WEEKLY CURRENT AFFAIRS MAGAZINE for

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PIONEER ACADEMY's

PATHFINDER

CURRENT AFFAIRS FOR CIVIL SERVICES

INDEX

Topic 1. FINDING PROOF FOR THE AXIOM THAT NUTRITION AIDS RECOVERY

Important for the subject: Science and tech

Importance of Nutrition

Proper nutrition is essential for **all biochemical processes**. It plays a fundamental role in the **body's ability to recover and heal during medical treatments.**

Medical professionals increasingly emphasize the **integration of nutrition with medicine.**

- **The RATIONS Trial: Exploring Nutrition's Impact on Tuberculosis Patients** Conducted by **Anurag Bhargava** and his team, the trial focuses on nutrition's impact on tuberculosis **patients and their families.**

Intervention and Control Groups

- The intervention group received a **6.5 kg food basket and micronutrients.** The control group continued with their **usual PDS-based diet.**
- Patients received a 10 kg/month food basket but were not randomized due to **ethical reasons.**

Key Findings:

- High prevalence of **undernutrition among both household members and patients.**
- **Early weight gain** (5% of body weight in the first 2 months) was associated with a **60% reduction in the risk of death.**
- After treatment, **75% of patients were able to return to work. Nutrition's Crucial Role in HIV/AIDS Recovery**
- **HIV infection and poor nutritional status** are closely linked.
- **Malnutrition** impairs immune function and worsens the effects of HIV infection. In response to these challenges, organizations like the **World Food Programme** initiated programs to address the lack of access to nutrition for **People Living with HIV (PLHIV) on Anti-retroviral Therapy (ART).**

Organizations involved:

- The RATIONS trial was sponsored by the **Indian Council of Medical Research (ICMR)** and led by researchers at **Yenepoya Medical College**, with other investigators from the **National Institute of Research on Tuberculosis – Chennai.**

Indian Council of Medical Research (ICMR):

- Established in 1911. Apex body for **biomedical research** in India. Supports and sponsors

medical research initiatives.

World Food Programme:

- Established in 1961. **United Nations** 'food assistance branch. Addresses **global hunger and food security.**
- Provides food aid and nutrition support, especially during **emergencies**.

National Institute of Research on Tuberculosis – Chennai:

- Established in **1956**.
- Specializes in **TB and respiratory disease research**. Conducts studies, clinical trials, and research projects related to TB and related health issues.

Tuberculosis (TB):

- TB is an **infectious** bacterial disease caused by ***Mycobacterium tuberculosis.*** It primarily affects the **lungs** but can also affect other parts of the body.
- It is a global health concern, with a high prevalence in many developing countries.
- Effective treatment involves a combination of **antibiotics** taken over several months.
- **Preventative measures include vaccination (BCG vaccine)** and infection control practices.

AIDS (Acquired Immunodeficiency Syndrome):

- HIV attacks the **immune** system, reducing the body's ability to fight off infections and diseases.
- Early HIV infection may not cause noticeable symptoms, but as the disease progresses, the immune system weakens.
- AIDS is diagnosed when the **CD4 T-cell count falls below a certain threshold** or **when specific opportunistic infections occur.**
- **Antiretroviral therapy (ART)** is the standard treatment for HIV, which can delay the progression to AIDS.
- Preventative measures include **safe sex practices, HIV testing, and access to ART for those with HIV.**

Topic 2. CHANDRAYAAN PROBE FINDS SPARSE PLASMA ON MOON

Important for the subject: Science and technology

Langmuir Probe (RAMBHA-LP) payload on board Chandrayaan-3's lander Vikram has completed the first in-situ measurements of the surface-bound **lunar plasma environment** over the south polar region.

Understanding RAMBHA-LP

- RAMBHA-LP stands for **Radio Anatomy of Moon Bound Hypersensitive Ionosphere and Atmosphere** – Langmuir Probe.
- Named after **Nobel laureate Irving Langmuir,** it characterizes **lunar plasma. RAMBHA-LP's milestone**: measuring **lunar plasma's density.**

Lunar Plasma Density Assessment

- Initial findings indicate **sparse plasma near the lunar surface.** Density ranges from about **5 to 30 million electrons per cubic meter**.
- **Importance**: Influence on **radio wave communication through space.**

Langmuir Probe Operation

- Langmuir probe functions as an **electrode in plasma**. **Collects electrons and ions,** measuring their properties.
- **RAMBHA-LP**: 5 cm metallic spherical probe mounted on 1-meter boom. Deployment **away from the lander to analyze undisturbed lunar plasma.** Can detect minute return currents as low as **pico-amperes.** Measures **ion and electron densities and their energies.**

Sulphur & Other Elements on the Moon

- Detection methods: **Laser-Induced Breakdown Spectroscopy (LIBS) and Alpha Particle X-ray Spectroscope (APXS).**

Other Elements Detected

- **APXS** instrument reveals the presence of additional elements. Elements include **aluminum, calcium, iron, chromium, titanium, manganese, silicon, and oxygen.**

Plasma and its significance

- **Fourth State of Matter**: Plasma is the fourth state, distinct from solids, liquids, and gases.
- **Charged Particles**: It's made up of charged particles, like electrons and ions. Widespread in the Universe: Plasma is abundant in stars, galaxies, and lightning.
- **Unique Properties**: It conducts electricity, generates magnetic fields, and emits light.
- **Temperature Range**: Plasma can be extremely hot (as in stars) or cooler (as in fluorescent lights).
- **Space Exploration**: Plasma affects communication, spacecraft charging, and space weather.
- **Measurement**: Instruments like **Langmuir** probes study plasma to enhance mission safety and success.

Plasma on Earth:

- **Natural Occurrence**: Plasma can be found naturally on Earth in phenomena like **lightning and the auroras** (northern and southern lights).
- **Man-made Plasma**: It's also created in man-made environments like **fluorescent lights and plasma TVs.**

Topic 3. LARGEST INDIGENOUSLY DEVELOPED N-PLANT UNIT IN GUJARAT STARTS OPS AT FULL CAPACITY

Important for the subject: Science and technology

The **third unit** of the **indigenously developed 700-megawatt electric (MWe) nuclear power reactor** at the **Kakrapar Atomic Power Project (KAPP3)** in **Gujarat** has commenced operations at full capacity.

- This comes a little over three years since the unit achieved its **'first criticality'** – a technical term that signifies the initiation of a controlled, but sustained nuclear fission reaction – in **July 2020.**
- On June 30 this year, the unit had started commercial operations. India is further planning to build a **900 MWe Pressurised Water Reactors (PWRs)** of **indigenous design**.

About kakrapar nuclear power plant:

- **Kakrapar Atomic Power Station** is a nuclear power station in **India**, which lies in the proximity of **Mandvi, Surat** and **Tapi river** in the state of **Gujarat**.
- **Four units** of the **700MWe reactor** are being constructed at **Kakrapar** (KAPP-3 and 4) and **Rawatbhata** (RAPS-7 and 8) site in **Rajasthan** currently.
- Originally expected to be commissioned in 2015. **Built by:** Larsen & Tubro (L&T).

Operated by:

- State-owned **Nuclear Power Corporation of India (NPCIL).**
- It will help in India's expansion plan of **Nuclear Power Plant capacity** from **7480 MWe to 22480 MWe** by **2031.**
- Currently, nuclear power capacity constitutes around **2 percent** of the total installed capacity of **4,17,668 MW.**

Significance of KAPP-3:

- **KAPP-3** is the **country's first 700 MWe unit** and the **biggest indigenously developed variant** of the **Pressurised Heavy Water Reactor (PHWR).**
- For **India**, the operationalisation of its **first 700MWe reactor** is a significant scale up in technology, both in terms of:
- The **optimisation of its PHWR design as** the new **700MWe unit** addresses the excess

thermal margins (thermal margin refers to the extent to which the operating temperature of the reactor is below its maximum operating temperature) — and marks an **improvement in the economies-of-scale,** without significant design changes to the **540 MWe reactor.**

Now India has experience in:

- Making large size pressure vessels
- Own isotope enrichment plants

Pressurised Heavy Water Reactor (PHWR):

- A PHWR is a nuclear reactor that **uses heavy water** (deuterium oxide D2O) as its **coolant** and **neutron moderator.**
- **PHWRs** frequently use **natural uranium as fuel**, but sometimes also use **very low enriched uranium.**
- The heavy water coolant is kept under pressure to avoid boiling, allowing it to reach higher temperature (mostly) without forming steam bubbles, exactly as for a pressurized water reactor.
- While heavy water is very expensive to isolate from ordinary water (often referred to as light water in contrast to heavy water), its low absorption of neutrons greatly increases the neutron economy of the reactor, avoiding the need for enriched fuel.
- The **high cost of the heavy water** is offset by the **lowered cost of using natural uranium and/or alternative fuel cycles**.
- As of the beginning of **2001, 31 PHWRs** were in operation, having a total capacity of 16.5 GW(e), representing roughly **7.76%** by number and **4.7%** by generating capacity of all current operating reactors.
- Till now, the biggest reactor of indigenous design was the **540 MWe PHWR**, two of which have been deployed in **Tarapur, Maharashtra.**

Safety features of PHWR:

- In terms of **safety features,** the **PHWR technology scores high**
- The biggest advantage of the **PHWR design** is the **use of thin walled pressure tubes** instead of **large pressure vessels** used in pressure vessel type reactors.
- This results in a **distribution of pressure boundaries** to a large number of small diameter pressure tubes and thereby lowers the severity of the consequence of an accidental rupture of the pressure boundary than in a pressure vessel type reactor.
- Additionally, the **700 MWe PHWR design** has enhanced safety through dedicated **'Passive Decay Heat Removal System',** which has the capability of removing **decay heat** (the heat released as a result of radioactive decay) from the reactor core without requiring any operator actions, on the lines of similar technology adopted for **Generation III+ plants** to negate the possibility of a **Fukushima type accident** that happened in

Japan in 2011.

- The **700 MWe PHWR unit,** like the one deployed in **KAPP**, is equipped with a **steel-lined containment** to **reduce any leakages** and a **containment spray system** to **reduce the containment pressure** in case of a loss of coolant accident.

Topic 4. LIGO INDIA PROJECT

Important for the subject: Science and technology

LIGO is an international network of laboratories that **detect the ripples in spacetime** produced by the movement of **large celestial objects like stars and planets.**

- LIGO-India will be located in **Hingoli district of Maharashtra**, about 450 km east of Mumbai, and is scheduled to begin scientific runs from 2030.

LIGO (Laser Interferometer Gravitational-Wave Observatory)

- It is an international network of laboratories meant to detect gravitational waves. Under this, **two large observatories (~ 3000 Km apart) were built in the US**
- **(Hanford Site, Washington and Livingston, Louisiana)** with the aim of detecting gravitational waves by laser interferometry.
- **Interferometry** is a technique which uses the interference of superimposed waves to extract information.
- Besides the US, such gravitational wave observatories are currently operational in **Virgo in Italy and KAGRA in Japan**
- LIGO-India will be the **fifth**, and possibly the **final node** of the planned network.

Why is a Fifth LIGO Observatory Needed?

- **Extremely low strength of gravitational waves** make their detection very difficult. Therefore, LIGO-India is part of the plan to expand the network of gravitational wave observatories in order to increase the chances of detecting these waves from anywhere in the observable universe.
- This will **improve the accuracy and quality of information** taken from them.

Gravitational Waves

- These are the ripples in space-time produced **by the movement of large celestial bodies like stars and planets.**
- Gravitational waves provide a new way to explore the universe, especially in **'dark' areas where electromagnetic radiation is absent.**
- These were postulated over 100 years ago in Albert Einstein's **General Theory of Relativity** that encapsulates the current understanding of how gravitation works.
- The celestial bodies' movements **could disturb space-time, creating gravitational waves—ripples in space-time.**

- They were **first discovered** in 2015 by two LIGOs based in the United States.
- In 2017, this experimental verification of the century-old theory received the **Nobel Prize in Physics (to Rainer Weiss, Barry C. Barish and Kip S. Thorne).**
- Until now, **at least 10 events** producing gravitational waves have been detected.

LIGO-India's Site and Equipment

- **Site Selection**: Hingoli was chosen due to **low seismic activity,** vital for precise measurements.
- **Geographical Impact:** Spans **430 acres**, affecting **six** villages, boosting the local economy and infrastructure.
- **Equipment**: Features **4-km arms with 1.2m diameters vacuum chambers** and **highly-reflective mirrors** for accurate gravitational wave detection.
- **Precision Engineering**: Mirrors **polished to nanometer scales**, vacuum chambers maintained at **near-absolute vacuum** for precise measurements.
- **Security**: **Strict access control** maintains a controlled environment to protect sensitive experiments.

Future Prospects and Benefits

- LIGO-India is poised to become a **hub for international collaboration**, attracting researchers from around the world to work on groundbreaking experiments.
- The project's **extended operational life of 30 years** ensures its enduring contribution to the scientific community.
- LIGO-India is expected to generate **vast amounts of data,** providing valuable information for **astronomy and astrophysics research.**
- The development of technology and infrastructure for LIGO-India, including the fabrication of key components and the establishment of a data center, can stimulate India's technological capabilities.

Local Impact and Scientific Outreach

- The project has created **employment opportunities for locals,** ranging from security personnel to administrative and support staff, providing a boost to the regional economy.
- Teachers in the Marathwada region have witnessed a surge of interest in astronomy among students, highlighting the project's educational impact.
- The **proposed science outreach center**, **'Light & Gravity',** represents a commitment to fostering scientific curiosity and knowledge in the local community.

Topic 5. INDIA'S FIRST SOLAR OBSERVATORY MISSION TO BE LAUNCHED TODAY

Important for the subject: Science and technology

Introduction

India's first solar observatory mission, named **AdityaL1**, is set to launch on Saturday from the **Satish Dhawan Space Centre in Sriharikota**, India. This mission aims to provide valuable insights into various aspects of **solar activity and space weather.**

Launch Details

- **Launch Vehicle:** The mission will be launched onboard the Polar Satellite Launch Vehicle (PSLV)
- This mission is one of the longest missions involving ISRO's PSLV.
- The spacecraft will stay in **earthbound orbits for 16 days**, during which it will undergo **five maneuvers to gain the necessary velocity** for its journey.
- Afterward, It will undergo a **TransLagrangian1 insertion maneuver**, marking the beginning of its **110-day trajectory to its destination.**
- AdityaL1 will be positioned approximately **1.5 million kilometers away from Earth, directed towards the sun.**
- This is about 1% of the distance between the Earth and the sun.

European Space Agency's Support for Aditya-L1

Deep Space Communication Support

- ESA is offering **deep space communication services** to the mission. ESA's **global network of deep space tracking stations**, including locations in **Australia, Spain, and Argentina**, will track, command, and receive data from Aditya-L1 throughout its journey in the solar system.
- ESA is also providing coordinated support from the **Kourou station in French Guiana and the Goonhilly Earth Station in the UK,** further enhancing communication capabilities.

Ground Services

- ESA is the **primary provider of ground station services** for Aditya-L1. ESA stations will support the mission **from its early stages,** including the 'Launch and Early Orbit Phase,' throughout the journey to L1, and during **routine operations for the next two years.**

Aditya L1 Payloads:

- **Seven Specialized Payloads**: Observe the photosphere, chromosphere, and the corona

using electromagnetic, particle, and magnetic field detectors.

- **Direct Sun Observation**: Four payloads directly study the Sun's dynamics. **In-situ Studies**: Three payloads provide data on solar dynamics in the interplanetary medium.

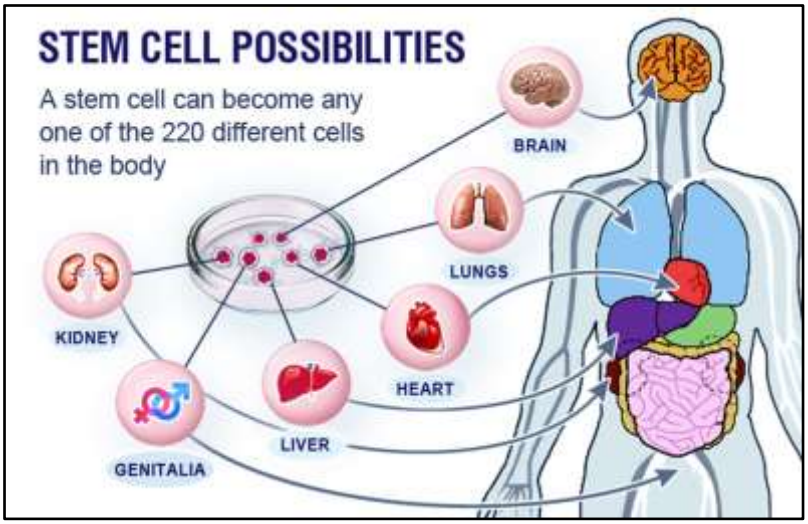
Sl. No.

Payload Capability 1

- **VELC** (Visible Emission Line Coronagraph)
- Corona Imaging & Spectroscopy 2
- **SUIT** (Solar Ultraviolet Imaging Telescope)
- Photosphere and Chromosphere Imaging 3
- **SoLEXS** (Solar Low Energy X-ray Spectrometer)
- Soft X-ray Spectrometer: Sun-as-astar 4
- **HEL1OS** (High Energy L1 Orbiting X-ray Spectrometer)
- Hard X-ray Spectrometer: Sun-as-a star 5
- **ASPEX** (Aditya Solar Wind Particle Experiment)
- Solar Wind/Particle Analyzer Protons & Heavier Ions 6
- **PAPA** (Plasma Analyser Package For Aditya)
- Solar Wind/Particle Analyzer Electrons & Heavier Ions 7
- Advanced Tri-axial High Resolution Digital **Magnetometers**
- In-situ Magnetic Field (Bx, By, and Bz)

Topic 6. COURT ALLOWS STEM CELL THERAPY FOR TWO AUTISTIC KIDS

Important for the subject: Science and technology



The Delhi High Court recently granted permission for two children with autism spectrum disorder (ASD) to undergo stem cell therapy, overturning a recommendation by the **Ethics and Medical Registration Board (EMRB)** of the **National Medical Commission (NMC)**

against such treatment.

- The EMRB recommendation had deemed the **use, promotion, and advertisement of stem cell treatment for ASD as professional misconduct.**

What are Stem Cells?

- **Stem Cells:** Stem cells are **undifferentiated cells** capable of developing into **various specialized cell types**. They can be broadly categorized into **pluripotent stem cells** and **adult stem cells.**
- **Pluripotent Stem Cells**: These are stem cells that have the potential to differentiate into all cell types in the adult body. They are **naturally found in embryos.**
- **Adult Stem Cells**: These are **tissue or organ-specific stem cells** that can regenerate to form only the cell types specific to the organ or tissue from which they are derived.
- **Induced Pluripotent Stem Cells (iPSCs)**: iPSCs are mature human adult cells that have been **reprogrammed to exhibit characteristics similar to embryonic stem cells,** making them pluripotent.

Medical Applications of Stem Cells

- Stem cell treatments fall under the umbrella of **regenerative medicine,** leveraging the **regenerative properties of stem cells**.
- **Hematopoietic** stem cell transplantation has been used for over 90 years to treat conditions like **leukemia and lymphoma.**
- Stem cell-based therapies are already used to treat patients, including bone marrow transplants for leukaemia, skin grafts for severe burns, and more recently corneal grafts for loss of sight due to ocular burns or infection.
- More stem cell therapies will be developed; however, some scientists and clinicians expect it will take at least 20 years before stem cell treatments become widely available.
- **Increase understanding of how diseases occur.** By watching stem cells mature into cells in bones, heart muscle, nerves, and other organs and tissue, researchers may better understand how diseases and conditions develop.
- **Test new drugs for safety and effectiveness.** Before using investigational drugs in people, researchers can use some types of stem cells to test the drugs for safety and quality. This type of testing will most likely first have a direct impact on drug development for cardiac toxicity testing.

Understanding Autism Spectrum Disorder (ASD)

- ASD is a **neurological and developmental disorder** affecting **communication, social interaction, learning, and behavior.**
- There is **no known cure for ASD;** treatment focuses on symptom management and improving functionality.
- Conventional therapies include **social skills training, behavior therapy, speech therapy,**

occupational therapy, and medication.

