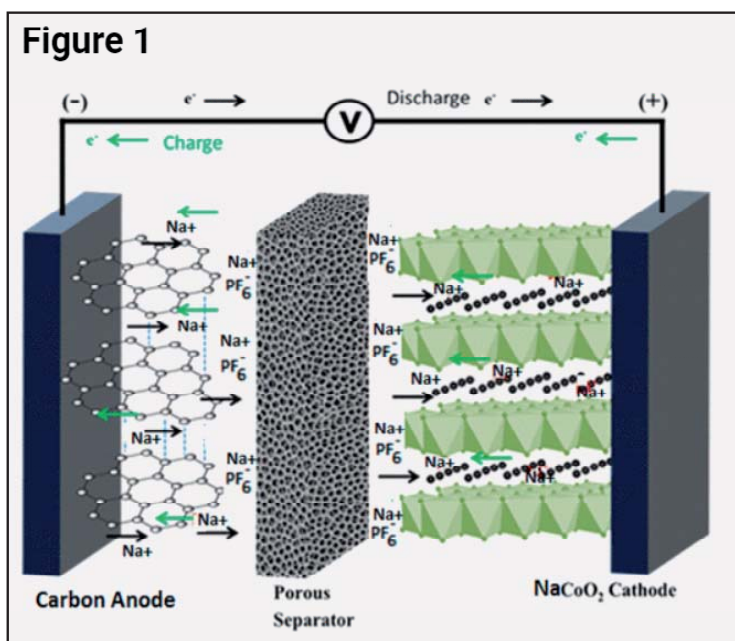
Battery Revolution in India:

- **Future aspirations:** India plans to have electric vehicle (EV) sales penetration of
 - 30 per cent for private vehicles,
 - 70 per cent for commercial vehicles,
 - 40 per cent for buses and
- 80 per cent for two and three-wheelers by 2030
- At present, the two dominant commercial options to fulfil energy storage needs in India are
 - Lithium-ion batteries (LIB) and
 - Lead-acid batteries (LAB)
- **Lead-acid batteries (LAB):**
 - LABs are hugely popular in India, especially for the manufacturing of two and three-wheeler electric vehicles.
 - LABs are popular because of their affordability, material accessibility and recycling rates.
 - LABs save 13.3% more emissions than nickel-manganese-cobalt (NMC) batteries. But their emissions can increase by 69 per cent if utilisation and disposal are considered.
- **Lithium-ion batteries (LIB)**
 - LIBs have gained high commercial value in the global market due to their high energy density, compact size and enhanced cycle life.

- Apart from being the drivers of EV manufacturing in the world, they are used for energy storage in electronics and off-grid power supply.

Sodium-ion Batteries (SIBs):

- Sodium-ion batteries have **three essential components**:
 - a negatively charged anode made up of hard carbons;
 - a positively charged cathode constituting sodium-containing layered materials; and
 - an electrolyte that allows electrons to move
- They work in a **similar manner to lithium batteries**.
- When the batteries are in a charging state, sodium atoms in the cathode become ions by releasing electrons.
- These ions flow through the electrolyte while the electrons move through an external circuit to reach the anode.
- During the discharge state, the reverse happens—from anode to the cathode.



About Sodium:

- The element is abundant in nature—the Earth’s crust has **2.9 per cent of the element** while **lithium’s share is only 0.01 per cent**.
 - Sodium is the **fourth most abundant element** on earth, has a seemingly unlimited distribution.
- Sodium can be found **naturally in seawater** and also mined from soda ash.
- The **cost of extracting** sodium is at least **20 per cent lower than lithium**.
- Sodium is also relatively **safer than lithium**.

Advantages of SIBs:

- SIBs have **45% less global warming potential** than lithium iron phosphate (LFP) batteries and about **25% less** than Nickel-Manganese-Cobalt (NMC) batteries in the cradle-to-gate life cycle comparison.

- SIBs have already reached an **energy density** of up to 160 watt hour per kilogram (Wh/kg), which is equivalent to LFPs and about 75 per cent of NMCs, making them competitive for stationary storage.
- They have also shown positive results in **retaining capacity, resisting moisture** and having **little voltage fade**, a common phenomenon with prolonged LIB cycles.
- SIBs have **higher operational safety** than LIBs with their operable temperature ranging from -30°C-60°C, making their temperature endurance higher than other battery chemistries.
- **SIBs can be discharged to zero volts to avoid accidents during transportation**, which also reduces the cost of transportation.

Difference between Sodium-ion Batteries and Lithium-ion batteries:

CHARACTERISTIC	Na-ion	Li-ion
Energy density	70-160 W h/kg, with potential to go to 200 W h/kg	Ranging from about 150 W h/kg for lithium-iron-phosphate cathodes to 275 W h/kg for nickel-manganese-cobalt cathodes
Manufacturing	Yet to be manufactured at commercial scale	Proven at scale and in high-performance cars
Raw material cost	Sodium hydroxide is \$300-\$800 per metric ton	Lithium hydroxide is \$78,000 per metric ton
Safety	No risk of thermal runaway	Can overheat and catch fire
Cycle life	Some developers have struggled to overcome performance fade	Steady performance over a high number of cycles
Performance at low temperature	Maintains >90% performance at -20 °C	Drops considerably in cooler temperatures
Recyclability	Simple recovery process	Complex separation of metals may be required

WHAT IS HERMIT, THE PEGASUS-LIKE SPYWARE

◎ **CONTEXT:** ‘Hermit’ is the latest sophisticated spyware in the news, and it is believed to have targeted iPhones and Android devices in Italy and Kazakhstan.

About:

- Hermit’s deployment – the spyware has been developed by an Italian vendor called RCS Lab.

What is Hermit?

- Hermit is a spyware on the lines of Pegasus by NSO Group.
- According to the report, Google and Lookout have confirmed that Hermit is a commercial spyware that known to be used by governments with victims in Kazakhstan, Italy and northern Syria.

What exactly does it do on a device?

- Once installed on a device, it can **record audio** on the device, carry out unauthorised calls, and carry out many unauthorised activities.
- The spyware can **steal stored account emails**, contacts, browser bookmarks/searches,

calendar events, etc.

- It can also **take pictures on the device**, steal device information such as details about applications, the kernel information, model, manufacturer, OS, security patch, phone number, etc.
- It can also **download and install APK** (the app software files on Android) on a compromised phone.
- The spyware can also **upload files from the device**, read notifications, and take pictures of the screen. Because it can gain access to the root or the 'privilege' access of an Android system.
- According to the researchers, the spyware can **silently uninstall/reinstall Telegram**. Except the reinstalled version is likely a compromised one.
 - It can also steal data from the old app. **For WhatsApp, it can prompt the user to reinstall WhatsApp via Play Store.**

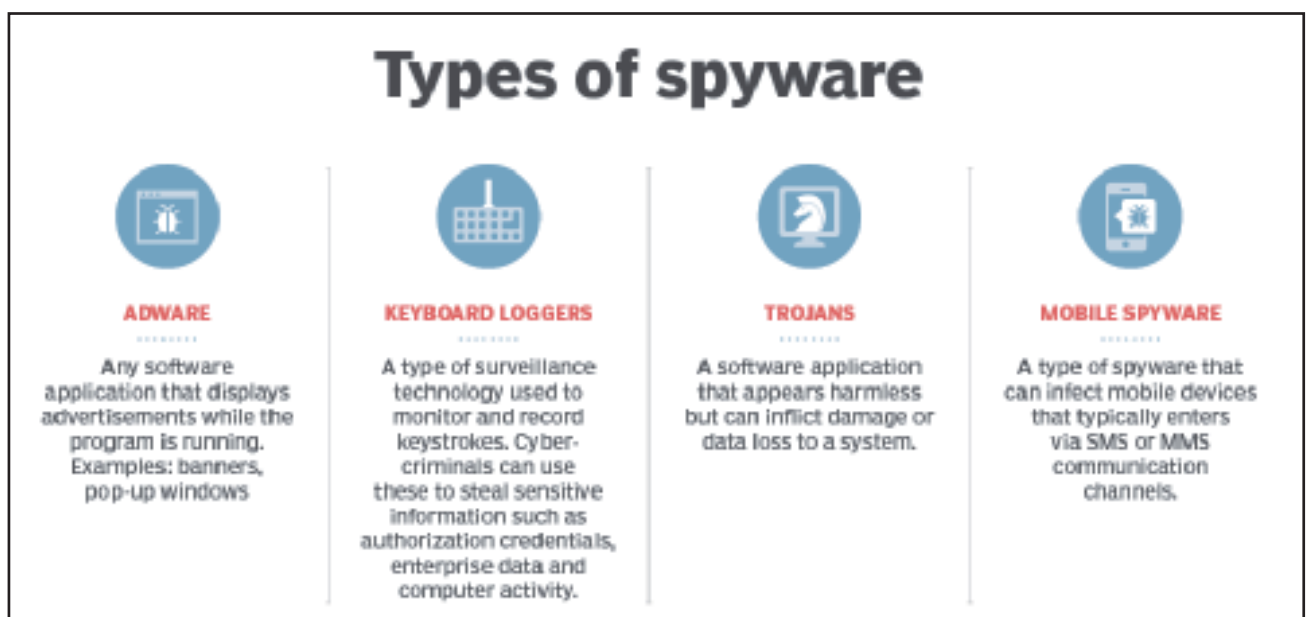
So, once Hermit has been deployed to a phone, it can control and track data from all key applications.