Potential for Stem Cell Treatment in ASD

- Some experts suggest that stem cell therapy may hold promise for ASD due to its **potential to regulate the immune system and enhance neural connectivity.**
- However, current clinical trials have yielded **mixed results,** and the therapy is still in the **experimental stage.**
- Concerns include **adverse reactions, debilitating side effects, limited long-term understanding, and the absence of established protocols.**

EMRB's Recommendations and Concerns

- EMRB recommended **against stem cell therapy** for ASD due to the **lack of conclusive evidence.**
- The board highlighted the risks associated with the treatment, including false hope from **"predatory marketing".**
- The court's decision doesn't pass judgment on the overall validity of stem cell therapy for ASD but allows the ongoing treatment to continue.
- The **NMC is authorized to take a final view on the recommendation according to the NMC Act.**

National Medical Commission (NMC):

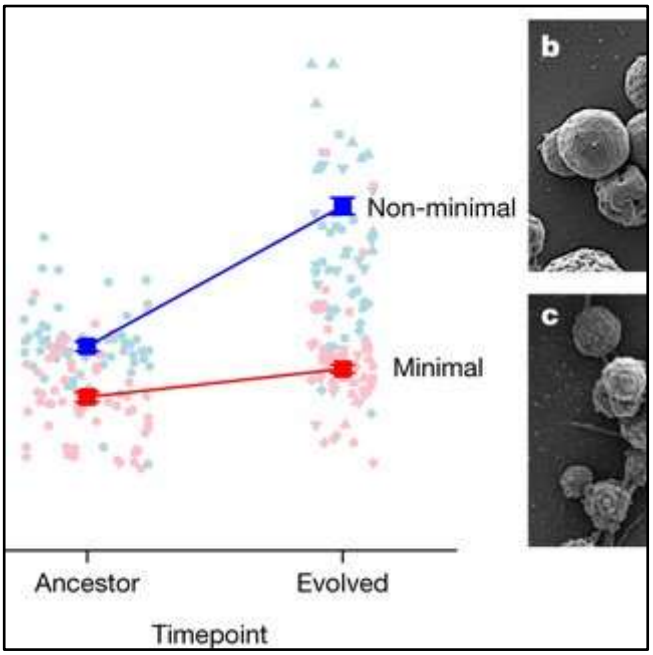
- Established through the **National Medical Commission Act, 2019.** It **replaced the Medical Council of India**.
- The NMC is responsible for **regulating medical education and practice in India.**

Aims:

- Improve medical education access and quality
- Ensure ample high-quality medical professionals
- Promote equitable healthcare
- Encourage research adoption
- Assess institutions transparently.
- Maintain the medical register
- Enforce ethical standards
- Establish effective grievance redressal

Topic 7. CELLS WITH MINIMAL GENOME CAN EVOLVE AS FAST AS NORMAL CELLS

Important for the subject :Science and technology



Introduction

Dairy farming introduced **gene mutations** in **humans to digest milk**. **Mutations in non-essential genes can drive evolution in complex organisms.**

- **Challenge**: How does a simple organism with essential genes evolve with minimal targets for selection?

Experimental Setup:

- **Mycoplasma mycoides Genome** (Sourced from **goat, cattle gut**)
- Created **minimal cell** (***Mycoplasma mycoides*** JCVI-syn3.B) with **493 genes** compared to non-minimal cell (JCVI-syn1.0). Genome minimization **reduced minimal cell fitness by over 50%**.

Testing Evolution

- Minimal and non-minimal cells **grown separately for 300 days**, **equivalent to 40,000 years of human evolution.**
- **Minimal cells showed mutation rates comparable to non-minimal cells.** Despite the minimal cell's reduced fitness due to genome minimization, the researchers found that **it could evolve as fast as a normal cell.**

Comparison and Genetic Pathways

- **Size difference**: Non-minimal cells increased by 80%, while minimal cells remained the same size. Examination of genomes of adapted cells reveals **distinct genetic pathways**.

Significance of Findings

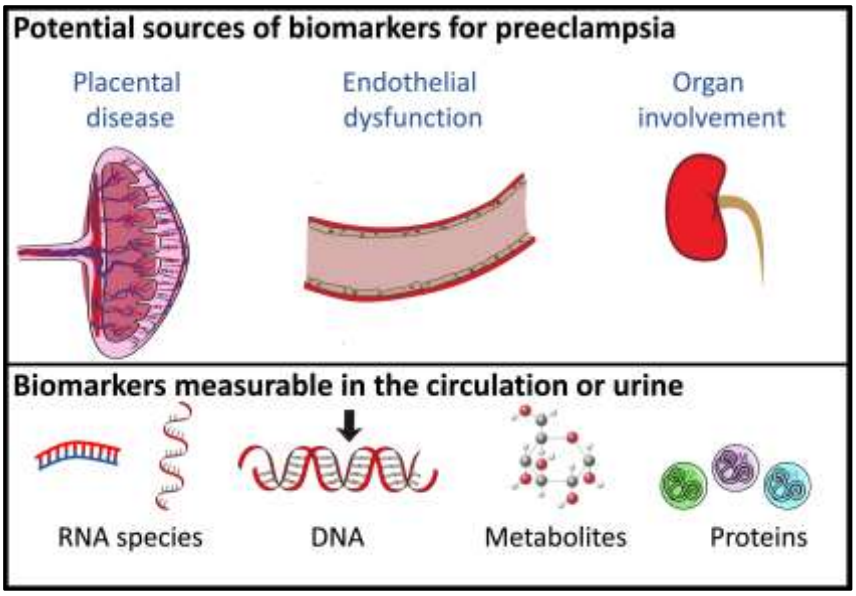
- Significant contribution to **microbial evolution.** Relevance to **synthetic biology and the adaptability of engineered cells. Life's robustness and adaptability even with minimal genomes.**
- Implications for **treating clinical pathogens, engineered microorganisms, and the origin of life.**

Key terms:

- **Gene Mutation**: A gene mutation is a **permanent alteration in the DNA** sequence that makes up a gene. Mutations can result from changes in the nucleotide sequence of DNA and can lead to variations in an organism's characteristics.
- **Evolution**: Evolution is the process by which **species change over time through the gradual accumulation of genetic changes**. It leads to the development of **new species** from pre-existing ones.
- **Genome**: A genome is the **complete set of an organism's genetic material,** including all of its genes and non-coding sequences of DNA.
- **Synthetic Biology**: Synthetic biology is an interdisciplinary field that combines principles from biology, engineering, and computer science to design and **construct new biological parts, devices, and systems, or to redesign existing biological systems for useful purposes.**
- **Minimal Cell**: A minimal cell is a simplified version of a biological cell that **contains only the essential genes and components required for life**.
- **Natural Selection**: Natural selection is the process by which organisms with traits that confer a **reproductive advantage** in a **given environment** are more likely to survive, reproduce, and **pass on their genes to the next generation.**
- **Fitness**: Fitness in an evolutionary context refers to an organism's ability to survive, reproduce, and pass on its genes to the next generation. It is a measure of how well an organism is adapted to its environment.
- **Genetic Variation**: Genetic variation refers to the **diversity of genetic material within a population**. It arises from **mutations**, genetic recombination, and other processes and is a source of genetic diversity within a species.

Topic 8. EARLY PREDICTION OF PREECLAMPSIA USING A BLOOD-DERIVED BIOMARKER

Important for the subject :Science and technology



A **liquid-biopsy approach** that measures **DNA-methylation levels** in the blood may improve the detection of pregnancies at risk of developing **preeclampsia** at early stages, according to a study.

Preeclampsia:

- Preeclampsia is a major cause of morbidities during gestation. Early-onset preeclampsia — occurring before **34** weeks of gestation — is associated with a higher risk of severe disease and foetal mortality.
- **Low-dose aspirin** at early stages of the disease (before 16 weeks of gestation) can reduce the risk of developing **preeclampsia**, but early identification of the disease is needed to initiate this intervention.
- Previous studies have shown that widespread **methylation changes in the placenta** occur at delivery.

Liquid biopsy:

- **Liquid biopsy** is a promising emerging tool for **non-invasive diagnostics** for preeclampsia.
- The researchers detected differences in **DNA methylation** in the control pregnancies versus the pregnancies that developed preeclampsia.
- The preliminary results suggest that **cell-free DNA methylation profiling** is a promising tool for presymptomatic PE risk assessment, and has the potential to improve treatment and follow-up in the obstetric clinic.

Biomarker:

- It generally refers to a measurable indicator of some biological state or condition.
- Biomarkers are often measured and evaluated to examine normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention.

Application:

- Biochemical biomarkers are often used in clinical trials, where they are derived from bodily fluids that are easily available to the early phase researchers.
- They are also used in pre-clinical work to identify compounds that appear to modulate disease in in vivo models and therefore might be tried in human clinical trials.
- Disease-related biomarkers give an indication of the probable effect of treatment on patients.

Topic 9. CHEST X-RAY INTERPRETATION USING AI CAN DETECT MORE TB CASES

Important for the subject :Science and technology

India has a powerful technology — **AI-assisted chest X-ray** — to screen presumptive TB cases.

AI-assisted chest X-ray- qXR:

- The **AI algorithm (qXR)** developed by the Mumbai-based **Qure.ai**, can help in early detection of people with **presumptive TB disease** in less than a minute, including people with **subclinical TB.**
- The AI software combined with molecular tests for TB disease confirmation can vastly increase detection rates.
- The **qXR software** got the **European CE certification** and the **Indian drug regulator**.

WHO recommendation:

- The **qXR** was **one of the three AI algorithms** that the **WHO** had referenced to when updating the **TB screening guidelines** in **March 2021. Qure.ai's AI algorithm has a CE certification for use in the paediatric population (person below 15 years of age).**
- Unlike in adults, paediatric pulmonary TB detection using X-rays is a challenge as radiological evidence of pulmonary TB in children is less specific.
- In **2021**, **WHO** recommended the use of **CAD products** which use the **AI** to automate interpretation of digital **chest X-rays** for **TB screening** and triage in people older than 15 years.
- The **qXR software** meets the **WHO requirement** with over 90% sensitivity and more than 70% specificity in people older than 15 years.
- The 2019 study demonstrated that **qXR** has the potential to **increase capacity and aid**

TB diagnosis, especially in settings with a shortage of trained human readers which is a huge shortcoming in using chest X-rays for TB screening.

- The **qXR algorithm** is already being used in over 50 countries. In **India, 24 States** are using it in about 150 sites. But nowhere in India is the software used at scale.
- In some States, the **qXR software** is used in just one site, like in Kerala. The use of the algorithm to screen the X-rays increased the yield (positivity) of **Gene Xpert molecular tests** by **18-27%, as per a survey.**
- The **qXR algorithm** can also be used for detecting TB disease from film-based X rays.

My Beam device:

- Active case finding got a boost when **Qure.ai** partnered with **My lab Discovery Solutions** to use the **qXR software** in **My lab's portable chest X-ray device (My Beam).**
- This will enable screening of presumptive TB cases with the AI algorithm even in rural areas.
- The portable device cuts the amount of X-ray exposure to 1/20th to 1/30th of a normal X-ray even while capturing all the details.

Ending TB by 2025:

- As per the **2019-2021 National TB prevalence survey in India** report, nearly **43%** of TB cases would have been missed if a chest X-ray was not included.
- Systematic screening for TB disease for early diagnosis is one of the main End TB strategies.
- Large-scale use of AI-assisted chest X-rays for screening is the first crucial step in the TB care cascade to achieve this goal.

Lower adoption rate:

- The **AI algorithm** was **first installed** in **January 2021** at the **S.K. Patil Hospital** in **Mumbai.**
- The **Central TB Division's** directive to States to procure and deploy the tool for early TB disease diagnosis will go a long way in widespread adoption.
- The absence of policy guidance has led to low adoption. The Central TB Division is yet to recommend the use of qXR.

Topic 10. WHAT WE LEARNT FROM A SAHARA SPACE ROCK LEFT OVER FROM THE DAWN OF THE SOLAR SYSTEM

Important for the subject :Science and technology

In May 2020, some **unusual rocks** containing **distinctive greenish crystals** were found in the **Erg Chech sand sea**, a dune-filled region of the **Sahara Desert** in **southern Algeria.**

Erg chech 002:

- The rocks turned out to be from outer space: lumps of rubble billions of years old, left over from the dawn of the Solar System.
- They were all pieces of a **meteorite** known as **Erg Chech 002**, which is the **oldest volcanic rock ever found,** having melted long ago in the fires of some nowvanished ancient protoplanet.
- Researchers have now analyzed **lead** and **uranium isotopes** in **Erg Chech 002** and calculated it is some **4.56556 billion years old**, give or take 120,000 years.
- The results also cast doubt on some common assumptions about the early Solar System.

Aluminum in the solar system:

- Around **4.567 billion years** ago, our Solar System formed from a vast cloud of gas and dust.
- Among the many elements in this cloud was **aluminium**, which came in **two forms**: First is the **stable form, aluminium-27**.
- **Second** is **aluminium-26**, a radioactive isotope mainly produced by exploding stars, which decays over time into **magnesium-26**.

Importance of Aluminium -26:

- It is useful to understand **how the Solar System formed** and developed. Because it decays over time, scientists use it to date events – particularly within the first four or five million years of the Solar System's life.
- The decay of **aluminium-26** was the **main source of heat** in the **early Solar System**.
- This decay influenced the melting of the small, primitive rocks that later clumped together to form the planets.

Uranium, lead and age

- However, to use **aluminum-26** to understand the past, we need to know whether it was spread around evenly or clumped together more densely in some places than in others.
- To figure that out, we will need to calculate the absolute ages of some ancient space rocks more precisely.
- As **Aluminum 26** decays relatively quickly (after around 705,000 years, half of a sample of **aluminium-26** will have decayed into magnesium-26), so it alone is not useful, but **combining aluminum 26 data** with **uranium and lead data**, can give desired results.
- There are **two important isotopes of uranium** (uranium-235 and uranium-238), which **decay into different isotopes of lead** (lead-207 and lead-206, respectively).
- The **uranium isotopes** have **much longer half-lives** (710 million years and 4.47 billion years, respectively), which means we can use them to directly figure out how long ago an event happened.

Meteorite groups

- **Erg Chech 002** is an **"ungrouped achondrite".**
- **Achondrites** are rocks formed from melted planetesimals, which are solid lumps in the cloud of gas and debris that formed the Solar System.
- The sources of many achondrites found on Earth have been identified.
- Most belong to the **Howardite-Eucrite-Diogenite clan**, which are believed to have originated from **Vesta 4, one of the largest asteroids** in the Solar System. Another group of **achondrites** is called **angrites**, which all share an unidentified parent body.
- Still other **achondrites**, including **Erg Chech 002**, are **"ungrouped":** their parent bodies and family relationships are unknown.

A clumpy spread of aluminum:

- **Erg Chech 002** was found to contain a **high abundance of lead-206** and **lead-207**, as well as relatively large amounts of **undecayed uranium-238** and **uranium-235.**
- Measuring the ratios of all the lead and uranium isotopes helped to estimate the age of the rock with such unprecedented accuracy.
- The comparison with a group of achondrites called volcanic angrites showed that the parent body of **Erg Chech 002** must have formed from material containing three or four times as much **aluminum-26** as the source of the angrites' parent body.
- This shows **aluminum-26** was indeed distributed quite unevenly throughout the cloud of dust and gas which formed the solar system.

Significance:

- The results contribute to a better understanding of the Solar System's earliest developmental stages, and the geological history of burgeoning planets.
- Further studies of diverse achondrite groups will continue to refine our understanding and enhance our ability to reconstruct the early history of our Solar System.

Topic 11. AS UPI CROSSES 10 BILLION TRANSACTIONS MARK, A LOOK AT INDIA'S KEY FOREIGN POLICY SELL: DIGITAL PUBLIC INFRA

Important for the subject: Science and Technology

Introduction

In August, the United Payments Interface (**UPI**) achieved a significant milestone, **surpassing 10 billion transactions.**

- UPI, initially a domestic success, has become a **critical element of India's foreign policy strategy.**

India's Global Outreach

- During its G20 presidency, India highlighted its efforts to establish **digital public infrastructure**, collectively known as the **India Stack.**
- India aimed to **encourage other nations to adopt similar technologies.**
- This strategy positions India as a global leader in digital governance, setting it apart from **China's focus on physical infrastructure.**
- Since June 2023, India has signed agreements with countries like **Armenia, Sierra Leone, Suriname, Antigua & Barbuda, and Papua New Guinea** to share the **India Stack model.**
- **Mauritius and Saudi Arabia** have expressed interest in adopting this approach.
- UPI has expanded to international markets like **France, UAE, Singapore, and Sri Lanka**, with **Japan** considering adoption.

Digital Public Infrastructure:

- Digital Public Infrastructure (DPI) is a **digital network or framework** that enables governments to deliver essential economic opportunities and social services efficiently and securely to all residents within a country.
- It typically includes systems for **digital identity, payments, and data exchange**, and it plays a crucial role in promoting financial inclusion, healthcare access, and economic growth.

The Global Digital Public Infrastructure Repository (GDPIR)

- **India** is developing the GDPIR to share best practices, experiences, and tools related to digital public infrastructure.
- The repository will **benefit G20 members** and extend its reach beyond.

The India Stack:

- India Stack is the moniker for a set of open APIs and digital public goods that aim to unlock the economic primitives of identity, data, and payments at a population scale.
- It comprises three layers:

Aadhaar – The Identity Layer

- **The core** of India Stack, reshaping **identity verification.**
- **Biometric authentication** for secure, remote identity verification.
- **Digilocker: Digital records**, like licenses and diplomas, are issued and shared securely.
- **Digital signatures** ensure legal validity in online transactions. Enables **financial inclusion and government service delivery**.

UPI – The Payments Layer

- Facilitates seamless, **interoperable payments** across institutions. **Open and unified**

payment platform for banks and service providers. **Private sector participation** (e.g., PhonePe, Google Pay) fosters innovation. Promotes **financial inclusion**, accessible to those without bank accounts.

Data Governance – The Third Layer

- **Data Empowerment and Protection Architecture (DEPA)** focuses on data governance.
- A **consent management system** gives users control over data sharing. Enhances services (finance, health) tailored to individual preferences. Emphasizes data privacy and security.
- A new category of regulated entities is known as '**consent managers**' (in the Financial Services sector these will be known as **Account Aggregators**).

Topic 12. WHAT IS THE PIROLA VARIANT OF THE CORONAVIRUS?

Important for the subject: Science and Technology

Introduction

A new Coronavirus variant, informally called **'Pirola'** or **2.86**, has emerged, leading to increased Covid-19 infections in multiple countries.

Pirola's Characteristics and Spread

- Pirola has over 30 mutations in its spike protein compared to XBB.1.5, a variant of **Omicron**, raising concerns as the spike protein is crucial for the virus to enter human cells.
- Pirola has been detected in the **US, the UK, and other countries i**n unrelated cases.
- The high number of mutations in Pirola is **similar to the shift seen from Delta to Omicron**, causing concern among experts.
- The strain **has been found in at least six countries**, suggesting international transmission that might go undetected.

How do viruses mutate?

- All viruses mutate over time, particularly **RNA viruses** like **coronaviruses and influenza viruses.**
- Mutations occur when **errors happen during the virus's replication process**, sometimes providing advantages like better infectivity. Widely circulating viruses have a higher chance of mutating due to increased replication.

What differentiates Pirola from other variants?

- Anne Hahn, a postdoctoral associate, describes Pirola as a **more interesting subvariant compared to XBB.1.9**, another Omicron subvariant.
- Surveillance labs in **Israel, Denmark, England, South Africa, and the United States** have detected Pirola.

- Recent data suggests that blood samples perform well in neutralizing Pirola, providing hope for booster effectiveness.

Current Status and Precautions

- **No deaths have been reported** due to Pirola as of now, according to the **WHO**.
- While there is not enough evidence to conclude if Pirola leads to more severe disease, precautions such as **masking, vaccination, and hand-washing remain important.**
- It's still important to remember that Pirola is the same virus at its core, and existing preventive measures can help people avoid infection.

Topic 13. Y, HEAVY RAINS, COURTESY EL NINO

Important for the subject: Science and Technology

The **Greater Horn of Africa** is likely to get heavy rains from October-December 2023, said the **Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC)** in its forecast.

Southern Ethiopia, eastern Kenya and southern Somalia are very likely to experience wetter-than-usual rainfall.

- The drier-than-usual conditions have been forecast for the isolated areas of southwestern Uganda and southwestern South Sudan.
- Below-average rainfall has been forecast until end of the season for Eritrea, central and northern Ethiopia, Djibouti, Western Kenya, significant areas of South Sudan and Sudan, and Northern Uganda.

Cause of heavy rain:

- Strong el-nino is developing over the Indian ocean. The Indian Ocean Dipole is also developing over the Indian Ocean and may strengthen the El Nino impacts.

Impact of heavy rainfall:

- It may contribute to flood situations.
- Agriculture sector may benefit from heavy rain.
- Desert locusts attack may increase.

About ICPAC:

- The forecast was released at the **65th Greater Horn of Africa Climate Outlook Forum (GHACOF65)** held by **ICPAC** in collaboration with the region's **National Meteorological and Hydrological Services**.
- ICPAC, the climate centre accredited by the World Meteorological Organization, provides climate services to 11 East African countries.

- Its service aims at creating resilience in a region deeply affected by climate change and extreme weather.
- Office: **Ngong, Kenya.**

Greater Horn of Africa region:

- The Greater Horn of Africa region includes **Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Sudan, Tanzania and Uganda.**
- **Cartesian coordinates: a means to find your way**

Cartesian coordinates system:

- A **coordinate system** is a set of numbers that allows you to specify the location of a point in some space.
- The **Cartesian coordinates** is one such system, which uses a set of three numbers to specify the distance of a point from three perpendicular planes.
- In general, this system uses N numbers if there are N perpendicular planes, including in higher dimensions.
- The **French philosopherand mathematician René Descartes** created this system in the **17th century.**
- His invention bridged the gap between algebra and geometry and created analytic geometry.

How does it locate a point?

- Cartesian coordinates use a pair of numbers – one on the x-axis, one on the y-axis – that can be used to locate a specific point on the plane.
- In three dimensions, the point's location can be fixed by adding one more number, e.g. the floor of the building you are on.
- The coordinates have an array of applications in astronomy, engineering, and most other disciplines that involve geometry, including representing spatial data in computer graphics and computer-aided geometric design. **Application:**
- The coordinates also have an array of applications in astronomy, engineering, and most other disciplines that involve geometry, including representing spatial data in computer graphics and computer-aided geometric design.

Topic 14. MARITIME INFRASTRUCTURE PERSPECTIVE PLAN 2023-37

Important for the subject: Science and technology

Maritime Infrastructure Perspective Plan 2023-37 was released in the Naval Commanders Conference.

- The Maritime Infrastructure Perspective Plan 2023-37, aims to **create sustainable architecture in sync** with the **broader policy directive of the PM Gati Shakti project**.

- The Navy is **planning its infrastructure needs** for the **next 15 years** using a **comprehensive perspective plan model**.
- The **plan is in line** with the **Indian government's vision** for **sustainable infrastructure and complies with broader policy** directives, including **PM Gati Shakti Project, Disaster Resilience, and Net Zero transition.**
- The Navy **received a revised set of "IRS Rules and Regulations Handbook for Construction and Classification of Naval Combatants"** to **accommodate technological advancements and promote self-reliance** in naval shipbuilding.
- This rule book **represents the self-reliance of the naval shipbuilding** industry and aims to **keep pace with modern technology.**
- Two **new initiatives were launched**: the **"Family Logbook for Defence Civilian Personnel of the Indian Navy"** for personal records and the **"Electronic Service Document Project"** to enhance HR records within the Navy.

Few of Indian Navy Warships Projects

- **Project 17** – **Shivalik class Frigate.** The Shivalik class or **Project 17 class is a class of multi-role frigates in service** with the Indian Navy.

Project 15 – Delhi Class destroyers.

- Delhi-class destroyers are guided-missile destroyers of the Indian Navy **Project 15A – Kolkata Class Destroyer**
- The Kolkata class (Project 15A) are a class of stealth guided missile destroyers

Project 15B – Visakhapatnam Class Destroyer

- The Visakhapatnam class (Project 15B) is a class of stealth guided missile destroyers currently being built for the Indian Navy.

Project 17A

- The Project 17A-class frigate is **follow-on of the Project 17 Shivalik-class frigate for the Indian Navy.**

Project 75

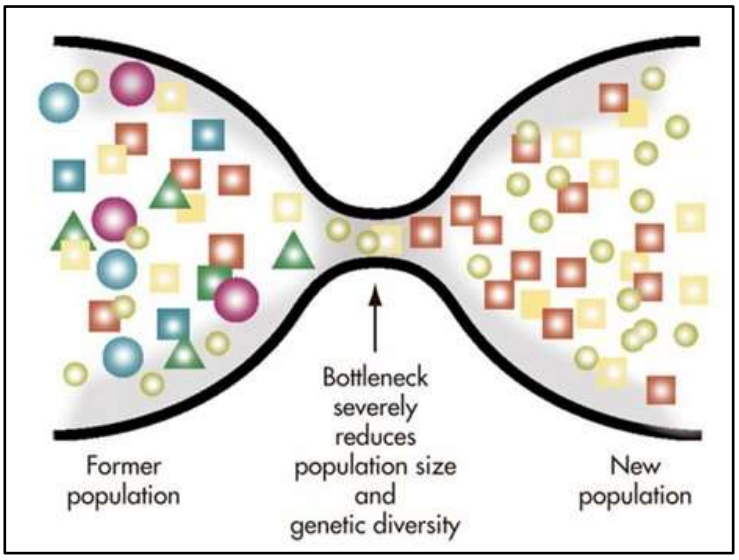
- Project 75 (P75) involves the acquisition of **six ships of the Kalvari-class diesel-electric attack submarines.**

Project 75I

- **6 Diesel submarines** with Air Independent Propulsion System (AIP) technology for Indian Navy.

Topic 15. VIKRAM LANDER DOES A HOP, GOES TO SLEEP; GOODNIGHT TILL SEPT. 22

Important for the subject: Science and Technology



Successful Hop Experiment and Significance

The Chandrayaan-3 mission's **lander**, Vikram, recently accomplished a significant feat by executing a successful **hop experiment.**

- On command, Vikram fired its engines and **ascended approximately 40 cm before landing safely about 30–40 cm away.**
- This achievement holds substantial importance for future moon missions, including **sample return and human missions.**

Vikram and Pragyan's Soft Landing and Lunar Activities

- The lander module, carrying the rover **Pragyan**, made a **soft landing** on August 23. Pragyan was deployed on the lunar surface shortly after.
- In-situ measurements conducted by one of Vikram's payloads confirmed the presence of **plasma near the moon's surface**.
- Additionally, two payloads detected and verified the presence of **sulfur** in the moon's south-polar region.
- Pragyan traversed **over 100 meters** on the moon's surface. **Vikram and Pragyan in Sleep Mode and Hope for Awakening** ISRO announced that Vikram had been placed in **sleep mode**, following Pragyan's earlier transition.
- ISRO **plans to awaken both** Vikram and Pragyan around September 22, 2023, with the expectation of successful reactivation.
- Vikram and Pragyan have a mission life of **one lunar day (approximately 14 Earth days)** due to **concerns about electronics' extreme cold tolerance during lunar nights**. The lunar night can reach **temperatures below minus 200°C.**

- The lander and rover will be in **power-saving mode until the lunar night ends**, similar to putting a phone in power-saving mode until a charging source becomes available.

Study spots 'bottleneck' in human evolution

Introduction:

- The human population **nearly faced extinction** due to a **bottleneck event**. A novel genomic analysis technique (**FitCoal**)sheds light on this critical period in human history.

The Bottleneck Crisis:

- Around **930,000 years ago**, the ancestors of modern humans experienced a **severe population crash.**
- **Drastic climate change triggered this bottleneck**, leading to a population of fewer than 1,280 breeding individuals.
- Approximately **98.7% of human ancestors were lost** at the start of this bottleneck, posing a threat of extinction.
- This population constraint **persisted for over 100,000 years before recovery**. The bottleneck **possibly** contributed to the divergence of early humans into **two evolutionary lineages**, including **Neanderthals and modern humans.**

Fit Coal (Fast Infinitesimal Time Coalescent):

- Researchers in **China** developed **FitCoal**, a cutting-edge **method for reconstructing human evolution.**
- FitCoal **divides history into fine time slices**, enabling a detailed model of evolution. The study **analyzed genomes of 3,154 individuals from 50 global populations**.
- The **pre-bottleneck population** consisted o**f approximately 98,000 breeding individuals.** Researchers speculate that the **fusion of chromosomes (forming Chromosome**
- **2 in modern humans) may have occurred after the bottleneck**, influencing modern human genetics.

Bottleneck Event in Evolution:

- **Population Contraction**: Bottleneck events involve a sharp reduction in a population's size.
- **Genetic Diversity Loss**: These events lead to a significant decrease in genetic diversity within the population.
- **Genetic Drift Impact**: Genetic drift, or random allele frequency changes, becomes influential during bottlenecks.
- **Founder Effect**: Sometimes, a **small group becomes isolated,** leading to a founder effect and distinct genetic characteristics.

- **Vulnerability Increase**: Reduced genetic diversity can make populations more **vulnerable** to environmental changes, diseases, or threats.
- **Causes**: Bottlenecks can result from **natural disasters, habitat changes, overhunting, or disease outbreaks.**
- **Long-term Impact**: Bottleneck consequences shape a species' future evolution and adaptation.

Topic 16. INDIAN GROUP PROPOSES RADICAL NEW WAY TO SETTLE UNIVERSE EXPANSION DISPUTE

Important for the subject: Science and Technology

Introduction to Universe Expansion

The **Big Bang** marked the universe's origin as a hot, dense point beyond space time. It initiated a **rapid expansion**, leading to the creation of **matter, galaxies, stars, and cosmic structures.**

- This expansion process has been ongoing for **approximately 13.8 billion years. Hubble's Law and the Hubble Constant Hubble's Law**, introduced by **Edwin Hubble in 1929,** is a fundamental concept in cosmology.
- It quantifies the **relationship between the velocity at which galaxies are moving away from us and their distance.**
- The **Hubble constant,** represented by **'H_0'**, reflects the **current rate of the universe's expansion.**

Methods for Measuring the Hubble Constant

- The **supernova method** involves comparing the observed brightness of Type Ia supernovae with their expected brightness to determine their distance.
- The **redshift of light** from these supernovae due to the universe's expansion is used to calculate their velocity.
- The **cosmic microwave background (CMB) method** leverages **radiation remnants from the Big Bang** to estimate the Hubble constant.
- **Gravitational wave detectors**, such as **LIGO and Virgo,** measure spacetime distortions created during **astronomical collisions** to infer distance and velocity.

Discrepancies in Hubble Constant Measurements

- The **supernova** method has yielded a Hubble constant estimate about **two units higher than the value derived from the CMB method.**
- Gravitational wave measurements, while promising, are **still evolving** and have not provided precise results.

Lensed Gravitational Waves

- **Gravitational lensing**, first observed by **Arthur Eddington in 1919** during a **solar eclipse**, involves the **bending of light due to massive objects**.
- Researchers are actively **searching for lensed gravitational wave**s, which could offer a unique perspective on the universe.
- **Future gravitational wave detectors** are expected to significantly enhance our ability to detect lensed gravitational waves.

The Study's Approach

- The **proposed method** involves **analyzing lensed gravitational waves to estimate the Hubble constant.**
- Researchers aim to use the characteristics and **time delays of these waves** to gauge the rate of the universe's expansion.
- This approach offers a novel and **potentially independent means** of measuring cosmological parameters.
- It can offer insights into the **universe's expansion at different stages**, potentially reconciling existing discrepancies.
- **Concerns** about **signal-to-noise ratio** underscore the need for **robust** data analysis.

Future Applications

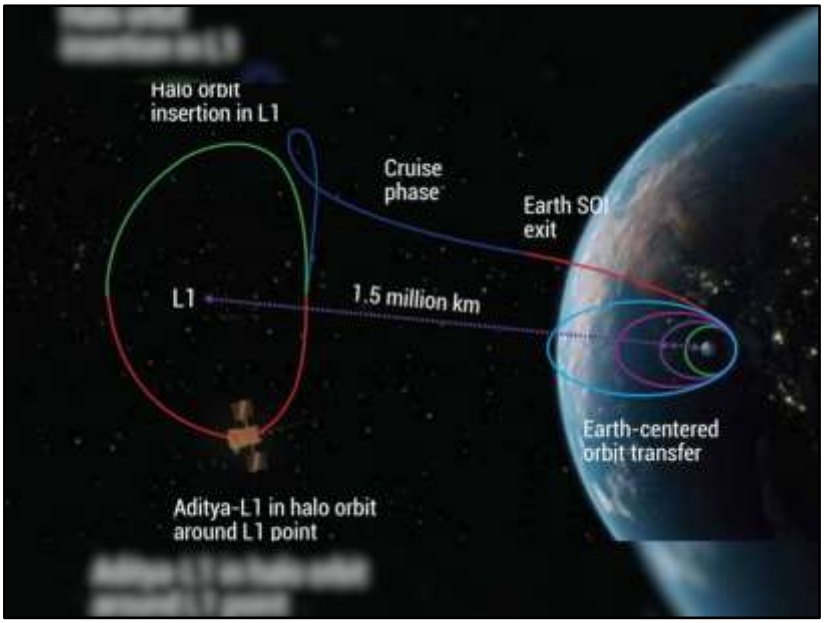
- Beyond Hubble constant estimation, the method's versatility may extend to other cosmological inquiries, including the **nature of dark matter particles.**

Key terms:

- **Gravitational Waves:** Ripples in spacetime caused by the **acceleration of massive astronomical objects**, such as black holes or neutron stars colliding.
- **Gravitational Lensing:** The **bending of light or gravitational waves** as they pass near massive objects, a phenomenon predicted by Einstein's theory of general relativity.
- **Dark Matter**: A mysterious, **unseen** form of matter that does not emit, absorb, or interact with electromagnetic radiation, yet exerts gravitational influence on galaxies and the universe.

Topic 17. ADITYA-L1: ITS FUNCTIONING AND PURPOSE

Important for the subject: Science and Technology



Launched on 2 September 2023, the observations from **Adtiya L1** will help in understanding the dynamics of the Sun and how solar variability impacts the climate on Earth and affects the space weather.

Lagrange point:

- **Lagrange point 1** or **L1** is one of the **five points** located **approximately 1.5 million kilometres away,** where the gravitational forces of the Sun and the Earth are in equilibrium.
- Hence, a spacecraft placed at L1 orbits the Sun at the same rate as Earth and affords an uninterrupted view of the Sun, making it an ideal observation post for space-based solar observatories. Discovered by: **Mathematician Joseph Louis Lagrange.**
- Currently the **European Space Agency (ESA)** and **NASA- Solar and Heliospheric Observatory (SOHO)** have placed their satellites at L1.

To understand climate variability:

- Solar activity is measured in terms of the number of sunspots.
- Sunspots are cooler regions on the Sun's surface which increase and decrease in a cycle of 11 years.
- When the Sun is active, the number of sunspots is in the hundreds, and at solar minimum, the numbers are nearly zero.
- Whatever changes we observe in the solar radiation, nearly 80% occur in the ultraviolet range. The Earth's upper atmosphere absorbs most of the solar UV rays.
- The absorbed energy affects the atmosphere's composition, temperature and other

parameters.

SUIT instrument:

- The **Solar Ultraviolet Imaging Telescope (SUIT)** developed by the **InterUniversity Centre for Astronomy & Astrophysics**, in close collaboration with the **ISRO**, the **Center of Excellence in Space Sciences India, Mohanpur**, the **Manipal Academy of Higher Education**.
- It will observe the **UV radiation** from different zones of the solar atmosphere.
- The onboard intelligence system will **detect any sudden appearance of bright spots**, such as **solar flares** (a sudden burst of high energy visible light, UV rays, X rays and Gamma rays) on the disc.
- The automated system will trigger the rapid imaging of different layers, and thus, we will obtain a 3D tomographic view of the Sun.
- Combining the data from the **Solar Low Energy X-ray Spectrometer (SoLEXS)** and the **High Energy L1 Orbiting X-ray Spectrometer (HEL1OS)** developed by **ISRO's** Bengaluru based **U. R. Rao Satellite Centre** with **SUIT** can help us gain insights into the emergence, progression and energetics of transient events on the surface of the Sun in the UV region.
- The data from SUIT and other papers of Aditya L1 will help us resolve the contribution of natural and anthropogenic factors driving climate change.

Coronal Mass Ejection (CME):

- A chunk of the corona suddenly accelerates and leaps into interplanetary space called the CME.
- This cloud consisting of billion tonnes of energetic plasma mixed with a solar magnetic field is hurled at 250 kilometers per second to 3,000 km/s.
- The corona is visible only during the solar eclipses, and a chronograph can create artificial eclipses in the solar telescope to observe the corona.

VELC instrument:

- The **Visible Emission Line Coronagraph (VELC)** developed by the Bengaluru-based **Indian Institute of Astrophysics** in close collaboration with the **ISRO** can peek as close as **1.05 solar radii**, a region never imaged by any solar telescope.
- From 1.05, it can scan upto three solar radii. With this unique capability of VELC, we can get crucial information about the mechanism responsible for CME acceleration.

When a solar storm brews:

- The Sun emits a constant stream of charged particles and a mixture of solar magnetic fields that travel throughout interplanetary space called a solar wind.
- The average speed of the flow near the Earth is about 300 kilometers per second.

- Solar winds impact the Earth's magnetosphere. These solar winds sneak through the weak region of the magnetosphere (at poles) to create aurora.
- When solar storms disrupt the earth's magnetosphere, geomagnetic storms occur, which result in disruption of GPS systems, short-wave communication, and power grids, forest fires.
- The energy from the charged particles heats the upper atmosphere, increasing the density and causing extra drag on satellites in low-earth orbit.

Space Weather:

- The changes in the solar wind's density, speed and direction is called space weather. Solar storms result in inclement space weather. Aditya L1 will function as a space weather station.
- The **Aditya Solar Wind Particle Experiment (ASPEX)** developed by the ISRO's Ahmedabad-based **Physical Research Laboratory**, the **Plasma Analyser Package For Aditya (PAPA)** developed by the Thiruvananthapuram based **Vikram Sarabhai Space Centre** and the **advanced Tri-axial High-Resolution Digital Magnetometers** developed by the Bengaluru based **ISRO's Laboratory for Electro-Optics Systems** keep a constant watch over the parameters of space weather near Aditya L1.
- Using the data from these instruments, scientists can predict probable geomagnetic storms and better understand space weather dynamics.

Topic 18. IN C.R. RAO'S LIFE, THE IMPORTANCE OF BUILDING – AND NURTURING – INSTITUTIONS

Important for the subject : Science and technology

Introduction

Calyampudi Radhakrishna Rao, (10 September 1920 – 22 August 2023), commonly known as C. R. Rao, was an **Indian-American mathematician** and **statistician**.

In 2023, Rao was awarded the **International Prize in Statistics**, an award often touted as the "**statistics' equivalent of the Nobel Prize**".

Early Life and Education

- Born on September 10, 1920, in **Huvvina Hadagalli, Karnataka**, had humble beginnings.
- His parents, **C. Doraswamy Naidu and A. Laxmikanthamma**, were pivotal in nurturing his intellectual growth from a young age.
- Rao displayed **exceptional mathematical talent early on**, memorizing multiplication tables at the **age of five.**

Academic Journey

- Rao pursued his education in **mathematics**, obtaining a BA (Hons) degree and an MSc in mathematics from **Andhra University.**
- His journey led him to the **Indian Statistical Institute (ISI) in Kolkata,** where he began to explore the field of statistics, **initially as a means to secure future employment.**
- At ISI, Rao's career took off as he engaged in research, published papers, and earned an **MA in 1943** with record-breaking marks.
- In 1945, Rao authored a seminal paper in the **Bulletin of the Calcutta Mathematical Society**, detailing his groundbreaking contributions, including the **Cramér-Rao lower bound,** the **Rao-Blackwell Theorem**, and insights into **'information geometry'**.
- These results revolutionized **statistical inference and data analysis.**

Contributions to Statistics

- **Cramér-Rao Lower Bound**: provided a framework to **assess the accuracy of statistical estimates.**
- **Rao-Blackwell Theorem:** offered **a means to optimize estimates,** significantly improving the quality of **statistical inferences.**
- **Wide-ranging Impact:** These contributions found applications in diverse fields such as **signal processing, spectroscopy, radar systems, risk analysis, and quantum physics.**

Institution Building and Leadership

- Rao spent time at **Cambridge University's Department of Anthropology**, analyzing **human skeletal measurements** and earning his **PhD**.
- He returned to **ISI** and held various leadership positions, contributing to the institution's growth and influence.
- Rao established **research units** in fields like **economics, sociology, psychology, genetics, anthropology, and geology, promoting interdisciplinary research.**
- He introduced courses and degree programs, including **BStat, MStat**, and a PhD program in **theoretical statistics and probability.**

Impact on National Statistical System

- **Collaboration with P.C. Mahalanobis**: Rao worked closely with P.C. Mahalanobis to establish the **State Statistical Bureaus,** contributing to the development of India's robust statistical system.
- **Government Committees:** Rao's involvement in government committees further enhanced statistical education, research, and national statistical systems in India.

Transition to the United States

- Rao's retirement at age 60 led him to the United States, where he held professorial positions at the **University of Pittsburgh, Pennsylvania State University, and the University at Buffalo.**

- His time in the US resulted in **274 research papers**, surpassing his Indian output of 201, highlighting his passion for research.

Indian Statistical Institute

- Founded by Professor **P.C. Mahalanobis** in **Kolkata** on **17th December 1931**. Gained the status of an **Institution of National Importance** by an act of the Indian Parliament in **1959**.
- Headquarters in the northern fringe of **Kolkata** with centers in **Delhi**, **Bangalore**, **Chennai**, and **Tezpur**. Focus on research in **Statistics and related disciplines.**
- Offices in various Indian cities engaged in projects and consultancy in **Statistical Quality Control and Operations Research.**
- Dedicated to research, teaching, and application of statistics, natural sciences, and social sciences.

International Prize in Statistics:

- Awarded **every two years** by a collaboration of **five major international statistics organizations.**
- Recognizes exceptional achievements in the field of statistics, particularly for practical applications and cross-disciplinary breakthroughs.
- Modeled after renowned awards like the Nobel Prize, Abel Prize, Fields Medal, and Turing Award.

Topic 19. ADITYA-L1 SUCCESSFULLY UNDERGOES THE SECOND EARTH-BOUND MANOEUVRE: ISRO

Important for the subject : Science and technology

Aditya-L1's Second Earth-bound Manoeuvre Successful execution of the second **Earth-bound manoeuver.** Conducted from **ISTRAC (ISRO Telemetry, Tracking and Command Network)**, Bengaluru.

- Tracking by ground stations at **Mauritius, Bengaluru, and Port Blair.** Performed on September 5, resulting in a **new orbit of 282 km x 40,225 km.**

Upcoming Manoeuvres

- Three more manoeuvres are scheduled.
- The next manoeuvre is planned for **September 10, 2023** Final manoeuvre on **September 18**, leading to a **Trans-Lagrangian1 insertion manoeuvre.**
- Aditya-L1's **110-day trajectory** towards the L1 Lagrange point. Binding to an orbit around L1 upon arrival.

Aditya-L1 Mission Details

- Aditya-L1's role as **India's first space-based observatory** for Sun study.
- **Halo Orbit**: A halo orbit is a three-dimensional, kidney-shaped orbit that **encircles the Lagrange point**.
- It allows the spacecraft to maintain a relatively **stable position** relative to the Lagrange point. **Continuous Sun observation without occultation or eclipses.**
- Real-time monitoring of solar activities and space weather. The location of L1 is approximately **1.5 million km from Earth**. Launch via ISRO's PSLV-C57 on September 2.
- **Seven** scientific payloads on Aditya-L1.
- **Objectives**: Observing the photosphere, chromosphere, and the solar corona using electromagnetic, particle, and magnetic field detectors.

Transfer orbits:

- Transfer orbits are used in spaceflight to **move spacecraft from one orbit to another or between celestial bodies.**

Here are some different types of transfer orbits:

Hohmann Transfer Orbit:

- **Purpose**: Efficiently transfers a spacecraft from **one circular orbit to another circular orbit.**
- **Characteristics**: **Elliptical** orbit with two burn maneuvers, one to raise the spacecraft's apogee (farthest point) and one to lower its perigee (nearest point).
- Commonly used for missions within the same gravitational field, like **Earth to Moon or satellite parking orbits.**

Bi-Elliptic Transfer:

- **Purpose**: Minimizes fuel consumption by taking a longer route with fewer **delta-v burns**.
- **Characteristics**: Involves transitioning from one circular orbit to a highly elliptical orbit and then to the final circular orbit. Used when efficiency and fuel conservation are more critical than travel time.