How did Hermit get deployed on Android and iOS devices?

- Sophisticated spyware such as Hermit and Pegasus cost millions of dollars in licensing fees, and these are not simple operations.
- It's not like common malware targeting regular users.
- And in the case of Hermit, it appears the operations used were complex.
- According to Google's TAG team, all campaigns started with a unique link sent to the victim's phone. When the user clicked, the page installed the application on both Android and iOS.

Spyware

- Spyware is the term given to a category of software which aims to steal personal or organisational information.
- Spyware is a type of malicious software or malware that is installed on a computing device without the end user's knowledge.
- It invades the device, steals sensitive information and internet usage data, and relays it to advertisers, data firms or external users.



Other terms related to it

- **Virus:** Viruses attach themselves to clean files and infect other clean files. They can spread uncontrollably, damaging a system's core functionality and deleting or corrupting files.
- **Trojans:** This kind of malware disguises itself as legitimate software, or is included in legitimate software that has been tampered with. It tends to act discretely and create backdoors in your security to let other malware in.
- **Spyware:** It hides in the background and takes notes on what you do online, including your passwords, credit card numbers, surfing habits and more.
- **Worms:** Worms infect entire networks of devices, either local or across the internet, by using network interfaces. It uses each consecutive infected machine to infect more.
- **Ransomware:** Also called scareware, this kind of malware can lock down computer and threaten to erase everything — unless a ransom is paid to its owner.
- **Adware:** Though not always malicious in nature, particularly aggressive advertising software can undermine security just to serve ads — which can give a lot of other malware a way in.
- **Botnets:** Botnets are networks of infected computers that are made to work together under the control of an attacker.

CAPSTONE

- ◎ **CONTEXT:** NASA recently launched **CAPSTONE**, a microwave oven-sized CubeSat that will serve as the first spacecraft to test a unique, elliptical lunar orbit.

About CAPSTONE:

- CAPSTONE, short for **Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment**, is designed to test a unique, elliptical lunar orbit.
- It is a microwave oven-sized CubeSat weighing just 55 pounds (**25 kg**).
- As a pathfinder for Gateway, CAPSTONE **aims to help reduce risk for future spacecraft by validating innovative navigation technologies**, and by verifying the **dynamics of the halo-shaped orbit**.
- **Halo-shaped orbit:**
 - The orbit is known as a **near-rectilinear halo orbit (NRHO)**.
 - It is **significantly elongated**, and is **located at a precise balance point in the gravities of Earth and the Moon**.
 - This offers stability for **long-term missions like Gateway**.
- At the Moon, CAPSTONE will enter NRHO, where it will fly within 1,600 km of the Moon's North Pole on its near pass and 70,000 km from the South Pole at its farthest.
- The spacecraft will repeat the **cycle every six-and-a-half days and maintain this orbit for at least six months to study dynamics**.

Mission objectives:

- Verify the characteristics of a **cis-lunar near rectilinear** halo orbit for future spacecraft

- Demonstrate **entering and maintaining this unique orbit** that provides a highly-efficient path to the Moon's surface and back
- Demonstrate **spacecraft-to-spacecraft navigation services** that allow future spacecraft to determine their location relative to the Moon without relying exclusively on tracking from Earth
- Lay a **foundation for commercial support of future lunar operations**
- Gain experience with small dedicated launches of CubeSats beyond low-Earth orbit, to the Moon, and beyond



An animated graphic depicting the unique orbit of the CAPSTONE cubesat around the moon. (Image credit: Advanced Space)



EARTH'S TOP 7 ASTEROID DEFENCES

- © **CONTEXT:** Recently, researchers published a new paper describing the results of the latest global planetary defense exercise which used an imaginary sweep of asteroid 'Apothis' near Earth.