Interplanetary Transfer Orbit:

- **Purpose**: Transfers a spacecraft between planets or celestial bodies within the solar system.
- **Characteristics**: Complex trajectory involving multiple phases, including Earth escape, cruise, and arrival/capture orbits around the target body. Used for missions like **Mars rovers or missions to outer planets**.

Gravity Assist Transfer:

- **Purpose**: Uses the gravitational pull of celestial bodies (usually planets) to change a spacecraft's velocity and trajectory.
- **Characteristics**: Spacecraft fly close to a planet and gain or lose energy to alter their path. Commonly used for outer solar system missions, like **Voyager** and **New Horizons.**

Heliocentric Transfer Orbit:

- **Purpose**: Transfers a spacecraft from an orbit around one celestial body to an orbit around the Sun.
- **Characteristics**: Typically used for missions to study the **Sun** or comets. The spacecraft may follow a **hyperbolic trajectory** for solar observation missions.

Polar Transfer Orbit:

- **Purpose**: Transfers a spacecraft into a polar orbit around a celestial body.
- **Characteristics**: Requires specific maneuvers to align with the desired polar orbit.
- Used for **Earth observation satellites** or planetary missions requiring global coverage.

Direct Ascent Transfer:

- **Purpose**: Moves a spacecraft directly from its launch orbit to its destination **without intermediate orbits.**
- **Characteristics**: Involves a single burn to reach the target orbit. Common for missions with tight launch windows and limited fuel, like crewed lunar missions.

Topic 20. FINALLY, PHYSICISTS HAVE A WAY TO 'SEE' INSIDE SHORT-LIVED NUCLEI

Important for the subject: Science and technology

Introduction

Physicists in Japan have made a significant breakthrough by developing a novel technique that allows them to **"see" inside short-lived atomic nuclei**, addressing a long-standing problem in nuclear physics.

- This development utilizes **electron scattering** and a sophisticated apparatus known as **SCRIT (Self-Confining Radioactive-isotope Ion Target)**.

Early Efforts in Nuclear Exploration

- In the 19th century, scientists like **Ernest Rutherford, Hans Geiger, and Ernest Marsden** conducted experiments with **radiation and gold foil,** leading to the discovery of the **dense central core in atoms** containing **mass and positive charge.**
- Seven decades ago, **Robert Hofstadter's team** used **high-energy electrons** to probe **atomic nuclei,** shedding light on charge and magnetic field arrangements within nuclei.
- These earlier experiments **focused on stable atoms and their nuclei**, utilizing other

particles to delve inside them.

The RIKEN Nishina Center Breakthrough

- Researchers at the **RIKEN Nishina Center for Accelerator-Based Science** in Japan have now succeeded in using electron scattering to explore unstable nuclei, **including those not found naturally.**
- Their novel approach involves the utilization of **SCRIT**, an apparatus that can hold **caesium-137** nuclei and facilitate electron interactions, thus allowing the exploration of short-lived nuclei.

The Advantages of SCRIT

- The SCRIT system involves **accelerating electrons in a particle accelerator** and **colliding** them with a **block of uranium carbide**, generating a **stream of caesium- 137 ions.**
- SCRIT employs **electric attractive forces to trap target ions along the electron beam in three dimensions,** ensuring a high probability of electron-ion collisions.
- This setup **minimizes the number of required caesium-137 ions,** reducing the need for a vast quantity, which would otherwise be necessary.

Quantum Mechanics in Action

- The electron-ion interaction is studied by using a **magnetic spectrometer** to record **interference patterns generated when scattered electrons behave like waves.**
- Interactions involving electrons are advantageous because they are **more predictable and well-understood**, simplifying data analysis.
- **Fine-tuning electron energy** allows researchers to avoid complex particle interactions, enhancing the clarity of results.

Probing Nuclear Structure

- The RIKEN setup involves **producing ions, transferring them to SCRIT, and subsequently colliding them with accelerated electrons.**
- Magnetic spectrometer readings confirmed that **the internal structure of a caesium-137 nucleus aligns with previous studies and theoretical calculations**.

The Emergence of the Femtoscope

- The RIKEN team's accomplishment can be likened to the development of a "**femtoscope**", a tool capable of probing the femtometer scale of atomic nuclei **(10- 15 meters)**.
- This innovation is significant as it aids physicists in addressing the persistent challenge of elucidating the structure of atomic nuclei, for which **no unified theory exists.**

Exploring Nuclear Quirks

- Over time, physicists have encountered various nuclear properties, such as the **"island of stability",** where **certain isotopes defy the usual trend of decay rate increasing with nucleus heaviness.**
- The "island of stability" is characterized by a clustering of nuclei with a proton number of 112, known as the "**magic number**".
- The existence of such islands remains unexplained, and physicists hope that the **femtoscope technology** can help bridge the gap between expected and unexpected nuclear shapes.
- Unstable nuclei with non-uniform densities of protons and neutrons may offer valuable insights into nuclear structure through femtoscope exploration.

Key Terms:

- **Atomic Nucleus:** The central core of an atom, consisting of protons and neutrons, where most of the atom's mass and positive charge are concentrated.
- **Electron Scattering:** A technique in which high-energy electrons are directed at a target, and the scattering of these electrons provides information about the internal structure of the target.
- **Particle Accelerator:** A device used to accelerate charged particles, such as electrons or protons, to high energies for various scientific and practical applications.
- **Femtoscope:** A specialized instrument designed to probe the femtometer scale (10^-15 meters) of atomic nuclei, allowing for the exploration of nuclear structures.

Topic 21. INDIA NEEDS INNOVATION IN CELL CHEMISTRY TO LEAPFROG IN THE BATTERY RACE

Important for the subject: Science and technology

Introduction

India has made significant progress in **electric vehicle (EV) battery research,** particularly in the field of cathode chemistry. The collaboration between **Altmin** and the **International Advanced Research Centre for Powder Metallurgy and New Materials** highlights the potential for innovation in this sector.

- The battery research journey, which began with **lead-acid batteries,** is a continuous process aimed at improving **energy density, power density, safety, and cycle life. Cathode Chemistry and Battery Evolution Altmin's Collaboration**:
- To manufacture **cathode active material** for **lithium-ion batteries (LIB)**, specifically **lithium iron phosphate (LFP)**.

Chemistry Trade-offs:

- Different LIB chemistries offer varying energy densities, power densities, cycle lives, and safety performance.
- For instance, **LFP is safer but has lower energy density** compared to **lithium nickel manganese cobalt (NMC) chemistry**.

Nickel-Dominant Chemistry:

- Nickel-dominant battery chemistries are **favored for high-performance** and **long-range vehicles due to their higher energy density.** However, they come with **thermal risks and toxic materials.**

Opportunity for India

LFP Chemistry in India:

- LFP chemistry is **preferable for India**, given **its high ambient temperatures and the advantages of safety and longer battery life**. India's rich **reserves** of **iron and phosphate** reduce dependence on imports.

Sodium-Ion Batteries (SIB):

- Sodium-ion batteries are emerging as an **alternative to lithium-ion batteries.**
- Although SIBs **currently have lower energy density, they are cost-effective** due to **abundant sodium resources**, reducing supply chain challenges. SIBs use **aluminum** as **current collectors** in place of **copper**.
- The cathode composition also **does not have cobalt,** which is difficult to obtain (mined mainly in the **Democratic Republic of Congo**)

Solid-State Batteries (SSB):

- SSBs are revolutionary because **they eliminate liquid electrolytes**, **reducing weight and enhancing energy density**.
- They are **safer** and **do not leak toxic electrolytes**.

SIB Development:

- Start-ups like **Indi Energy and Sodion** in India have **commercialized** SIB technology successfully, highlighting its potential.

Global Battery Evolution:

- The global EV industry is **rapidly transitioning to newer battery technologies like SIB and SSB.**
- India has a chance to **leapfrog** in the battery race by focusing on these innovations.

Corporate Interest:

- Indian companies, like Reliance Industries' acquisition of Faradion, a UKbased SIB specialist, indicate that the private sector is closely monitoring battery R&D breakthroughs.

Government Support

Government Research Initiatives:

- Various government institutions in India, such as **Vikram Sarabhai Space Centre** and the **Department of Science and Technology,** possess **battery expertise**.
- The Ministry of Electronics and Information Technology has established **pilot plants for battery manufacturing.**

Advanced Chemistry Cell (ACC) PLI Scheme:

- The government has allocated **Rs 18,100 crore** under the ACC PLI scheme to **promote battery manufacturing.**

Lack of Research Funding:

- Despite these efforts, there is a gap in government-sponsored research in EV battery technology, particularly for emerging technologies like SIB and SSB.

Topic 22. PROTECT WORLD HERITAGE SITES TO CONSERVE BIODIVERSITY: UN

Important for the subject: Environment

Protecting **world heritage sites** can help conserve biodiversity and meet the targets set by the **Kunming-Montreal Global Biodiversity Framework (GBF)**, according to a joint assessment by **UNESCO** and **IUCN**.

Biodiversity in UNESCO WHS:

- The total of **1157World Heritage sites** take up **only 1 per cent** of the earth's surface.
- **UNESCO World Heritage sites (WHS)** are home to **75,000 species of plants,** and over **30,000 species of mammals, birds, fish, reptiles** and **amphibians** — a **fifth** of all the species mapped globally.
- Today, up to **1/3** of remaining elephants, tigers and pandas can be found in these sites, as well as at least one in 10 great apes, giraffes, lions and rhinos.
- They are home to **all remaining Javan rhinos, vaquitas** (the world's smallest cetacean) and **pink iguanas,** as well as more than half of all **Sumatran rhinos, Sumatran orangutans** and **mountain gorillas**.

Threats to these WHS:

- agricultural expansion, infrastructure development, Poaching, overexploitation of

resources and proliferation of invasive species. Every **1 degree Celsius rise** in **global temperature** can **double** the number of species threatened by dangerous climate conditions.

These WHS are instrumental in:

- Maintaining a beneficial relationship between human beings and nature
- Conservation of water resources
- Opportunity for people to earn a livelihood through sustainable work
- Strengthen the link between nature and culture

World Heritage List:

- The **United Nations Educational, Scientific and Cultural Organization (UNESCO)** seeks to encourage the identification, protection and preservation of **cultural** and **natural heritage** around the world considered to be of outstanding value to humanity. It has a **World Heritage List** for the same.
- This is embodied in an **international treaty** called the **Convention concerning the Protection of the World Cultural and Natural Heritage,** adopted by **UNESCO** in **1972**.

International Union for Conservation of Nature (IUCN):

- **IUCN** is a membership Union uniquely composed of both government and civil society organizations. Created in **1948**, **IUCN** has evolved into the world's largest and most diverse environmental network.
- It is headquartered in **Switzerland.**
- The **IUCN Red List of Threatened Species**, is the world's most comprehensive inventory of the global conservation status of plant and animal species.
- The **IUCN World Heritage Outlook** provides conservation outlook assessments for **all natural World Heritage sites.**

About the Kunming-Montreal Global Biodiversity Framework (GBF):

- Adopted in **15th COP** of **UN-CBD** held in **Montreal, Canada** in **2022.** The framework has **4 long-term goals** to be achieved by **2050** and **23 targets** that the world needs to achieve by **2030.**
- In **2020**, the world failed to meet the last set of targets, the **Aichi Targets.** The countries will monitor and report every five years or less on a large set of indicators related to progress.
- The **CBD** will combine national information submitted by late February 2026 and late June 2029 into global trends and progress reports.

Topic 23. 50 MOST POLLUTED REGIONS OF WORLD IN INDIA'S NORTHERN PLAINS: UNIVERSITY OF CHICAGO REPORT

Important for the subject: Environment

The **world's 50 most polluted regions** belong to the **Northern Plains of India,** showed the **Air Quality Life Index (AQLI) report** for **2023** by the **University of Chicago.**

Particulate pollution has increased over time. From **1998** to **2021,** average annual particulate pollution **increased by 61 per cent,** further **reducing life expectancy by 3.2 years.**

- **Delhi** is the most polluted city in India and the world.
- **Seven states and Union territories** that include **Bihar, Chandigarh, Delhi, Haryana, Punjab, Uttar Pradesh** and **West Bengal**, comprise a majority of this region.
- These states/UTs also face the greatest health burden due to particulate pollution in India.
- In north India, fine particulate air pollution (particulate matter 2.5) shortens lives by eight years.
- In the **most polluted region of the Northern Plains** — the **national capital territory of Delhi** — **18 million residents** are on track to lose **11.9 years of life expectancy** on average relative to the **World Health Organization guidelines** and **8.5 years** relative to the **national guideline** if current pollution levels persist.
- Even in the **least polluted district** in the region — **Pathankot** in the state of **Punjab** — **particulate pollution** is **more than seven times** the **WHO guideline**, taking **3.1 years off life expectancy** if current levels persist.

High pollution density:

- North plains (with **38.9 per cent** of India's population) live in areas where the **annual average particulate pollution level** is **17.3 times higher** than the **WHO guideline**.
- Human activity plays a key role in generating the severe particulate pollution. The **region's population density** is nearly **three times** that of the rest of the country, meaning **more pollution from vehicular, residential** and **agricultural sources**.

About Air Quality Life Index (AQLI):

- **AQLI** is a **pollution index** that translates **particulate air pollution** into the most important metric that exists: **Its impact on life expectancy**.
- Developed by the U**niversity of Chicago's Milton Friedman** Distinguished Service Professor in Economics, Michael Greenstone, and his team at the **Energy Policy Institute** at the **University of Chicago (EPIC).**
- The index also illustrates **how air pollution policies** can **increase life expectancy** when they meet the **WHO's guideline** for **a safe level of exposure**, **existing national air**

quality standards or **user-defined air quality levels.**

- This information can **help inform local communities and policymakers** about the importance of air pollution policies in concrete terms.

What are the Initiatives Taken for Controlling Air Pollution in India?

- **System of Air Quality and Weather Forecasting and Research (SAFAR)** Portal. **Air Quality Index:** AQI has been developed for **eight pollutants** viz. PM2.5, PM10, Ammonia, Lead, nitrogen oxides, sulphur dioxide, ozone, and carbon monoxide.

Graded Response Action Plan (for Delhi).

For Reducing Vehicular Pollution:

- BS-VI Vehicles, Push for Electric Vehicles (EVs), Odd-Even Policy as an emergency measure (for Delhi).

New Commission for Air Quality Management

- Subsidy to farmers for buying **Turbo Happy Seeder (THS) Machine** for reducing stubble burning.
- **National Air Quality Monitoring Programme (NAMP):** Under **NAMP,** four air pollutants viz. SO2, NO2, PM10, and PM2.5 have been identified for regular monitoring at all locations.

Topic 24. PROGRESS IN NATIONAL MISSION FOR CLEAN GANGA (NMCG)

Important for the subject: Environment

Launched in: **2014**

Outlay: **₹20,000 Crore 80%** of the outlay is for the purpose of setting **Sewage treatment Plants (STPs).**

- **Core Objective:** To ensure that no untreated sewage flows into the river. Steps tekan to achieve the objective: Installation of treatment plants along the banks of Ganga river.
- **Progress:** Till now treatment plants are capable of treating **only 20%** of the sewage estimated to be generated in the five major states that lie along the river.
- **Future prospect:** It is expected to increase to about **33%** by **2024**, and about **60%** by **2026**.
- These calculations are premised on sewage to the tune of **11,765 million litres per day (MLD)** being generated in the **five States** – **Uttarakhand, Uttar Pradesh, Bihar, Jharkhand** and **West Bengal** – through which the river courses.
- The **NMCG** plans on setting up **sewage treatment plants (STPs)** capable of treating about **7,000 MLD** of sewage by **2026**, remaining capacity will be set up by the states.

Picking up pace

- As of **July 2023**, STPs capable of treating **2,665 MLD** have actually been commissioned, and are now functional.
- From **2014**, when the mission was first announced, to **2021**, **only 811 MLD** of capacity was completed. In the last financial year **2022-23**, **1,455 MLD** capacity was completed.

Challenges:

- Land acquisition process
- Detailed Project Report needs revision
- Lack of coordination between center and states
- Though **NMCG** is a **₹20,000 crore mission**, the government has so far given in-principle approval for projects worth **₹37,396 crore**, of which **only ₹14,745 crore** has been released to States for infrastructure work, as of June 2023.
- So far the **maximum number of plants** have been set up, or upgraded in the case of older plants, in Uttarakhand (36), Uttar Pradesh (35), and West Bengal (11).

Dolphins thriving

- The **river's water quality** is now **within prescribed limits** of notified primary bathing water quality.
- **Dolphins and Indian carp** (a fish species that only thrive in clear water) populations are increasing which is a **sign of improved water quality**.
- The typical parameters used by the **Central Pollution Control Board** — such as the **levels of dissolved oxygen, biochemical oxygen demand**, and **faecal coliform** — vary widely along various stretches of the river.
- The **NMCG** is now working to develop a **water quality index**, on the lines of the **air quality index,** to be able to better communicate about river-water quality, he added.

Topic 25. PARIS FUMIGATED FOR 1ST TIME AS DISEASE-CARRYING MOSQUITO SPREADS, LIKELY TRIGGERED BY CLIMATE CHANGE

Important for the subject: Environment

Paris health authorities sprayed **insecticides** in public spaces in the city's southeast like gardens and trees, which are **breeding grounds for mosquitoes** to check the **spread of disease-carrying tiger mosquitoes** found to be rapidly expanding in Europe.

- Experts have linked their proliferation to climate change. This was the **first fumigation exercise** in Paris. The aim is to reduce the risk of dengue transmission.

Aedes albopictus:

- The **mosquito (Aedes albopictus)** is an **invasive species** and is **native** to the tropical areas of **Southeast Asia.** It was **first spotted in France** in **2004**.

- **Ten years ago**, in **2013,** the **Aedes albopictus mosquito** was established in **8 EU/EEA countries**, with **114 regions** being affected. Now in **2023**, the mosquito is established in **13 countries** and **337 regions**.

Mosquito spread in European region:

- The **establishment of mosquito species** is defined as having self-sustained mosquito populations that are overwintering and reproducing in a given administrative region.
- The **mosquito species Aedes albopictus,** a known **vector** of **chikungunya** and **dengue** viruses, is establishing itself further **northwards** and **westwards** in
- **Europe**, according to the latest data from ECDC. Also, **Aedes aegypti,** known to transmit **dengue, yellow fever, chikungunya, Zika** and, potentially, **West Nile viruses**, has been established in **Cyprus** since **2022** and may continue to spread to other European countries.
- The **mosquito's spread** has also been **quite rapid across the rest of Europe**. There have been sporadic cases of the diseases caused by the mosquito in the continent, but the number of these local infections have grown over the years.

Probable reason for spread:

- **Climate change** may have a role to play in this. This is because **warmer weather has shortened the incubation period for its eggs** while **winters are no longer cold enough** to kill off the pests.
- The **European health agencies** have recognised **mosquito-borne diseases** as a growing threat and have urged residents to be more proactive in reporting sightings of the mosquito.

Topic 26. WHAT DERIVES THE PROCESS OF ATLANTIFICATION IN ARCTIC OCEAN

Important for the subject :Environment

New research by an international team of scientists explains what's behind a stalled trend in Arctic Ocean sea ice loss since 2007.

The findings indicate that stronger declines in sea ice will occur when an atmospheric feature known as the **Arctic dipole** reverses itself in its recurring cycle.

- The analysis helps explain **how North Atlantic water influences Arctic Ocean climate**, a process scientists call **"Atlantification."**

Atlantification of Arctic ocean:

- Atlantification is the increasing influence of Atlantic water in the Arctic. Warmer and saltier Atlantic water is extending its reach northward into the Arctic Ocean.
- This change in the Arctic climate is most prominent in the **Barents Sea**, a shallow shelf sea north of **Scandinavia**, where sea-ice is disappearing faster than in any other Arctic

region, impacting the local and global ecosystem.

Key findings of the research:

- Analysis shows that the Arctic dipole alternates in an approximately **15-year cycle** and that the system is probably at the end of the present regime.
- In the **Arctic dipole's** present **"positive"** regime, **high pressure** is centered over the **Canadian sector** of the **Arctic** and produces **clockwise winds.**
- **Low pressure** is centered over the **Siberian Arctic** and features counterclockwise winds. This wind pattern drives **upper ocean currents**, with year-round effects on: regional air temperatures, atmosphere-ice-ocean heat exchanges, sea-ice drift and exports, and ecological consequences.
- **Water exchanges** between the **Nordic seas** and the **Arctic Ocean** are critically important for the state of the Arctic climate system" and sea ice decline is "a true indicator of climate change."

Ocean responses to wind pattern:

- Decreased flow from the **Atlantic Ocean** into the **Arctic Ocean** through the **Fram Strait** east of **Greenland**, along with increased Atlantic flow into the **Barents Sea**, located **north of Norway** and western **Russia**.
- These alternating changes in the **Fram Strait** and the **Barents Sea** are referred to as a **"switchgear mechanism"** caused by the Arctic dipole regimes. This mechanism can lead to potentially more suitable living conditions for **sub-Arctic boreal species** near the eastern part of the **Eurasian Basin**, relative to its **western part.**
- **Counterclockwise winds** from the **low-pressure region** under the current positive Arctic dipole regime drive freshwater from Siberian rivers into the **Canadian sector** of the Arctic Ocean.
- This **westward movement of freshwater** from **2007** to **2021** helped slow the overall loss of sea ice in the **Arctic** compared to **1992** through **2006**. The freshwater layer's depth increased, making it too thick and stable to mix with the heavier saltwater below. The thick layer of freshwater prevents the warmer saltwater from melting sea ice from the bottom.