What is an Asteroid?

- Asteroids are small, airless rocky worlds revolving around the sun that are too small to be called planets.
- They are also known as **planetoids or minor planets**.
- In total, the mass of all the asteroids is less than that of Earth's moon. But despite their size, asteroids can be dangerous.
- Many have hit Earth in the past, and more will crash into our planet in the future.

Where asteroids are located?

- Most asteroids lie in a vast ring between the orbits of Mars and Jupiter.
- Not everything in the main belt is an asteroid, for instance, comets have recently been discovered there, and Ceres, once thought of only as an asteroid, is now also considered a dwarf planet.
- Many asteroids lie outside the main belt. For instance, a number of asteroids called Trojans lie along Jupiter's orbital path.
- Three groups — **Atens, Amors, and Apollos** — known as **near-Earth asteroids orbit** in the inner solar system and some **asteroid or comet impacts with Earth, and then either prevent them or mitigate their possible effects**.
- **Asteroid impact avoidance** comprises the methods by which **near-Earth objects (NEO)** on a potential collision course with Earth could be diverted away, preventing destructive impact events.
- An impact by a sufficiently large asteroid or other NEOs would cause, depending on its impact location, massive tsunamis or multiple firestorms, and an impact winter caused by the sunlight-blocking effect of large quantities of pulverized rock dust and other debris placed into the stratosphere.

Potentially Hazardous Asteroids (PHAs):

- It means that an asteroid has the potential to make **threatening close approaches** to the Earth.
- Specifically, all asteroids with a **Minimum Orbit Intersection Distance (MOID)** of 0.05 AU (which is about 7,480,000 Km) or less and an **Absolute Magnitude (H)** of 22.0 (about 150 mt in diameter) or less are considered PHAs.
- MOID is a **method for calculating the minimum distance** between two almost overlapping elliptical orbits.
- The **absolute magnitude** is a measure of the star's luminosity i.e. the total amount of energy radiated by the star every second.

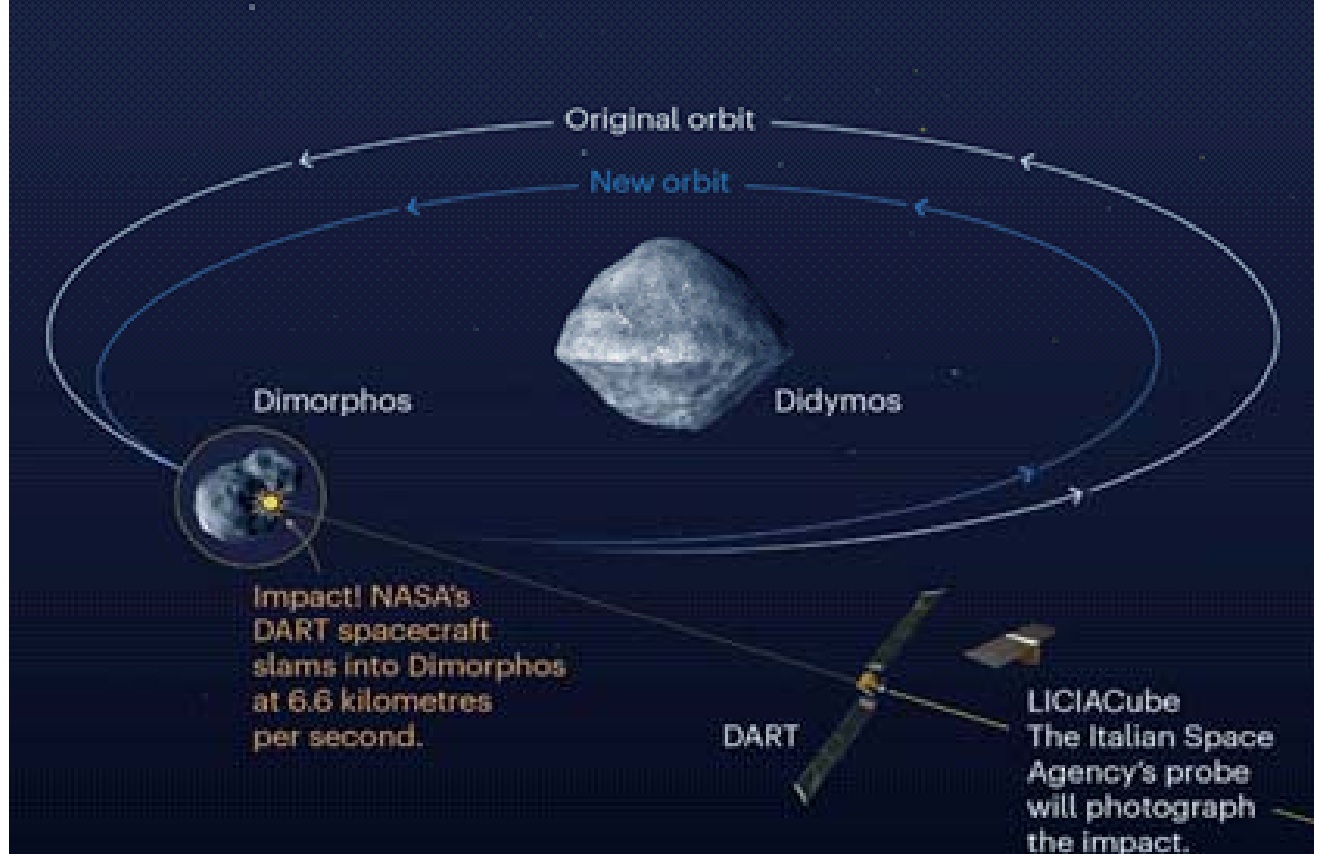
Various Defense mechanisms against Asteroids