Fram strait:

- The Fram Strait is the passage between Greenland and Svalbard.
- The Greenland and Norwegian Seas lie south of Fram Strait, while the Nansen Basin of the Arctic Ocean lies to the north.
- Fram Strait is noted for being the only deep connection between the Arctic Ocean and the World Oceans. The dominant oceanographic features of the region are the **West Spitsbergen Current** on the east side of the strait and the **East Greenland Current** on the west.

Topic 27. INDIA'S ICONIC RAPTORS ARE DECLINING FAST, WARNS NEW REPORT

Important for the subject :Environment

India's raptors (birds of prey) are d**eclining fast** and the reasons for the decline are poorly understood, according to the **State of India's Birds 2023: Range, trends, and conservation status** released on August 25, 2023.

What does the report say?

- **Raptors are in decline globally due to:** loss of habitat, pesticide accumulation
- Harriers have declined in their breeding range in Europe due to pesticide use. Harriers winter in India and some, like the Pallid Harrier have shown a 70 per cent decline.
- All woodland species, and **White-eyed Buzzard** and **Common Kestrel** among generalists continue to decline at a lower rate than earlier.
- In contrast, **open country specialists** show a particularly strong decline both in the long term and currently, although **Black-winged Kite** and **Western Marsh Harrier** show trends that are roughly stable in the long term.
- Some raptors in India are on the decline as they need large tracts of high-quality habitat to serve their dietary needs which the country no longer has.
- An example of this is the **Tawny Eagle.** It is becoming increasingly difficult to see today and is of High Conservation Concern like many other large raptors.

Declining vulture population:

International Day for Vulture Awareness: 2 September

- **India's vulture** populations started plummeting in the **1990s** due to the widespread use of **diclofenac**, a **nonsteroidal anti-inflammatory drug (NSAID)**, in veterinary medicine.
- When vultures fed on the carcasses of animals treated with **diclofenac**, they experienced **kidney failure,** leading to their rapid decline. Populations of some vulture species have decreased by over **99 per cent,** pushing these birds to the brink of extinction.
- The **diclofenac ban** (since 2006) may have slowed vulture declines in some places, but the analyses in this report shows that countrywide, vultures continue to decline: Indian Vulture by over 8% every year, and Red-headed and White-rumped Vultures by over 5% and 4% respectively.
- Several **Non-Steroidal Anti Inflammatory Drugs (NSAIDS),** including **diclofenac** and **aceclofenac**, continue to be produced for human use and can thus be used for livestock as well.
- Besides drugs, vultures are now facing challenges in that carcasses are being buried. Moreover, feral dogs compete with the birds at carcass dumps. Carcasses poisoned to kill feral dogs often cause vulture deaths as collateral damage.
- Recently the Government has banned aceclofenac and ketoprofen. But **Nimesulide**,

another **NSAID** that is also harmful to vultures, still remains in use.

Other threats to vultures:

- Electrocution from power lines
- Issue of accidental poisoning

Role of vultures:

- Vultures play a critical role in maintaining the ecological balance by scavenging ungulate carcasses and preventing the spread of diseases.

Positive trends in the report:

- There are some positive trends too. Generalist species like **Shikra, Booted Eagle, Greater Spotted Eagle**, and **Brahminy Kite** (which occupy a range of habitats, including human habitats) and **woodland species** appear to have suffered the least declines in the long term.

Topic 28. CORAL BREACH: A SILENT, CATASTROPHIC INVASION HAS HAPPENED IN THE GULF OF MANNAR; HERE IS HOW

Important for the subject: Environment

An investigation of **three coral colonies** adjoining **Kurusadai island** of the **Gulf of Mannar Marine National Park** along the **Tamil Nadu coastline**, shows them to be grey and eerie, an indication of coral bleaching.

Kurusadai island:

- It is **one of the 21 uninhabited islands** that form the **Gulf of Mannar Marine National Park** along the **Tamil Nadu coastline**.
- The **21 islands** came under the control of the **forest department** in **1986**, which established the national park — a 10,500 sq km reserve that is a habitat for the **rare seacow, dolphin** and dozens of **coral species** — the same year.
- Tourism was not allowed till 2022, after that it is being opened for tourism. The other 20 islands are still closed for tourists.

Coral bleaching due to Kappaphycus seaweed:

- The corals provide shelter to myriad marine life, protect against storms and support livelihoods through fisheries and tourism.
- **Prime threats**: **Kappaphycusalvarezii,** a seaweed (alga) species deliberately introduced in **Ramanathapuram** for commercial cultivation.
- The **International Union for Conservation of Nature** lists it as **one of the world's 100 most invasive species**.
- As of 2021, Kappaphycus has invaded six of the 21 islands of the Gulf of Mannar. The

seaweed grows fast, doubling its size in **15-30 days**, and thrives on live corals — unlike native seaweeds, which typically grow on dead corals.

Continued cultivation of kappaphycus:

- Currently, about **750 farmers** are engaged in seaweed farming, primarily **Kappaphycus**, in 18 villages of Ramanathapuram.
- **Pudukottai, Thanjavur, Thoothukudi** and **Kanyakumari** are the other four districts of the state where the alga is cultivated.
- **Kappaphycus** is also likely to be cultivated in **Tamil Nadu's proposed seaweed park,** proposed by the center in **Union Budget for 2021-22**.
- The park is likely to function as **two hubs:** a seaweed bank in **Valamavoor village** in **Ramanathapuram** and a processing hub for factories for seaweed products in **Pudukottai**.
- In **2021, India** cultivated around **34,000 tonnes** of seaweed. The Centre earmarked **Rs 600 crore** to increase seaweed production to **85 million tonnes** by **2025.**

Industrial use of kappaphycus:

- National research institutes and companies are for **increased cultivation of Kappaphycus** to **improve livelihoods, profits** and to **reduce India's import of kappa-carrageenan,** a **polysaccharide** extracted from the alga that finds use in **industrial gums** and as a **smoothening agent** in ice cream, toothpaste, jellies, medicines and paint.
- India produces **100-132 tonnes** of **carrageenan** a year and **imports 1,800- 2,000 tonnes**.

Sequence of events:

- In the **1960s** commercial cultivation of kappaphycus began in its **native land of the Philippines**.
- In the **1970s** it was introduced in **Hawaii**, and spread to 6km from the area where it was introduced. It caused considerable damage to **Coconut Island in Hawaii,**
- **Cubagua Island in Venezuela, Zanzibar in Tanzania**, and **Almirante** and **Cristobal** in **Panama** and **Costa Rica**.
- In **1984Kappaphycusalvarezii** of **Philippine origin** from **Japan** was introduced in **Okha, Gujrat** and **Mandapam town, Ramanathapuram** of **Tamilnadu** by the **CSMCRI**.
- In **2000**, it was introduced in the **Gulf of Mannar Marine National Park** by without a proper EIA.
- The seaweed provided an annual income of **₹50000** to cultivators. In **2005**, the **Goa**-based **National Institute of Oceanography** noted signs of **bioinvasion**.
- The Tamilnadu government on **12 december 2005**, prohibited cultivation of the species in sea waters between the north of Palk Bay and south of Tuticorin district.
- In **January 2014,** the invasive species was discovered on a new base, Mulli island, located about 40 km south of Kurusadai.

- By **2019**, the exotic species had extended its range to Valai and Thalaiyari islands. In **2021**, a multi-departmental survey found **bio-invasion of Kappaphycus** in both Valai island and the southern part of Kurusadai island.

Livelihood at stake:

- Repeated cultivation of the same fragment brought from Japan has reduced the quality and thus price of the seaweed. Cost of seaweed farming is also high.

Topic 29. GOVERNMENT PROPOSES IN SC TECH PANEL TO EVALUATE CARRYING CAPACITY OF 13 HIMALAYAN STATES

Important for the subject: Environment

The Centre has proposed forming a 13-member technical committee to evaluate the "carrying capacity" of 13 Himalayan States.

What is the need of a committee?

- Frequent landslides leading to deaths and destruction had led to a re-evaluation of the load-carrying capacity of hill towns and cities.
- Earlier, the Centre had asked the 13 hill States to assess the carrying capacity of their hill stations and submit the report.
- **Committee is headed by:** Director of the GB Pant National Institute of Himalayan Environment.

Carrying capacity:

- The carrying capacity is the maximum population size that an ecosystem can sustain without getting degraded. In the broader sense, carrying capacity also means that all plants and animals which an area of the Earth can support at once.

Assessing carrying capacity is important because:

- It helps in identifying the upper limit of development that the region can sustain without exceeding the carrying capacity.
- Knowing the carrying capacity of an ecosystem helps in identifying the optimal level of resource use that will ensure the long-term sustainability of the ecosystem.
- It helps in planning for resource management and allocation in a way that is environmentally sound and economically viable.
- To prevent environmental degradation, loss of biodiversity and long-term economic loss.
- To determine the maximum population a region can sustain. It helps in planning for Population growth and developing policies that ensure the sustainable use of resources for future generations.
- To maintain ecosystem services such as water, air and soil quality.

Topic 30. INDIA NEEDS A SINGLE AND COMPREHENSIVE POLICY TO TACKLE INVASIVE SPECIES: ANKILA HIREMATH

Important for the subject: Environment

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is all set to release its landmark report on invasive species.

Report title:

- The status of Invasive Alien Species (IAS) and ways to control them.

Invasive Alien Species (IAS):

- Alien species are animals, plants and microbes that have been introduced by humans to new regions. Of these, **invasive alien species have negative impacts on nature.**
- Of the more than 37,000 alien species identified across the world, around 3,500 are invasive.
- Of the 37,000, six per cent of the plants, 22 per cent of the invertebrates, 14 per cent of the vertebrates and 11 per cent of microbes are invasive.

For example:

- Diseases such as malaria, Zika and West Nile Fever are spread by invasive alien mosquito species like Aedes albopictus and Aedes aegyptii.

Invasive Alien Species as a threat to biodiversity:

- Invasive alien species are one of the five major direct drivers of biodiversity loss globally, alongside land and sea-use change, direct exploitation of organisms, climate change, and pollution.
- **Example:** The arrival of avian malaria, for instance, in Hawaii, wiped out a very large proportion of their bird species. These species are more fire prone leading to more frequent forest fires.
- Invasive alien species have been a major factor in 60% and the only driver in 16% of global animal and plant extinctions that we have recorded, and at least 218 invasive alien species have been responsible for more than 1,200 local extinctions.
- In fact, 85% of the impacts of biological invasions on native species are negative. IAS costs the global economy $423 billion per year.
- Birds in some islands (eg. New Zealand, Australia and Tasmania) are not familiar with invasive rats, as these birds make their nests on ground. Many of them are flightless birds like: kiwi.

Some prominent invasive alien species:

- African catfish

- Prosopis juliflora
- Parthenon hysterophorus
- Lantana camara
- Kappaphycus alvarezii
- Water hyacinth
- Black rat
- European shore crab
- Caribbean false mussel
- Aedes albopictus and Aedes aegyptii
- Zebra mussel (a small freshwater mussel)
- Brown tree snake

Steps taken:

- **Target 6** of the recently adopted **Kunming-Montreal Global Biodiversity Framework** is to "eliminate, minimize, reduce and or mitigate the impacts of invasive alien species on biodiversity and ecosystem services".
- **Target 4** of **India's National Biodiversity Action Plan** is specifically focused on the prevention and management of invasive species.
- The Environment Protection Act,

The Livestock Importation Act, 1898

- The Act regulates the import of Livestock in India.
- **Section 1** (Short title and local extent);
- **Section 2** (Definitions);
- **Section 3** (Power to regulate importation of live-stock),
- **Section 3A** (Power to regulate Importation of live-stock products);
- **Section 4** (Power of State Government to make rules); and
- **Section 5** (Protection to persons acting under Act).

The Plant Quarantine Rules.

- Plant quarantine is the legal enforcement of measures to prevent further spread or proliferation of pests that have already invaded and settled in new restricted areas.

Objectives of plant quarantine

- New strains of pathogens have been developed to control the spread of harmful diseases and pests.
- With the application of the DIP Act 1914 and the Plant Quarantine (Import Control to India) Order 2003, imported agricultural products are controlled to prevent the invasion of foreign pests and diseases harmful to Indian flora and fauna.

- As required by FAO's 1951 International Plant Protection Convention (IPPC), plants and plant materials for export are controlled to ensure pest-free trade.
- The **Plant Protection, Storage, and Storage Bureau**, which is part of the **Ministry of Agriculture,** is primarily responsible for implementing the quarantine restrictions issued under the **DIP Act**. This agency is responsible for the import and export of seeds and seedlings from ethnic minorities for commercial purposes.

Topic 31. AFRICA CLIMATE SUMMIT AND CALL FOR GLOBAL CARBON TAX

Important for the subject: Environment

African leaders call for new global taxes to fund climate change action African leaders proposed **new global taxes to fund climate change** action in a declaration that **will form the basis of their negotiating position** at November's **COP28 summit.**

What is the Africa Climate Summit (ACS):

- The Africa Climate Summit is a **landmark event co-hosted by the Republic of Kenya,** the **African Union Commission (AUC)**.
- It brings **together Heads of State and Government**, policymakers, civil society organizations, the private sector, multilateral institutions, and youth to design and catalyse actions and solutions **for climate change in Africa** by **providing a platform to deliberate on the nexus between climate change, Africa's development reality, and the need to push for increased investment in climate action globally**, and specifically in Africa. Africa Climate Summit (ACS) is going to be held in **Nairobi, Kenya.** The theme for this year's summit is, '**Driving Green Growth and Climate Finance Solutions for Africa and the World.'**

What is Africa Climate Week (ACW):

- It is an **annual event** that **brings together leaders from governments, businesses, international organizations and civil societ**y to explore ways to reduce greenhouse gas emissions while adapting to the mounting fallout from the climate crisis. ACW 2023 is **organized into four systems-based tracks**, each focusing on specific themes:

Energy systems and industry

- **Cities, urban and rural settlements, infrastructure and transport Land, ocean, food and water Societies, health, livelihoods, and economies** ACW 2023 is **organized by the United Nations Framework Convention on Climate Change (UNFCCC), United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and the World Bank, with the support of regional partners:**
- **African Union (AU), United Nations Economic Commission for Africa (ECA) and the African Development Bank (AfDB)**.

Topic 32. CRIMINALIZING WILFUL ENVIRONMENTAL DAMAGE IS HARDER THAN IT SOUNDS

Important for the subject: Environment

Maya Project of Mexico:

Mexico's 'Maya train' project, which aims to connect historic Maya sites with a route length of 1525 km, is being called a 'Megaproject of death' or 'Pharaonic project' because it imperils Yucatán peninsula of its rich wilderness, ancient cave systems, and Indigenous communities.

- The Tribunal for the Rights of Nature in August said the project caused "crimes of ecocide and ethnocide".

Ecocide and ethnocide- International crime:

- **Ecocide**, derived from **Greek** and **Latin**, translates to **"killing one's home"** or **"environment".**
- Such **'killing'** could include **port expansion projects** that destroy: Fragile marine life and local livelihoods; Deforestation; Illegal sand-mining; and Polluting rivers with untreated sewage.
- **Mexico** is pushing to elevate ecocide to the ranks of an international crime, warranting similar legal scrutiny as genocide.

Ecocide:

- Extensive loss, damage to or destruction of ecosystems such that the peaceful enjoyment by the inhabitants has been or will be severely diminished." Here, "inhabitants" applies to all living creatures.
- There is **no accepted legal definition of ecocide**, but a panel of lawyers in June 2021 for the **Stop Ecocide Foundation** prepared a 165-word articulation.
- Ecocide, they proposed, constitutes the "unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts."
- The biologist **Arthur Galston** in **1970** is credited with **first linking environmental destruction with genocide**, which is recognised as an **international crime**.
- The **Rome Statute** of the **ICC** deals with **four atrocities:** genocide crimes against humanity war crimes the crime of aggression.
- The provision on war crimes is the only statute that can hold a perpetrator responsible for environmental damage, but only if it is intentional and in wartime. **Limitations to defining ecocide:**
- There are also many arguments against criminalizing ecocide. Words like "long-term" or "widespread damage" are abstract and leave room for misinterpretation.
- The threshold to prove **'ecocide'** may also be too high.

- Countries like **Belarus** and **Moldova** specify "**intentional**" or "**deliberate**" destruction, but **environmental disasters are not caused intentionally or deliberately**.
- Without any significant changes, the **ICC** will not be unable to hold corporate entities criminally liable.

Why should ecocide be a crime?

- **Ecocide** is a crime in **11 countries**, with **27** others considering laws to criminalise environmental damage that is wilfully caused and harms humans, animals, and plants.

Most national definitions penalize:

- "mass destruction of flora and fauna", "poisoning the atmosphere or water resources" or "deliberate actions capable of causing an ecological disaster." **Need for an ecocide law:**
- Deforestation of the Amazon, deep-sea trawling or even the catastrophic 1984 Bhopal gas disaster could have been avoided with ecocide laws in place, according to Stop Ecocide International.
- These laws could also hold individuals at the helms of corporations accountable.
- **Ecocide** laws could also double up as calls for justice for low- and middle-income countries disproportionately affected by climate change.
- **Small nation-states** like **Vanuatu** and **Barbuda** are already lobbying the **ICC** to **declare crimes against the environment** to be **violations of international law**.

What has been India's stance?

- India has recognised rivers as legal entities with the right to maintain their spirit, identity, and integrity. The concept hasn't fully materialized in law yet.
- In **Chandra CFS and Terminal Operators Pvt. Ltd. v. The Commissioner of Customs and Ors (2015),** the **Madras High Court** noted: "the prohibitory activities of ecocide has been continuing unbridledly by certain section of people by removing the valuable and precious timbers".
- In an ongoing case, **T.N. Godavarman Thirumulpad vs Union Of India & Ors**, the Supreme Court called attention to an **"anthropogenic bias"** and argued that "environmental justice could be achieved only if we drift away from the principle of anthropocentric to ecocentric".
- India's legislative framework vis-à-vis environmental and ecological governance includes the **Environmental (Protection) Act 1986**, the **Wildlife (Protection) Act 1972,** and the **Compensatory Afforestation Fund Act (CAMPA) 2016,** as well as separate Rules to prevent air and water pollution.
- The **National Green Tribunal**, India's apex environmental statutory body, does not have the jurisdiction to hear matters related to the **Wildlife (Protection) Act 1972,** the **Indian Forest Act 1927**, and other **State-enacted laws**.

Disaster due to Russia-Ukraine war:

- The **ICC** and Ukraine's public prosecutor are also investigating Russia's role in the collapse of the **Nova Kakhovka dam**, which unleashed a flood that drowned 40 regions, and released oils and toxic fluids into the Black Sea.

Topic 33. LAWS GOVERNING FORESTS OF NORTHEAST INDIA

Important for the subject: Environment

On August 22, the **Mizoram Assembly** unanimously passed a resolution opposing the **Forest (Conservation) Amendment Act, 2023**, "to protect the rights and interest of the people of Mizoram".

Why are the Northeast states opposing the amendment?

- The amendment allows the diversion of forest land for roads, railway lines or "strategic linear projects of national importance and concerning national security" within 100 km of India's international borders or lines of control, without a forest clearance under the Forest (Conservation) Act (FCA) 1980.
- **Most of India's Northeast falls in this 100 km range**. **Nagaland, Tripura, Mizoram** and **Sikkim** are opposing the FCA.

Grant of FCA clearances:

- Special Constitutional protections – **Article 371A** for **Nagaland** and **371G** for **Mizoram** – prohibit the application of any law enacted by Parliament that impinges on Naga and Mizo customary law and procedure, and ownership and transfer of land and its resources.
- Such laws can be extended to these States **only if their Legislative Assemblies decide thus in a resolution**.
- Nagaland extended the application of the FCA to government forests and such other forests and Wildlife Sanctuaries under the control of the State Government.
- Government forests make up only 2.71% of the State's Recorded Forest Area. Mizoram Union Territory became a State with the **Constitution (Fifty Third Amendment) Act 1986,** adding **Article 371G** to the Constitution.
- It stipulated that **all Central Acts in force before 1986 are extended to the State**, including the FCA.
- Moreover, the powers of the **Autonomous District Councils** in the **three Sixth Scheduled areas** in Mizoram don't extend to reserved forests. So the **FCA** covers **84.53%** of forest areas that are notified forests, and 6,630 ha have thus far received FCA clearance.
- **The FCA is applicable in the rest of Northeast:** in **Meghalaya** and **Tripura**, the **Sixth Schedule Areas** within these States, and in **Arunachal Pradesh**, **Sikkim,** and **Manipur**.
- **Arunachal Pradesh** ranked **first** among these States in **FCA clearance** (21,786.45 ha), followed by **Tripura** (9,051 ha), **Assam** (5,261 ha), **Manipur** (3,604 ha), **Sikkim** (2,902

ha), and **Meghalaya** (807 ha).