- **Deflecting Asteroids:** Blowing up the asteroid before it reaches Earth, or deflecting it off its Earth-bound course by hitting it with a spacecraft may ward off the threat.
- AIDA: The measure undertaken so far is the **Asteroid Impact and Deflection Assessment (AIDA)**, which includes NASA's Double Asteroid Redirection Test (DART) mission and the European Space Agency's (ESA) Hera.
- **DART:** In 2018, NASA announced that it had started the construction of DART, which is scheduled to launch in 2021 with an aim to slam into the smaller asteroid of the Didymos system at around 6 km per second in 2022. Didymos, is a binary near-Earth asteroid, that could pose the most likely significant threat to Earth.
- **Hera:** It is scheduled to launch in 2024, and will arrive at the Didymos system in 2027 to measure the impact crater produced by the DART collision and study the change in the asteroid's orbital trajectory.

- **Monitoring of PHAs:** It is not necessary that asteroids classified as PHAs will impact the Earth. It only means there is a possibility of a threat.
- By monitoring these PHAs and updating their orbits as new observations, it is possible to predict the close-approach statistics and thus their Earth-impact threat.

A NOT-SO-GENTLE NUDGE

Next year, the Double Asteroid Redirection Test (DART) spacecraft will attempt to change the orbit of one asteroid that is circling another. Neither is a danger to Earth, but the test is a dress rehearsal for protecting the planet from future threats.



SECTION: C
(QUIK BYTE)

CURRENT AFFAIRS

NEW GUIDELINES AGAINST 'SERVICE CHARGE'

◎ **CONTEXT:** The Central Consumer Protection Authority (CCPA) recently issued guidelines to prevent unfair trade practices, and to protect the interest of consumers with regard to the levy of service charge in hotels and restaurants.

The guidelines:

- The CCPA has issued five major guidelines regarding the levy of service charge by restaurants and hotels, which has for long been a contentious issue and has periodically triggered complaints from consumers. These are:
 - No hotel or restaurant **shall add service charge automatically** or by default in the bill;
 - Service charge **shall not be collected from consumers by any other name;**
 - No hotel or restaurant shall force a consumer to pay service charge and shall clearly inform the consumer that service charge is voluntary, optional, and at the consumer's discretion;
 - No restriction on entry or provision of services based on collection of service charge shall be imposed on consumers; and
 - **Service charge shall not be collected by adding it along with the food bill and levying GST on the total amount.**
- Under the guidelines, consumers can **lodge complaints against hotels** and restaurants by **calling the number 1915** or on the **National Consumer Helpline (NCH) mobile app**.
- The consumer can complain to the Consumer Commission, or through the **edaakhil portal**.
- A consumer can submit a complaint to the **District Collector** of the concerned district for investigation and subsequent proceedings by the CCPA.
- A consumer can complain **directly to the CCPA** by sending an e-mail to com-ccpa@nic.in.

Under which law have these guidelines been issued?

- The CCPA has issued guidelines under **Section 18 (2) (I) of The Consumer Protection Act, 2019**.
- The guidelines are in addition to the Centre's 2017 guidelines which prohibit the levy of service charge on consumers by hotels and restaurants.

About Central Consumer Protection Authority (CCPA):

- The **CCPA was established in July 2020** under The Consumer Protection Act, 2019, to **promote, protect, and enforce the rights of consumers** as a class, and to investigate, prosecute, and punish violators.
- The authority is being constituted under **Section 10(1) of The Consumer Protection Act, 2019**.
- **Aim:** To protect the rights of the consumer by cracking down on unfair trade practices, and false and misleading advertisements that are detrimental to the interests of the public and consumers.

COMMONWEALTH ADOPTS 'LIVING LANDS CHARTER' FOR FUTURE GENERATIONS

◎ **CONTEXT:** Commonwealth leaders have officially adopted the Living Lands Charter: A Commonwealth Call to action on Living Lands (CALL), which commits all 54 member countries to safeguarding global land resources while taking coordinated action on climate change, biodiversity loss and sustainable land management.

Living Lands Charter:

- It is a non-binding agreement.
- The Living Lands Charter is a testament to our commitment to the people of the Commonwealth, and to the Commonwealth principles of transparency, consensus, and common action.
- It helps to encapsulate combined effort to hold the global average temperature increase to 1.5°C.
 - It seeks to catalyse the global political momentum for enhancing climate action, building resilience, reducing biodiversity loss, and arresting land degradation.
- The Call to Action on Living Lands seeks to propel sustainable land management by supporting the 54 Commonwealth member countries to
 - prevent biodiversity loss and
 - desertification while reducing emissions,
 - enhancing resilience and
 - promoting sustainable development
- It aimed to support member countries to effectively deliver their commitments under the three Rio conventions —
 - UN Convention on Biological Diversity,
 - UN Convention to Combat Desertification (UNCCD) and
 - UN Framework Convention on Climate Change.

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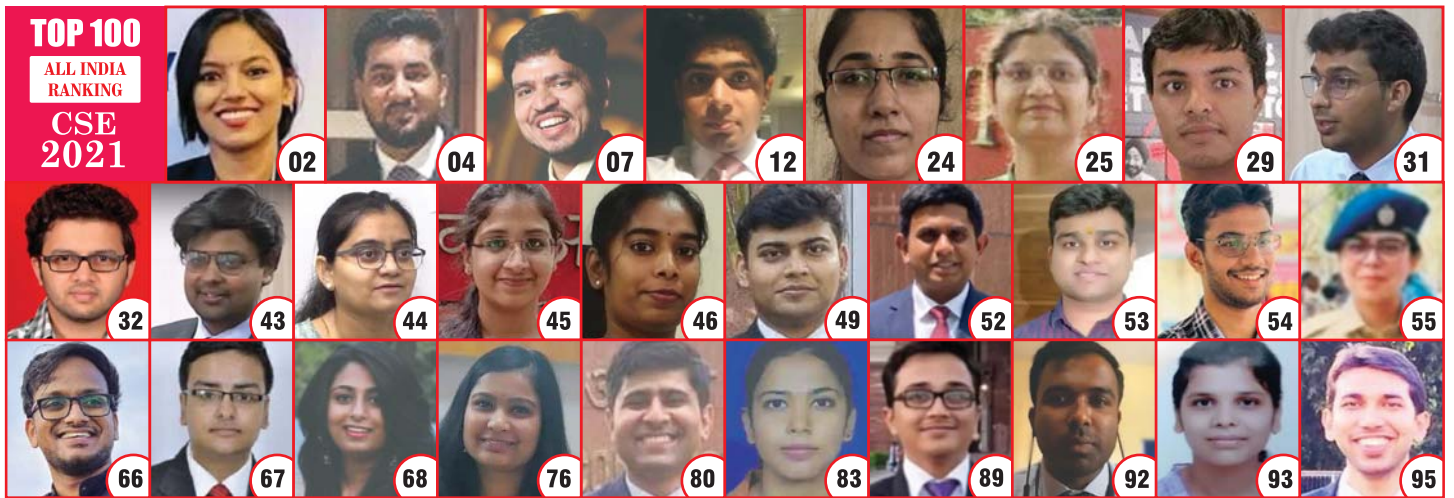
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