FCA 1980 vis-à-vis the Northeast:

- In **1996**, the Supreme Court expanded the term **"forest land"** in the FCA in the **Godavarman case** to "not only include 'forest' as understood in the dictionary sense, but also any area recorded as forest in the Government record irrespective of the ownership" called as the "deemed forest", thus extending the FCA to unclassed forests.
- These are recorded forests but not notified as forests. More than half of the Northeast is **Recorded Forest Area (RFA).**
- Of this, 53% are unclassed forests controlled by individuals, clans, village councils or communities, and governed by customary law and procedures. The remainder is notified forest controlled by the State Forest Departments.
- **RFA** ranges from **34.21%** in **Assam** to **82.31%** in **Sikkim** with **Mizoram** having **35.48%, Meghalaya 42.34%, Nagaland 53.01%, Arunachal Pradesh 61.55%, Manipur 78.01%** and **Tripura 60.02%.**
- Of these, **unclassed forests** range from **nil** in **Sikkim** to **97.29% in Nagaland**, with **15.47% in Mizoram, 33.43% in Assam, 42.96% in Tripura, 75.67% in Manipur** and **88.15% in Meghalaya**.
- The apex court's **1996** order brought unclassed forests under the FCA's purview everywhere except in **Nagaland**. There are also **forests outside RFA**, neither recorded nor surveyed: **38.5%** of the cover in **Assam**; **29%** in **Nagaland**; and **1.5% in Mizoram**.

FRA 2009 vis-à-vis the Northeast

- In the **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act (FRA) 2006**, **"forest land"** includes:
- Unclassified forests, undemarcated forests, existing or deemed forests, protected forests, reserved forests, Sanctuaries and National Parks.
- These States can **take suo motu cognisance** of the **existing rights** and obtain the concerned **Gram Sabha** approvals for issuing titles.
- The **Ministry of Tribal Affairs** can also issue **legally enforceable directions** under **Section 12** of the **FRA**, paving the way for this. But none of the Northeast States have implemented FRA except for **Assam** and **Tripura**.

FRA compliance under FCA

- States can formulate and take legal measures to ensure **mandatory fulfillment of the FRA before recommending a forest diversion proposal,** and **ensuring Gram Sabha consent** before handing over forest land. The **Ministry of Tribal Affairs** can also issue **legally enforceable directions** under the FRA, or even enact a separate law, to recognise and settle forest rights when forests are diverted for other purposes and forest-dwellers are relocated, as forest rights fall squarely within its Business Rules.

Topic 34. INDIA'S CREDUCE TO SET UP DIGITAL REGISTRY TO HELP SMALL FARMERS EARN CARBON CREDITS

Important for the subject: Environment

Creduce, one of India's leading services providers in the field of **climate change** and **carbon asset management**, plans to set up a **digital registry** to help **small and marginal farmers** claim **carbon credits,** its founder Shailendra Singh Rao has said.

How Creduce's digital registry will help farmers?

- CREDUCE is a macro scale organization headquartered at Ahmedabad (Gujarat). **Creduce**, launched in **2012** and rebranded in **2020**, has made a soft launch of the registry and trial runs are on to test the platform through demo projects.
- A farmer has to be onboard and his activities will be recognised on the company's platform.
- Farmers will be awarded carbon credits for free and these credits can be traded on our integrated marketplace.
- The money that a farmer earns through such a trade will directly be credited into the farmer's account through the direct beneficiary transfer model.
- As per 2021 data, 200 million plus carbon credits were traded globally with trading from India accounting for 30 per cent. India is a major beneficiary.
- Creduce also deals with **afforestation**, which is basically rendering barren lands green or developing forests on such lands.
- There is also reforestation where new trees are planted on land where forests had existed previously.

Creduce's involvement with various States governments:

- **Arunachal Pradesh government**– to develop **bamboo resources** on community land covering one lakh hectares.
- **"Red plus" forestation-based carbon credit activity** with **Mizoram** and **Assam** governments.
- The afforestation/reforestation based rubber plantation activity in **Kerala**. Carbon credit from sustainable rice cultivation. Sustainable super cultivation in Gujarat and Maharashtra.

'Red plus' forestation:

- **"Red plus" forestation** refers to reckless activities that damage existing forest lands that have carbon stock which would have to be accounted for and claimed.
- "Such a process can help to preserve these forests using the carbon credits money garnered from its existing carbon stocks.

Renewable Energy Certificates (RECs):

- Renewable Energy Certificates (RECs) is a market-based instrument to promote renewable sources of energy and development of the market in electricity.
- One REC is created when one megawatt hour of electricity is generated from an eligible renewable energy source.

Topic 35. WHAT IS SF_6? WHY SHOULD WE BE MONITORING IT?

Important for the subject: Environment

What is SF_6?

SF_6 is a stable colourless, odourless, synthetic fluorinated gas that makes effective insulating material for medium and high-voltage electrical installations.

- Around 80% of the SF_6 used globally is in electricity transmission and distribution. Medium- and high-voltage electrical equipment contains SF_6 to insulate the live electrical parts and to switch the flow of electrical current on and off.

A powerful Greenhouse Gas:

- Sulphur hexafluoride or SF_6 is the **strongest known greenhouse gas** with a global warming potential of **25200** and an atmospheric lifetime of **3,200 years.**
- SF_6 is rapidly accumulating in the atmosphere, driven by the demand for SF_6- insulated switchgear in developing countries due to increased renewable energy installations.
- SF_6 emissions occur during all stages of the component lifecycle: manufacturing, operation, and decommissioning of equipment contribute the most to the emissions of the operational phase.

Where is SF6 used?

- Power Industry for electricity transmission and distribution
- Semiconductors devices like: mobiles, computers etc.
- Renewable energy installations like: wind turbines, solar panels etc.
- Batteries for Electric Vehicles Production of magnesium

What is the status of SF_6 in India?

- SF_6 is mostly imported into India. There is a lack of publicly available data on total production, use growth rates and emissions of SF_6 in India.
- India imported 600 shipments from China, Taiwan and the United States and is the largest importer of SF_6 in the world.
- In developed countries, SF_6 is regularly monitored to immediately detect any SF_6 leakages, on an almost real-time basis while India still needs to make a lot of progress in SF_6 handling and monitoring.

- The maximum threshold for leakage of SF6 is 0.5 per cent per year.
- There is currently no regulatory framework to monitor, report and manage SF_6 in India and the country needs to develop a framework for SF_6 monitoring, reporting and phase out.

What are the international regulations on SF_6?

- The U.S. Environmental Protection Agency (EPA) made mandatory the reporting of large SF_6 emissions in 2009.
- In Europe, it is also mandatory to recycle, reclaim or destroy the SF_6 gas contained in electrical equipment.
- There are no SF_6 regulations in Asia that focus directly on transmission and distribution operators.
- Japan's switchgear OEMs and electric utilities created a voluntary action plan in the late 1990s and reported a substantial reduction in reduction in SF_6.
- In 2015 South Korea implemented a GHG Emissions Trading Scheme, which includes SF_6.
- China has also made moves away from SF_6.

What are the alternatives to SF_6?

- Use of clean air, hydrogen, nitrogen, etc is being considered but these are available mostly for medium voltage (MV) switchgear

Topic 36. BOTANICAL SURVEY OF INDIA GETS PATENT FOR BAMBOO BASED REUSABLE STRAW

Important for the subject: Environment

The patent office of Government of India has granted a **patent** to **Botanical Survey of India** for **'reusable straw and its manufacturing'**.

Details of Bamboo straw:

- The **reusable straw** is developed from a species of **endemic bamboo plant**. Bamboo species: **Schizostachyum andamanicum** Found in the **Andamans and Nicobar Islands**, three decades ago.
- Work on the bamboo straw started at **Dhanikhari Experimental Garden-cumArboretum,** at the **BSI Regional Centre** in **2011**.

Patent has been granted in 2023.

What makes this bamboo species suitable for making straw?

- This species of **bamboo** is characterized by a **thin large hollow erect culm (stem)** with **long internodes** and has potential for developing into a straw.

- The **morpho-anatomical structure** of **culm internodes** of the endemic bamboo were **identical to modern synthetic drinking straws** which led to the idea for this novel invention.
- The **germplasm of the bamboo species is only found in some forested areas of Andamans** and large-scale production of the straw will be dependent on commercial cultivation of the species.

Benefit:

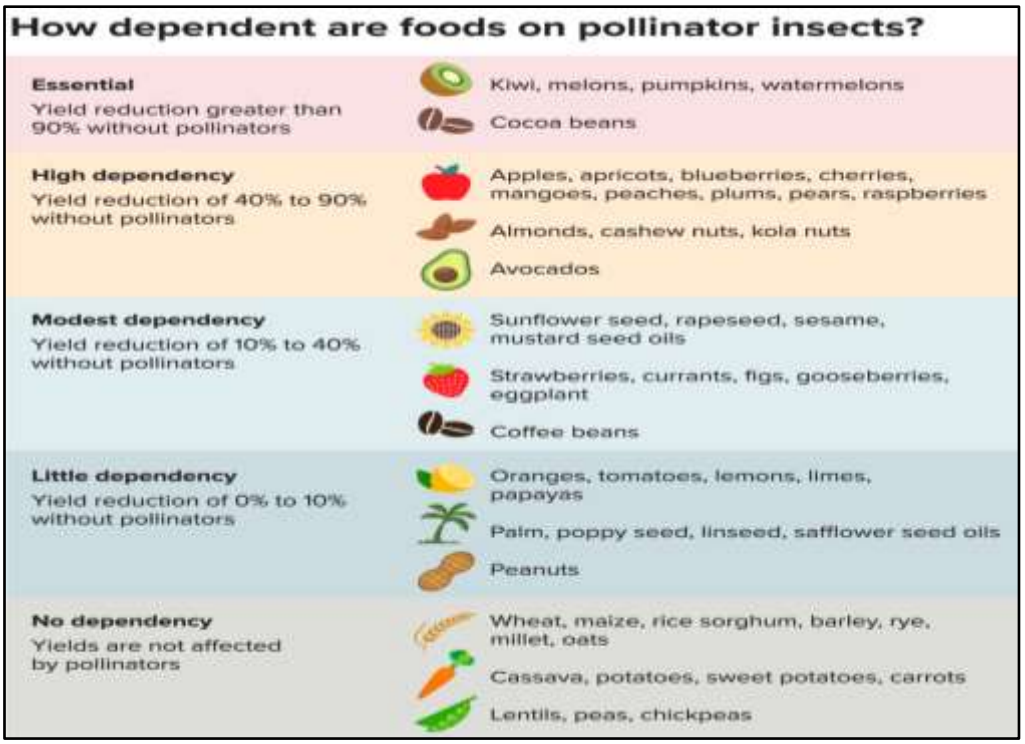
- It will boost the economic potential of these bamboo plants. Replace plastic straws with an organic alternative. Enhance the economy of farmers and bamboo growers of the island. Helps in curbing the plastic pollution.

Botanical Survey of India (BSI):

- Botanical Survey of India (BSI) located in **Kolkata, West Bengal, India.**
- It was founded on **13 February 1890**, is Government of India **Ministry of Environment, Forest and Climate Change's organization for survey, research and conservation of plant wealth** of India, flora and endangered species of India, including by collecting and maintaining germplasm and gene bank of endangered, patent and vulnerable plant species.

Topic 37. THE UNDERAPPRECIATED BENEFITS OF WILD BEES

Important for the subject: Environment



A species of **plasterer bee** in the **New Jersey Pine Barrens**, not seen in 50 years and

suspected to have gone extinct, was found again.

Native bees are crucial as:

- They are an important pollinators.
- Their presence is crucial for various agricultural crops. Native bees are essential to flourishing ecosystems and farms.
- **Domestic honey bee colonies** are vulnerable to collapse due to a combination of poor nutrition, pesticides and pathogens.
- Loss of pollinators could lead to lower availability of crops and wild plants that provide essential micronutrients for human diets, impacting health and nutritional security and risking increased numbers of people suffering from vitamin A, iron and folate deficiency.

Benefits of Wild Bees:

- There are about **20,000 wild bee species globally**.
- Wild species are **solitary** (bumblebees, which form colonies, are one well-known exception), **nesting in cavities in rocks** and **wood** or on the ground in leaves and woody debris.
- More than 80% of flowering plants depend on insect pollinators to reproduce. In a **2013 study** covering **27 types of crops** it was found that the **wild insects** increased the rate at which flowers turn to fruit.
- In a study in 2020 it is found that, for seven crops, including apples and pumpkins, wild bees were responsible for over $1.5 billion in annual production.
- The wild insects land on flowers and **isolate their flight muscles from their wings**, **allowing the muscles to vibrate their thorax** as their wings stay still, making them by far the **most effective pollinators for these plants**.
- They provide high-quality food—honey, royal jelly and pollen — and other products such as beeswax, propolis and honey bee venom.

Declining Bee species:

- The **number of bee species** documented in a yearly survey from 2006 to 2015 had **dropped by a fourth** compared to similar tallies before 1990.

Some causes for their decline are:

- Habitat loss
- Disease and pesticides
- Climate change
- Forest fires
- Invasive Alien Species

Competition for food: Dense herds of cattle can graze away food for native bees.

- **Monocuture:** In large fields concentrated with one fruit or vegetable, natural habitat tends to be minimal, and pesticide use maximal, leaving less food for insects while degrading their health.
- Public land management

Waggle Dance:

- **Waggle dance** is a term used in **beekeeping** and **ethology** for a particular **figure eight dance** of the honey bee.
- By performing this dance, successful foragers can **share information about the direction and distance to patches of flowers yielding nectar and pollen, to water sources, or to new nest-site locations** with other members of the colony.
- The **waggle dance** and the **round dance** are **two forms of dance behaviour** that are part of a continuous transition.
- As the distance between the resource and the hive **increases,** the **round dance transforms into variations of a transitional dance,** which, when communicating resources at even greater distances, becomes the **waggle dance.**
- The image presents the **waggle dance** – the direction the bee moves in relation to the hive indicates direction; if it moves vertically the direction to the source is directly towards the Sun. The duration of the waggle part of the dance signifies the distance.

Colony Collapse Disorder (CCD):

- Colony collapse disorder (CCD) is an abnormal phenomenon that occurs when the majority of worker bees in a honey bee colony disappear, leaving behind a queen, plenty of food, and a few nurse bees to care for the remaining immature bees.
- Several possible causes for CCD have been proposed, but no single proposal has gained widespread acceptance among the scientific community.

Suggested causes include:

- Pesticides; Infections with various pathogens especially those transmitted by **Varroa** and **Acarapis mites**; Malnutrition; Genetic factors; Immunodeficiencies; Loss of habitat; Changing beekeeping practices; or a combination of factors.
- A large amount of speculation has surrounded the contributions of the **neonicotinoid** family of pesticides to **CCD**, but many collapsing apiaries show no trace of **neonicotinoids**.

Topic 38. BIZARRE' BIRD-LIKE DINOSAUR HAS SCIENTISTS ENTHRALLED

Important for the subject: Environment

Scientists said on September 6 they unearthed in **Fujian Province** the **fossil of a Jurassic Period dinosaur** they named **Fujianvenator prodigiosus** – a creature that sheds light on a

critical evolutionary stage in the **origin of birds**.

- A **pheasant-sized** and **bird-like dinosaur** with **elongated legs and arms** (like wings) inhabited **southern China** about **140-150 million years** ago. The anatomy indicated that it either was a fast runner or a wader (shorebird) bird.
- Around **150 million years ago** in **Germany,** the oldest known bird **Archaeopteryx a crow-sized bird with teeth, a long bony tail, and no beak**- rose from a lineage in **late Jurassic period**, of **small feathered two-legged dinosaurs** known as **Theropods.**
- Birds survived the asteroid strike **66 million years ago** that doomed their non-avian dinosaur comrades.

Fujianventor prodigiosus:

- Member of a grouping called **avialans** that includes all birds and their closest nonavian dinosaur relatives.
- The fossil is fairly complete but lacks the animal's skull and parts of its feet, making it hard to interpret its diet and lifestyle.
- Fujianvenator's lower leg bone – the **tibia** – was twice as long as its thigh bone – the femur. Such dimensions are unique among the ropods; it also had a long bony tail.
- The **forelimb** is built like a **bird's wing,** but with **three claws on the fingers,** which are absent from **modern birds**. So it can be called a wing but it is impossible to determine whether it could fly or not.

Topic 39. READY TO GROW ROOTS: SAPLINGS FROM 17 COUNTRIES AWAIT G20 LEADERS

Important for the subject: Environment

India has imported saplings from at least **17 countries**, which are to be planted by visiting **G20 leaders** in the **national capital** on occasion of the summit this weekend. The saplings of native plants have been imported from **10 G20 member countries** and **seven other**

countries.

- These saplings have been imported over the past two months and have now been kept at a **post-entry quarantine facility** at **ICAR-National Bureau of Plant Genetic Resources, Pusa, New Delhi**.
- Saplings identified and selected by: **Ministry of Agriculture**
- It is suggested that the **imported plant** should have some **religious, cultural or national significance** in the source country.

Among the G20 member countries:

- Silver Tree (Neolitsea sericea) from South Korea;
- Date Palm (Phoenix dactylifera) from Saudi Arabia;
- Olive (Olea europaca) from Italy and Turkey;
- Real Yellowwood (Podocarpus latifolius) from South Africa;
- Winterlinde (Tilia Cordata) from Germany;
- Cockspur Coral (Erythrina crysta-galli) from Argentina;
- Camphor Laurel (Cinnamomum camphora) from China and Japan; and Golden Wattle (Acacia pycnantha) and Northern Black Wattle (Acacia auriculiformis) from Australia.

Among the invitee countries:

- Ghaf tree (Prosopis cineraria) from the UAE;
- Frankincense (Boswellia sacra) from Oman;
- Frangipani (Plumeria obtusa) from Mauritius;
- Mango tree (Mangifera indica) from Bangladesh;
- African Mahogany (Khaya senegalensis) from Nigeria;
- Doum/Date Palm (Hyphaene thebaica/ Phoenix dactylifera) from Egypt; and Olive tree from Spain.

For the remaining leaders, the plants have been sourced locally.

- Sycamore/Chinar (Platanus ori-entalis) plant has been sourced locally for the French President;
- Chir Pine (Pinus roxburghii) for Russia's representative;
- Queen's Crepe-myrtle (Lagerstroemia speciosa) for the US President;
- Weeping Willow (Salix baby-lonica) for the UK Prime Minister;
- Arjun (Terminalia ar-juna) for Canada;
- Teak tree (Tectona Grandis) for Indonesia; and Fern tree (Jacaranda mi-mosifolia) for Brazil.

Banyan tree saplings have been sourced locally for Prime Minister Narendra Modi.

For the international organisations:

- Saplings of Peepal tree (Ficus religiosa) has been sourced locally for the United Nations and Parijat (Nyctanthes arbortristis) for the International Monetary Fund and World Bank.

Ghaf tree from UAE:

- Ghaf was declared **UAE's national tree in 2008**.
- The **Ghaf is a drought-tolerant tree**, which can **remain green** even in harsh desert environments. It is essential for the survival of animal and plant species alike. Ghaf trees can live for up to 120 years on average.
- A well-known example of the **Ghaf** is the **400-year-old 'Tree of Life'** in **Bahrain**, which is still growing in the desert without any obvious sources of water.
- It is learnt that **six mango plants** –**Amrapali** and **Langra** varieties – have also been **imported from Bangladesh**.

Topic 40. SPECIAL SESSION OF PARLIAMENT FROM SEPT. 18 TO 22

Important for the subject: Polity

Govt. calls special session of Parliament from Sept. 18 to 22. The government said a **special session of Parliament** was being convened from **September 18 to September 22**.

No reason for calling the session was given which woul**d have five sittings.** This special session of Parliament will also set the **tone for the forthcoming P20 summit – a meeting of Parliamentary Speakers of G20 countries** – which is to be held in New Delhi in October.

More about Parliament Sessions:

- The summoning of Parliament is **specified in Article 85 of the Constitution.** The **power to convene a session** of Parliament **rests with the government.**
- The decision is **taken by the Cabinet Committee on Parliamentary Affairs.** The committee comprises ministers, including those for **Defence, Home, Finance, and Law.**
- The decision of the Committee is **formalised by the President,** in whose name **MPs are summoned to meet for a session.**
- India **does not have a fixed parliamentary calendar**. By convention, **Parliament meets for three sessions in a year.**
- **Budget Session:** The**longest**, the Budget Session, starts **towards the end of January and concludes by the end of April or the first week of May.** The **session has a recess so that Parliamentary Committees can discuss** the budgetary proposals.
- **Monsoon Session:** The **second session** is the **three-week Monsoon Session, which usually begins in July and finishes in August. Winter Session:** The **parliamentary year ends with a three-week-long** Winter Session, which is held from **November to December.**

Topic 41. ONE NATION, ONE ELECTION

Important for the subject: Polity

Recently, the **government has announced to form a committee** to explore the **feasibility of "one nation, one election"**

- The government has constituted a committee **headed by former President of India Ram Nath Kovind** to explore the possibility of **"one nation, one election".**
- The recent moves by the government have thrown open the possibility of advancing the general elections and some state polls, which are scheduled after and with the Lok Sabha contest.

What is Simultaneous election:

- The concept of **"One Nation, One Election"** envisions a system in **which all state and Lok Sabha elections must be held simultaneously.**
- This will **entail restructuring** the **Indian election cycle** so that **elections to the states and the center coincide.**
- This would imply that **voters will vote for members of the LS and state assemblies on the same day and at the same time**.

What is the history holding of Simultaneous Election in India:

- Simultaneous elections have previously been **conducted in India in 1952, 1957, 1962 and 1967.**
- Soon after, this norm was discontinued following the **dissolution of some Legislative Assemblies between 1968 -69.**
- Since then, the **Indian Electoral system holds polls to Centre and states separately.**

Urge for simultaneous elections:

- The idea of returning to simultaneous elections was **raised in the Election Commission's annual report in 1983**. It was **also mentioned in the Law Commission's Report in 1999.**
- Following the Prime Minister of **India's reintroduction of the idea in 2016**, the **NITI Aayog** prepared a **working paper** on the Important for the subject in **2017.**
- The **Law Commission stated in its 2018** working paper that at least "**five Constitutional recommendations"** would be required to **make simultaneous elections a reality in India again.**
- In **June 2019, PM Modi** said that a **committee would be formed to examine the issue** and a meeting with leaders of political parties would be called.

What are the Constitutional challenges involved:

- The **Indian Constitution** provides for the **dissolution of the legislature** if the **ruling**

party loses majority by passing a vote of no confidence.

- **Clause (2) of Article 83, Article 172(1)** of Indian constitution **deals with the term of Lok Sabha and State Assemblies** respectively.
- Through **Articles 85(2)(b) and 174(2)(b)** these Houses **can be dissolved ahead of the scheduled expiry** of the **term of five years**
- However, **there is no provision for extension of the term** unless a **proclamation of Emergency is in operation.**
- **Bringing the terms of all the Houses to sync** with one another necessarily **calls for either extending the terms of several of the Houses or curtailing of terms or a combination of both**, that too by two to three years in some cases.
- In such a case, simultaneous elections could **not be held within the existing framework of the Constitution.**

These could be held **together through appropriate amendments to**:

- **The Constitution, The Representation of the People Act 1951, and The Rules of Procedure of Lok Sabha and state Assemblies.** Since it will **affect federal character, at least 50% of the states will require to ratify the constitutional amendments.**

Topic 42. SPECIAL SESSION OF PARLIAMENT

Important for the subject: Polity

Government calls a special **session of Parliament from Sept. 18 to 22.**

How Parliament Session is Convened:

The power to **convene a session of Parliament rests with the government**. The decision is **taken by the Cabinet Committee on Parliamentary Affairs**, which currently comprises **nine ministers, including those for Defence, Home, Finance, and Law.**

- The **decision of the Committee** is **formalised by the President**, in whose name **MPs are summoned to meet for a session.**

What are the Constitutional Provisions w.r.t. Parliamentary Sessions:

- The **summoning of Parliament** is specified in **Article 85 of the Constitution.** Like many other articles, it is **based on a provision of the Government of India Act, 1935.**This provision **specified tha**t the **central legislature had to be summoned to meet at least once a year,** and that not more than 12 months could elapse between two sessions.

What is a Special Session of Parliament:

- The Constitution **does not use the term "special session"**. The term sometimes **refers to sessions the government** has convened for **specific occasions, like commemorating**

parliamentary or national milestones.

- For the two Houses to be in session, the **presiding officers should chair** their proceedings.
- The presiding officers **can also direct that the proceedings of their respective Houses would be limited and procedural devices like question hour would not be available** to MPs during the session.
- While the Constitution **doesn't explicitly mention "special sessions," Article 352,** which pertains to the Proclamation of Emergency, does **make a reference to a "special sitting of the House."**
- Parliament **added the part relating** to the **special sitting** through the Constitution **Forty-fourth Amendment Act, 1978.**
- Its purpose was to **add safeguards to the power of proclaiming Emergency** in the country.
- It specifies that **if a Proclamation of Emergency is issued and Parliament is not in session, then one-tenth of Lok Sabha MP**s can ask the President to convene a **special meeting to disapprove the Emergency.**

Topic 43. SIMULTANEOUS ELECTION WILL NEED SPECIAL CONSTITUTION AMENDMENT

Important for the subject : Polity

The centre setup committee to examine various aspects, both legal and logistical, for implementing the "one nation, one election" idea. The Law Ministry has outlined seven terms of reference for the eight-member panel headed by former President Ram Nath Kovind and including Union Home Minister Amit Shah. One of the terms of reference is to examine if a constitutional amendment of facilitate simultaneous polls would have to be ratified by the states.

- While some amendments to the Constitution can be made like any ordinary legislation, others need more rigorous methods.
- **Part XX** of the Constitution deals with **its amendment.**
- **Under Article 368(2),** Parliament can amend the Constitution by passing a Bill in each House by a majority of the total membership of that House and by a majority of not less than two-thirds of the members of that House present and voting.
- Thereafter, the Bill shall be presented to the President who shall give his assent… and thereupon the Constitution shall stand amended.
- Parliament cannot amend those provisions which form the basic structure of the Constitution according to the Supreme Court ruling in the landmark 1973 Kesavananda Bharati case.
- FRs and DPSPs are the two most important provisions that can be amended by the special majority.
- All provisions that do not require ratification by states, and those that come directly under

the purview of Article 368, have to be amended by the special majority.

Various Procedures for Amendments

[I] Simple Majority

- A large number of provisions contained in the constitution are open to change by a simple majority. These may be divided into two classes:
- Where the text of the constitution is not altered but the law is changed
- Article 11 confers on the Parliament power to enact a law regarding citizenship. An Act made in pursuance of that power will change the law relating to citizenship without altering the text of Article 5 to 10.
- Article 124 still refers to the Supreme Court as consisting of the Chief justice and 7 judges.
- But in exercise of its power the Parliament has increased the strength of the judges from 7 to 25.
- Where the text of the constitution is changed Formation of new state.
- Creation or abolition of legislative council
- Creation of council of ministers for Union territories
- Extending the period of 15 years fixed for the use of English in Article 343
- Defining Parliamentary privileges
- Salaries and allowances of President, Vice-President, Judges, etc.

[II] Special Majority

- Except those provisions which are amendable by an ordinary majority, the rest of the provisions require a special majority for amendment.
- The Amendment Bill must be passed by a majority of two-thirds of the members of each House present and voting and such majority must exceed 50% of the total membership of the House.

[III] Special Majority and Ratification by half of the States

- Those provisions which relate to the **federal structure** of the constitution require special majority in Parliament as well as ratification by at least half of the state legislatures.
- This procedure is required in the following provisions:
  1. **Manner of election of President**
  2. **Executive power of the Union and the State**
  3. **The Supreme Court and the High Courts**
  4. **Distribution of legislative power between the Union and the States**
  5. **Representation of states in Parliament Article 368 itself**

Topic 44. BASIC STRUCTURE AND ART 370

Important for the subject: Polity

Chief Justice of India D.Y. Chandrachud on September 4 said petitioners were placing Article 370 on a pedestal loftier than the Basic Structure Doctrine of the Constitution and even beyond the reach of the amending powers of Parliament.

- Senior advocate Kapil Sibal argued before the Constitutional Bench hearting the petition challenging revoking of Art 370 that Article 370 (1) had assumed a permanent character as soon as the Jammu and Kashmir Constituent Assemblywas dissolved in 1957 after the framing of the State Constitution.
- Sibal argued that clause (3) of Article 370, which empowered the President to abrogate the Article as done on August 5, 2019, had ceased to exist.
- Sibal said Article 368 (Parliament's power to amend the Constitution) did not apply to Article 370 as the special procedure for repealing or modifying the Article was only available under clause (3) of Article 370 and none other. Under Article 370(3) and its proviso, the constitutional provision can be declared inoperative by the President through a notification, provided the Constituent Assembly of J&K recommends the move.

Basic structure

- A **13-judge Bench was set up by the Supreme Court, the biggest so far,** and the case was heard over 68 working days spread over six months.
- The case was **primarily about the extent of Parliament's power to amend the Constitution**.
- First, the court was **reviewing a 1967 decision in Golaknath v State of Punjab** which, had ruled that Parliament cannot amend fundamental rights.
- Second, the court was **deciding the constitutional validity of several other amendments**.
- The **executive vs judiciary manoeuvres displayed in the amendments ended with the KesavanandaBharati case**, in which the court had to settle these issues conclusively.
- In its majority ruling, the court held that fundamental rights cannot be taken away by amending them. While the court said that **Parliament had vast powers to amend the Constitution, it drew the line by observing that certain parts are so inherent and intrinsic to the Constitution that even Parliament cannot touch it.**
- The **origins of the basic structure doctrine are found in the German Constitution** which, after the Nazi regime, was amended to protect some basic laws. The original Weimar Constitution, which gave Parliament to amend the
- Constitution with a two-thirds majority, was in fact used by Hitler to his advantage to made radical changes. Learning from that experience, the new German Constitution introduced substantive limits on Parliament's powers to amend certain parts of the
- Constitution which it considered 'basic law'. In India, the **basic structure doctrine has**

formed the bedrock of judicial review of all laws passed by Parliament.

- The present position is that the **Parliament under Article 368 can amend any part of the Constitution including the Fundamental Rights but without affecting the basic structure** of the Constitution.
- However, the **Supreme Court is yet to define or clarify as to what constitutes the basic structure of the Constitution**. From the various judgments, the following have emerged as basic features of the Constitution or elements / components / ingredients of the 'basic structure' of the constitution:
- Supremacy of the Constitution
- Sovereign, democratic and republican nature of the Indian polity
- Secular character of the Constitution
- Separation of powers between the legislature, the executive and the judiciary
- Federal character of the Constitution
- Unity and integrity of the nation
- Welfare state (socio-economic justice)
- Judicial review
- Freedom and dignity of the individual
- Parliamentary system
- Rule of law
- Harmony and balance between Fundamental Rights and Directive Principles
- Principle of equality
- Free and fair elections
- Independence of Judiciary
- Limited power of Parliament to amend the Constitution
- Effective access to justice
- Principle of reasonableness
- Powers of the Supreme Court under Articles 32, 136, 141 and 142

Topic 45. INDIA THAT IS BHARAT AND THE CONSTITUENT ASSEMBLY

Important for the subject: Polity

A political row has erupted **after invites** for a dinner to be hosted by the President for world leaders, during the upcoming G20 Summit, were sent out in the name of the **'President of Bharat' instead of the customary 'President of India'.**

What was the view of Constituent Assembly:

- In his **'Discovery of India',** Nehru r**eferred to "India", "Bharata" and "Hindustan"**, but when the question of naming India in the Constitution arose, **'Hindustan' was dropped and both 'Bharat' and 'India' were retained.**
- During the **Constituent Assembly debate**s the **"Name and territory of the Union"** was

taken up for discussion on **September 17, 1949**.

- Right from the **time Article 1** was read out as "India, that is Bharat, shall be a Union of States", a division arose among the members.
- There were quite a **few members who were against the use of the name 'India'**, which they saw as being a reminder of the colonial past.
- **HV Kamath** suggested that the **first article should read, "Bharat**, or in the English language, India, shall be…"
- **Hargovind Pant**, who represented the **hill districts of the United Provinces,** made it clear that the pe**ople of Northern India "wanted Bharatvarsha** and nothing else".
- **None of the suggestions were accepted**, illustrating contrasting visions of the budding nation.
- The draft **Article 1** of the Constitution – "India, that is Bharat, shall be a Union of States" – was **adopted by the Constituent Assembly on September 18, 1949**.
- Apart from Article 1, the **Constitution, originally drafted in English does not refer to "Bharat" in any other provision.** The Preamble also refers to "We the People of India."

What are the recent attempts of Name Change of the Nation:

- In **2004**, the **Uttar Pradesh Assemblypassed a resolution that the Constitution** must be amended to say **"Bharat, that is India," instead of "India, that is Bharat."**
- In **2020**, the **Supreme Court had dismissed a PIL** seeking **to remove "India" from the Constitution and retain only Bharat** in order to ensure the citizens of this country get over the colonial past.
- The apex court held that **"India is already called Bharat in the Constitution itself."**
- In his **Independence Day address 2022,** the **Indian PM** had spoken about the **"Panch Pran",** stressing the need to **decolonise minds and taking pride in India's civilisational heritage.**
- A **government booklet on the Indian PM's upcoming** visit to **Indonesia for the 20th ASEAN-India Summit and the 18th East Asia Summit** referred to **him as the "Prime Minister of Bharat".**

Topic 46. DECODING THE OCCRP'S ADANI REPORT

Important for the subject: Economy

Introduction:

In March 2023, the **Supreme Court of India** ordered investigations into the **Adani Hindenburg matter**.

- The investigations were directed at the **Securities and Exchange Board of India (SEBI)** and an **Expert Committee** to examine **potential violations of securities regulations.**
- The **Organized Crime and Corruption Reporting Project (OCCRP)** has done an

independent investigation into the case.

Rule 19A and its Significance:

- **Rule 19A** of the **Securities Contracts (Regulation) Rules 1957** is a crucial regulation inserted through an amendment in **2010** under the **"Continuous Listing Requirement".**
- The rule mandates that **every company listed in the Indian stock market must maintain a minimum of 25 percent public shareholding**.
- In this context, "**public**" is defined within the rule, encompassing **individuals other than "the promoter and promoter group".**
- The **"promoter group"** includes the **spouse of the person, parents, siblings, children, subsidiaries, or associates of the company.**
- It plays a vital role in ensuring that a sufficient **number of shares of a listed company are available for trading in the stock market.** This facilitates **price discovery**.
- **Violations** of Rule 19A may suggest **potential issues like stock price manipulation and insider trading,** which can undermine the **integrity of the equity market.**

Latest Revelations by OCCRP:

- OCCRP uncovered investments in Adani companies by **two Mauritius-based funds, EIFF and EMRF, between 2013 and 2018.**
- Key foreign investors were **Nasser Ali Shaban Ahli and Chang Chung-Ling.** Funds were channeled through the **Global Opportunities Fund (GOF),** revealing significant investments.
- **UAE-based firm Excel Investment and Advisory Services**, owned by **Vinod Adani**, received substantial **advisory fees** from these funds.
- There's prima facie evidence suggesting these entities served as **fronts** for Vinod Adani's massive investments in Adani group stocks, potentially breaching securities regulations.

SEBI and DRI Probe:

- OCCRP reveals correspondence between the **Directorate of Revenue Intelligence (DRI) and SEBI in 2014** regarding Adani group's stock market dealings.
- **SEBI's former chairperson's connection to the Adani group** adds complexity to the situation.
- SEBI claims to have conducted numerous investigations into **Adani-Hindenburg matters** but faces challenges in identifying "**economic interest shareholders"** in suspected overseas entities.

Key Organizations and Terms:

OCCRP (Organized Crime and Corruption Reporting Project):

- An international **non-profit organization** of **investigative journalists.** Specializes in

exposing corruption, money laundering, and organized crime.

- **Collaborates with news outlets worldwide** to publish in-depth investigative reports.

SEBI (Securities and Exchange Board of India):

- India's regulatory authority for **securities and commodity markets** was established under the **Securities and Exchange Board of India Act, 1992.**
- **Regulates and supervises market activities** to protect investors and ensure market integrity.
- Enforces **securities laws and issues guidelines** for market participants. Promotes **transparency, fairness, and efficiency in the Indian financial markets.**

Directorate of Revenue Intelligence (DRI):

- A government agency under the **Central Board of Indirect Taxes and Customs, Department of Revenue, Ministry of Finance**.
- Responsible for **investigating customs, excise, and tax-related offenses.** Focuses on curbing smuggling, tax evasion, and illegal financial activities. Works to ensure **compliance with customs and taxation laws.**

SCRR 1957 (Securities Contracts (Regulation) Rules 1957):

- A comprehensive rulebook governing securities transactions in India under the **Securities Contracts (Regulation) Act, 1956.**
- Contains provisions related to **trading, listing, and regulation of securities.** Provides the **legal framework** for the functioning of the Indian securities market.

Continuous Listing Requirement:

- A **regulatory framework** that stipulates ongoing obligations for listed companies under the **Listing Obligations and Disclosure Requirement (LODR)** Regulations.
- Includes rules related to **corporate governance, financial reporting, and disclosures.**
- Aims to maintain market integrity and **protect investor interests. Requires companies to meet specific criteria to remain listed on stock exchanges.**

Tax Haven-Based Shell Companies:

- Entities registered in **jurisdictions with low taxes** and strict financial secrecy laws, often Important for the subject to international agreements and conventions against tax evasion.
- Often used for legitimate tax planning but **can also be exploited for illegal financial activities.**
- May facilitate **tax evasion, money laundering, and concealment of beneficial ownership,** Important for the subject to international anti-money laundering standards.

Foreign Portfolio Investors (FPIs):

- Foreign entities, including institutional investors and individuals, **invest in the securities markets of another country.**
- Often **Important for the subject to regulations and reporting requirements by the host country's regulatory body**, e.g., SEBI in India.

Economic Interest Shareholder:

- A term referring to a shareholder or entity that **holds an economic or financial interest in a company**, often **distinct from legal ownership.**
- May have a stake in the **company's profits, losses, or financial performance without necessarily holding the formal legal title to shares.**

Ultimate Beneficiary Ownership:

- A concept related to **identifying and verifying the actual individuals or entities that ultimately benefit from or control an asset or entity**, particularly in cases of complex ownership structures.
- Often a focus of **anti-money laundering (AML) and know-your-customer (KYC)** regulations to prevent hidden ownership and **illicit** financial activities.

Round Tripping

- Money **leaves the country** through various channels such as **inflated invoices, payments to shell companies overseas, the hawala route** and so on.
- After cooling its heels overseas for a while, this money returns in a freshly laundered form; thus completing a round-trip.
- How does the money return to India? It could be invested in offshore funds that in turn **invest in Indian assets**. The Global Depository Receipts (GDR) and Participatory Notes (P-Notes) are some of the other routes that have been used in the past.

Topic 47. STATE BANK OF INDIA ALLOWS CBDC USERS TO LINK TO UPI

Important for the subject: Economy

SBI has introduces UPI interoperability in its Digital Rupee (e rupee). SBI has introduced UPI interoperability in its Digital Rupee (e rupee), also known as the Central Bank Digital Currency (CBDC).

- This feature is accessible through the 'e rupee by SBI' application and allows SBI CBDC users to scan merchant UPI QR codes for transactions.
- SBI believes this integration will have a significant impact on the digital currency ecosystem. The bank strives to provide secure and efficient transaction solutions.
- SBI was among the first few banks to participate in the RBI's retail digital e-rupee project in December 2022.

- SBI said the seamless integration of CBDC with UPI will enhance the acceptance and utilization of digital currencies in everyday transactions.
- A few banks, including State Bank of India, Bank of Baroda, Kotak Mahindra Bank, Yes Bank, Axis Bank, HDFC Bank and IDFC First Bank, have introduced UPI interoperability on their digital rupee application.

What is UPI QR code-CBDC interoperability?

- Interoperability of UPI with the digital rupee means all UPI QR codes are compatible with CBDC apps. Initially, when the pilot for the retail digital rupee was launched, the e₹-R users had to scan a specific QR code to undertake transactions.
- However, with the interoperability of the two, payments can be made using a single QR code. The digital rupee issued by the RBI, or the **CBDC, is a tokenised digital version of the rupee.**
- The e₹ is held in a digital wallet, which is linked to a customer's existing savings bank account. UPI is directly linked to a customer's account.
- Interoperability of UPI and CBDC will ensure seamless transactions between a customer and merchant without having the need to switch between multiple digital platforms.

Topic 48. CCI TO SPELL OUT NORMS ON SIGNIFICANT BUSINESS OPERATION

Important for the subject: Economy

Competition Commission of India is likely to issue draft proposals this month on the calculation of **deal value threshold (DVT)** and what constitutes **significant business operations (SBO)**.

- After the amendment of the Competition Act, 2002, in April this year, **CCI's nod is needed** for Mergers and acquisitions (M&A) is needed if the transaction is valued at **over Rs 2,000 crore**, and if the target entity being acquired or merged has substantial business operations in India.

Why was the change brought?

- In the past, several transactions, especially in the digital space, were concluded without the CCI's review, despite the potential impact on competition.
- With so many companies being multinational, there is a need to have objective criteria for jurisdiction in competition matters.

What is the SBO test?

- Tests for significant business operations to be similar to that applied in Germany, Austria. For digital companies, the determinants could include monthly subscribers, unique visitors.
- Turnover from India, market share, location and access to data of Indian customers are

other factors.

- For pharma firms an R&D centre or a contract manufacturing unit in India could determine SBO.

Topic 49. PROBLEM POSED BY CONVERGING NOMINAL AND REAL GDP

Important for the subject: Economy

Basis For Comparison	Nominal GDP	Real GDP
Meaning	Nominal GDP is Sum-total of economic output produced in a year valued at current market price	Real GDP is Sum-total of economic output produced in a year valued at a pre-determined base market price
Effect of Inflation	Nominal GDP doesn't take inflation into account	Real GDP is a Inflation-Adjusted GDP
Expressed in	Current Market Price	Base Year's Market Price
Value of GDP	Is much higher since current market changes are taken into effect	Is much lower since market price of the base year is taken into consideration
Uses	Can be compared with various quarters of the given year	Can be compared with two or more financial years

GDP growth rates show interesting behaviour with both nominal and real terms are almost the same.

- GDP growth rates show interesting behaviour with both nominal and real terms are almost the same (convergence), at 7.8-8 per cent.
- This means there is hardly any difference in the growth rates when production is reckoned at current prices and at constant **(base 2011-12**) prices.
- Normally the growth in GDP in nominal terms tends to be higher than that of real GDP.

What is causing this convergence?

- The answer lies in the queer case of inflation in India, where CPI inflation is moving in the positive direction, and the WPI inflation is in negative territory.
- For every component of nominal GDP there are **appropriate price deflators**. And in this calculation, the **WPI indices** are generally used. Hence, if WPI inflation is in the negative zone, which is what it was in Q1, then growth at both constant and current terms would tend to converge.

What are the implications of this trend?

- It is critical from the point of view of targeting fiscal plans as well as external balances.
- Low nominal growth will come in the way of achieving the target of a $5 trillion economy; the time taken to reach this mark will be more.
- Revenue receipts on both taxation and disinvestment will be challenged this year. This is

so as tax collections are contingent on GDP increasing at a faster tick which provides buoyancy to the system.

- Care must be taken when interpreting any of the policy ratios such as **fiscal deficit to GDP ratio, current account deficitto GDP ratio** as the **denominator effect** can exert undue influence.
- With the denominator of this ratio, GDP in nominal terms, being lower than was expected the current account deficit is likely to be pushed ahead.
- With the growth rate now coming down to 6.5 per cent , the denominator effect will automatically raise the fiscal deficit ratio as the GDP will be lower in nominal terms.
- Further on the fiscal side the debt-to-GDP ratios will also tend to look higher.

Real and Nominal GDP growth

- **Nominal Growth Rate**: The nominal growth rate represents the economic growth rate without adjusting for inflation. It is calculated using the current market prices of goods and services. Nominal GDP growth reflects both changes in the quantity of goods and services produced (real growth) and changes in their prices due to inflation.
- **Real Growth Rate**: The real growth rate, on the other hand, adjusts for the effects of inflation. It measures the increase in the production of goods and services after removing the impact of rising prices. Real GDP growth reflects changes in the quantity of goods and services produced, holding prices constant.
- The nominal and real growth rates of an economy **can be the same when there is no inflation**. In other words, when the inflation rate is zero, nominal and real growth rates will be equal. When there is no inflation (i.e., the general price level is stable, and prices are not rising), the prices used in calculating nominal GDP remain the same as those used in calculating real GDP. In this situation:
- Nominal GDP Growth Rate = Real GDP Growth Rate (since there is no inflation) However, in most real-world economies, some level of inflation is typically present.

In such cases:

- Nominal GDP Growth Rate > Real GDP Growth Rate (because nominal GDP reflects both quantity and price changes due to inflation).
- The **difference between the nominal and real growth rates represents the inflation rate**. So, if you want to calculate the inflation rate when you know the nominal and real growth rates, you can use the following formula:
- Inflation Rate = Nominal Growth Rate – Real Growth Rate

Price Deflators

- Price deflators are economic indicators used to adjust nominal values for inflation, converting them into real values.
- They are essential for accurately assessing economic growth, comparing economic

variables over time, and analysing the impact of policies.

- Price deflators are constructed using price indices and play a key role in converting nominal GDP into real GDP, providing a more accurate measure of an economy's actual production levels.
- The formula for calculating a price deflator is: **Price Deflator = (Nominal Value / Real Value) x 100**

Topic 50. GOVT TIGHTENS 'BENEFICIAL OWNER' RULES UNDER PMLA

Important for the subject: Economy

Government has further tightened **rules for the ultimate beneficiary** and finetuned the definition of reporting entity under the **Prevention of Money Laundering Act (PMLA)**

- The Finance Ministry has notified changes in the Prevention of Money Laundering (Maintenance of Records) Rules, 2005.
- These amendments aim to give more power to the agency under the PMLA Act and enlarge the type and nature of individuals who can come under the ambit of the Act.

What are the changes?

- A person having **ownership of more than 10 per cent** of the capital or profits of a partnership will be brought within the ambit of sub-rule 3 as a 'beneficial owner'. Earlier, this limit was 15 per cent.
- Similarly, a person, **who does not have any ownership or entitlement** to more than 15 per cent (**now 10 per cent**) of capital or profits of the partnership **but exercises control over the partnership** through other means, will be treated as a beneficial owner.
- A person is said to exercise control if he has the right to control management i.e, make appointments to the management etc., and also controls policy decisions of a partnership.

What will be the impact?

- In the short term, compliance related complexities may see an increase. Would lead to greater regulation and transparency vis-à-vis the operations of trusts, family offices which were often used to bypass reporting requirements. Would address the problem of money laundering and market manipulation.

Topic 51. CBDCS CAN MAKE PAYMENTS ACROSS BORDERS EFFICIENT: DAS

Important for the subject: Economy

RBI Governor highlights the benefits to cross border payments from adoption of the Central Bank Digital Currencies (CBDCs).

RBI Governor said that the adoption of Central Bank Digital Currency (CBDC), or digital currency, can help in making cross border payments more efficient.

- The key challenges to existing cross-border payments continued to be **high cost, low speed, limited access and insufficient transparency**.
- And adoption of the Central Bank Digital Currencies (CBDCs) can make crossborder payments efficient.
- Faster, cheaper, more transparent, and more inclusive cross-border payment services would deliver widespread benefits to people and economies worldwide. It would also support economic growth, international trade and financial inclusion.
- Instant settlement feature, I believe, CBDCs can play an important role in making cross-border payments cheaper, faster and more secure.
- They can help in reducing illicit finance risk; forex and technology solutions for currency settlement; and technology solutions for multilateral cross-border CBDC platforms.
- India is one of the few countries which have launched CBDC pilots in both wholesale and retail segments

Way ahead:

- Developing solutions and technologies for multilateral cross-border CBDC platforms which could contribute to interoperability across multi-CBDC platforms or domestic payment systems;
- Reduce operational cost; and increase efficiency, while ensuring consistency in standards across multiple jurisdictions

What is CBDC?

- The term central bank digital currency (CBDC) refers to the virtual form of a fiat currency.
- A CBDC is an electronic record or digital token of a country's official currency.
- As such, it is issued and regulated by the nation's monetary authority or central bank. As such, they are backed by the full faith and credit of the issuing government.
- CBDCs can simplify the implementation of monetary and fiscal policy and promote financial inclusion in an economy by bringing the unbanked into the financial system.
- Because they are a centralized form of currency, they may erode the privacy of citizens.
- Although they aren't formally being used, many countries are exploring the introduction and use of CBDCs in their economy.

Topic 52. INDIAN-ORIGIN SINGAPORE EX-MINISTER ELECTED PRESIDENT

Important for the subject : International Relations

Indian-origin Singapore ex-minister elected President.

Indian-origin **ex-minister Tharman Shanmugaratnam** have been elected as the **ninth president of Singapore** with **70.4 per cent of the votes**, and became the **third Indian-origin**

person to **head the prosperous city-state**

Who is Tharman Shanmugaratnam:

- **Tharman Shanmugaratnam** is a **distinguished economist.** Tharman is the **son of Emeritus Professor K. Shanmugaratnam**, a medical scientist known as the **"father of pathology in Singapore".**
- Tharman Shanmugaratnam is a **distinguished economist** and was the **Chairman of the Monetary Authority of Singapore,** the de facto central bank**, between 2011 and 2023,** and the **Deputy Chairman of the Government of Singapore Investment Corporation (GIC) between 2019 and 2023.**
- He has served as **chair of the Board of Trustees of the Group of Thirty**, **World Economic Forum** and a **member of the United Nations Secretary-General's High-Level Advisory Board on Effective Multilateralism.**

Some Details about Singapore:

- Singapore is an **island country and city-state** in maritime Southeast Asia. It is **located about one degree of latitude north of the equator**, off the southern tip of the **Malay Peninsula, bordering the Strait of Malacca to the west, the Singapore Strait to the south, the South China Sea to the east, and the Straits of Johor to the north.**
- Singapore has **four official languages** i.e **English, Malay, Mandarin, and Tamil.** It has a **highly developed market economy**, based historically on **extended entrepôt trade**.
- Along with **Hong Kong, South Korea, and Taiwan, Singapore is one of the Four Asian Tigers.**

Topic 53. NOBEL BODY REVERSES INVITATION POLICY

Important for the subject: International Relations

The **Nobel Foundation** that administers the **prestigious awards, has reversed its invitation policy** and invited Russia, Belarus and Iran.

The **Nobel Foundation** that **administers the prestigious awards,** has **reversed its invitation policy and invited Russia, Belarus and Iran,** as well as the **leader of a far-right Swedish party,** who had **previously been banned.**

- The foundation said that **invitation for the 2023 events** was e**xtended to all countries with diplomatic missions in Sweden and Norway and parties** "**that have parliamentary representation via democratic elections,"**

More details about Nobel Prize:

- The Nobel Prize was **set up when businessman and entrepreneur Alfred Nobe**l died and left the majority of his fortune to the **establishment ofprizes in physics, chemistry, physiology or medicine, literature, and peace**

- The Nobel Prizes are **awarded annually in six categories**: **Peace, Literature, Physics, Chemistry, Physiology or Medicine, and Economic Sciences.**
- The **Economic Sciences category** was **added later in 1968** and is officially known as **the Sveriges Riksbank Prize in Economic Sciences** in Memory of Alfred Nobel.
- The **first Prizes** were awarded in **1901**
- The **Nobel Peace Prize** is **awarded in Oslo**, Norway, while the **others are awarded in Stockholm, Sweden.**
- The Nobel Prize **consists of a Nobel Medal and Diploma, and a document confirming the prize amount**
- **The Nobel Prize cannot be given posthumously and** it **cannot** be **shared between more than three people.** One **cannot nominate** himself/herself for a **Nobel Prize.**

Some details about the Nobel Foundation:

- The Nobel Foundation, a **private institution established in 1900**, has **ultimate responsibility** for fulfilling the **intentions of Alfred Nobel's will.**
- They also e**nsure that the prize-awarding institutions are guaranteed independence** in their work of selecting recipients.
- The Foundation is also **tasked with strengthening the Prize's position** by administering and developing the brands and intangible assets that have been built up during the Nobel history, which spans more than 100 years.
- The Nobel Foundation also **strives to safeguard the prize-awarding institutions' common interests.**

How are the Nobel Prize laureates selected:

What are the institutions that choose winners:

- The Nobel Committees of the prize-awarding institutions are responsible for the selection of the candidates, the institutions being:
- **Nobel Prize in Physics, Nobel Prize in Chemistry: The Royal Swedish Academy of Sciences**

Nobel Prize in Physiology or Medicine: The Karolinska Institutet

- **Nobel Prize in Literature: The Swedish Academy**
- **Nobel Peace Prize: A five-member Committee elected by the Norwegian Parliament (Storting)**
- **Prize in Economic Sciences: The Royal Swedish Academy of Sciences**

Who are the Indians (or individuals of Indian origin) who have been honoured with the Nobel:

- **Rabindranath Tagore (Literature, 1913),**

- **C V Raman (Physics, 1930)**
- **Hargobind Khorana (Medicine, 1968)**
- **Mother Teresa (Peace, 1979)**
- **Subramanian Chandrashekhar (Physics, 1983),**
- **The Dalai Lama (Peace, 1989)**
- **Amartya Sen (Economics, 1998)**
- **Venkatraman Ramakrishnan (2009)**
- **Kailash Satyarthi (Peace, 2014). Seven years on, mission to clean the Ganga remains a work in progress**

Topic 54. MYANMAR WILL NOT BE ALLOWED ASEAN LEADERSHIP IN 2026

Important for the subject : International Relations

Myanmar won't be allowed to lead Association of Southeast Asian Nations in 2026 Southeast Asian leaders have decided that **Myanmar will not take over the rotating leadership** of their regional bloc **as scheduled in 2026.**

- ASEAN leaders have **condemned the Myanmar military's removal of Aung San Suu Kyi's** democratically elected government and have demanded her release from detention, along with other officials. The **Philippines** will take over **the chairmanship of ASEAN in 2026**.

Some facts about ASEAN:

- ASEAN is a **political and economic organization** aimed primarily at promoting economic growth and regional stability among its members.
- It was **established on 8 August 1967 in Bangkok,** Thailand, with the signing of the **ASEAN Declaration (Bangkok Declaration)** by the f**ounding fathers** of ASEAN: **Indonesia, Malaysia, Philippines, Singapore and Thailand.**
- **Current members** of ASEAN are **Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam.**
- The m**otto of ASEAN** is "**One Vision, One Identity, One Community".** The ASEAN **Secretariat** is located in **Jakarta, Indonesia.**

How did ASEAN originate and evolve:

- **Association of Southeast Asia (ASA), 1961**: It was **formed by Indonesia, Malaysia, the Philippines, Singapore, and Thailand** to promote economic, cultural, and social cooperation.

Bangkok Declaration, 1967: It formally **established the ASEAN.**

- **First ASEAN Summit, 1976**: In the summit, member countries pledged to work towards regional peace and stability.

- T**reaty of Amity and Cooperation (TAC), 1976**: It esta**blished a framework** for peaceful relations and cooperation among member states.
- **ASEAN Free Trade Area (AFTA), 1992:** It aimed to **create a free trade area among member countries.**
- **ASEAN Charter, 2008**: It provides a **legal framework** for the organization and strengthens its institutional structure.
- **ASEAN Economic Community (AEC), 2015**: It aimed to **integrate the economies of member countries** and promote regional economic growth.

ASEAN joins Regional Comprehensive Economic Partnership(RCEP), 2020:

- ASEAN members join RCEP, a free trade agreement.

Topic 55. INDIA REJECTS UN EXPERT'S REMARK ON MANIPUR

Important for the subject : International Relations

India's response came after a **group of UN experts raised** alarm about reports of **'serious human rights violations and abuses' in Manipur.**

- India has termed comments on Manipur by UN experts as "unwarranted, presumptive and misleading".

What is Special Procedure Mandate Holders (SPMH):

- The **term 'special procedures'** refers to the **list of mechanisms** established by the **Human Rights Council** to report and **advise on human rights** from a thematic and country-specific perspective.
- **Special procedures mandate-holders** are **either an individual (called a Special Rapporteur (SR) or Independent Expert (IE)) or a Working Group (WG)** of five members.
- Mandate holders **serve in their personal capacities**, they **are not UN staff** and **do not receive salaries or other financial remuneration** for their work.
- Mandate holders are **appointed by the Human Rights Council** and their **work is supported by the OHCHR.**
- As p**art of their mandates**, special procedures examine, **advise and publicly report on human rights issues** and situations.
- They **conduct thematic studies** and **convene expert consultations, contribute to the development of international human rights** standards, **engage in advocacy and provide advice for technical cooperation.**

Some facts about UNHRC:

- It is an **intergovernmental body** within the United Nations system. The UNHRC **replaced** the **former UN Commission on Human Rights**. It was **created by the UNGA**

on **March 15, 2006**, and the **body met in its first session in June, 2006.**

- The **Council is made up of 47 UN Member States** who are **elected by majority vote** through a **direct and secret ballot** at the UNGA.
- The **membership of the Council** is based on **equitable geographical distribution.**
- **African and Asia-Pacific states have 13 seats each, Latin American and Caribbean states have 8 seats, Western European and other states have 7 seats, and Eastern European states have 6 seats**.
- The UNGA **takes into account the candidate States' contribution** to the promotion and protection of human rights, as well as their **voluntary pledges and commitments in this regard.**
- The members **serve for three years and are not eligible for immediate reelection** after **serving two consecutive terms.**

What's behind the violence in Manipur:

- Manipur was **boiling since February 2023**
- Manipur has been r**estive since February** when the **state government** launched an **eviction drive** seen as targeting a **specific tribal group.** The drive **led to protests** but not on the scale of the one seen recently.

High Court's order acted as a trigger point

- The recent protests were **triggered by the Manipur High Court's direction** to the State to pursue a **10-year-old recommendation to grant Scheduled**

Tribe (ST) status to the non-tribal Meitei community.

- The Court's order brought the **historical tensions between the valleydwelling Meitei community and the state's hill tribes to a boil.**
- A 'tribal solidarity march' was organised by the **All Tribal Students' Union of Manipur (ATSUM)** against the order of the High Court which led to the violent clashes at various places in Manipur during the course of this march.

Topic 56. EAST ASIA SUMMIT

Important for the subject: International Relations

Prime Minister arrives in Indonesia to attend the 18th East-Asia Summit.

Some facts about the East Asia Summit:

The **East Asia Summit (EAS)** is the **Indo-Pacific's premier** forum for strategic dialogue. It is the **only leader-led forum** at which **all key Indo-Pacific partners meet** to discuss political, security and economic **challenges facing the region, and has an important role to play in advancing** closer regional cooperation.

- The **concept of East Asia Grouping** was **first promoted in 1991** by the then **Malaysian Prime Minister, Mahathir bin Mohamad.**
- The **first summit** was **held in Kuala Lumpur**, Malaysia on **14 December 2005.** The **EAS has 18 members** – the **ten ASEAN countries** i.e **Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam** along with **Australia, China, India, Japan, New Zealand, the Republic of Korea, Russia and the United States.**
- **ASEAN leads** the forum, and the **chair position rotates between ASEAN Member States annually.**

Some facts about ASEAN:

- ASEAN is a **political and economic organization** aimed primarily at promoting economic growth and regional stability among its members.
- It was **established on 8 August 1967 in Bangkok,** Thailand, with the signing of the **ASEAN Declaration (Bangkok Declaration)** by the f**ounding fathers** of ASEAN: **Indonesia, Malaysia, Philippines, Singapore and Thailand.**

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How did ASEAN originate and evolve:

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- **ASEAN Charter, 2008**: It provides a **legal framework** for the organization and strengthens its institutional structure.
- **ASEAN Economic Community (AEC), 2015**: It aimed to **integrate the economies of member countries** and promote regional economic growth.
- **ASEAN joins Regional Comprehensive Economic Partnership (RCEP), 2020:** ASEAN members join RCEP, a free trade agreement.

Topic 57. INDIA SEES LOWEST AUGUST RAINFALL IN A CENTURY; SEPTEMBER IS LIKELY TO BE 'NORMAL': IMD

Important for the subject: Geography

Rainfall in August had been the **least in over a century,** with **India** getting **36% less rain** than it usually does in the month.

What was the usual trend?

- Of the four monsoon months, **August** usually sees the **most amount of rainfall (25.4 cm)** after July's 28 cm.
- The rainfall was deficient in the whole part of India except in **northeastern India**, the **Himalayan States,** and **parts of Tamil Nadu.**
- Earlier in **August 2005**, shortfall was about **25%** of the normal, and in **August 2009,** shortfall was about **24%** of the normal.
- There is an increasing trend in the **break days** (of Break in Monsoon). **Break days** refer to rainless stretches during the monsoon months of June September.

Regional analysis:

- Rainfall in August has brought the **overall national deficit** to **10%,** with the regional

deficits being:

- **17%** in east and northeast India, **10%** in central India, and **17%** in southern India.
- Monsoon rainfall in **September**, the **last of the four monsoon months,** is likely to be within a **10% window** of the **16.7 cm** that's usual for the month.

Probable reason for rainfall deficit:

- Strengthening of **El-Nino**. Unfavorable conditions both in the Arabian Sea and the Bay of Bengal.

Topic 58. STUDY FINDS FISH SURPRISINGLY RESISTANT TO MARINE HEATWAVES

Important for the subject: Geography

A new study has found that **fish** are surprisingly resistant to heatwaves in the ocean.

Researchers in **Canada, Europe** and the **United States** collaborated on the study, titled **Marine heatwaves are not a dominant driver of change in demersal fishes**.

- The study relied on data from **long-term scientific trawl surveys** of continental shelf ecosystems in **North America** and **Europe** conducted between **1993** and **2019**.
- **Trawl surveys** are conducted by towing a net above the seafloor to assess the abundance of species at the ocean's bottom. During the survey period, **248 marine heatwaves** with **extreme sea bottom temperatures** were included in the analysis.

Blob:

- The **Blob** was a **large mass of relatively warm water** in the **Pacific Ocean** off the coast of **North America**.
- The **Blob** is caused by **a combination of warmer air temperatures** (that warms the ocean's surface), **changes in the patterns of wind speed, direction and duration** (wind helps mix the ocean and by bringing cool water from depth) and **the persistent mass of warmer water along the equator** known as **ENSO**.
- This very warm mass of water is unusual, an anomaly. Nothing like it has been seen in the climate record since climatologists have been recording data in this region.
- It is unprecedented in its magnitude (how warm and widespread) and its duration (to last multiple years).

Impact of blob on marine ecosystem:

- The scientists looked at the **infamous "Blob"** that hit the **British Columbia coast** from **2014** to **2016**.
- The researchers studied how it affected populations of **demersal fish** or **groundfish,** which include some of the **world's largest fisheries** like **Alaskan pollock** and **Atlantic**

code.

- They found **no evidence** that **marine heatwaves** have a significant impact on regional fish communities.
- While **the Blob** resulted in a **22 per cent loss** of ground fish biomass in the Gulf of Alaska, a **2012 marine heatwave** resulted in a **70 per cent biomass gain** in the Northwest Atlantic.
- The scientists also considered whether **marine heatwaves were causing changes in the composition of fish communities,** looking for losses of species associated with cold water and an increase in species associated with warm water (known as **"tropicalisation"**).
- They found no consistent signature for such losses caused by marine heatwaves.

Marine heatwaves can lead to:

- Decay and bleaching of sponges and corals, seabirds dying in large numbers, water bodies witnessing harmful algal blooms, decimation of seaweeds and increased marine mammal strandings.

Topic 59. THREE-FOURTHS OF INDIA'S IRRIGATION SOURCES RUN ON ELECTRICITY: STUDY

Important for the subject :Geography

The latest edition of the **Minor Irrigation Census (MIC)** — a compendium of bore wells, tube wells, and other privately owned irrigation sources by farmers — finds that **electricity is the dominant source of power** to extract water, over diesel, windmills, and solar pumps.

About Micro Irrigation Census (MIC):

- A **micro irrigation scheme** is a type of irrigation project that uses surface water or groundwater to irrigate a **culturable command area (CCA)** of up to 2,000 hectares.
- Released by- **Ministry of Jal Shakti.** The **MIC** reports aren't a reflection of the present state of use. Because data collection requires collecting granular data down to the block level, it takes a few years to compile and make the data public.

Six MICs have been conducted so far:

- The **First Census of Minor Irrigation schemes** was conducted with reference year **1986-87**.
- The **Second Census** with reference year **1993-94** was conducted in all States and Union Territories, except Gujarat, Maharashtra and UTs of Chandigarh, Daman & Diu and Lakshadweep.
- The **Third Minor Irrigation Census** with reference year **2000-01** was conducted in all States and Union Territories except Daman & Diu and Lakshadweep.
- The **fourth Census** in the series was conducted with reference year **2006-07** in all States

and Union Territories except Daman & Diu and Lakshadweep.

- The **Fifth MI Census** was conducted with reference year **2013-14** in all States and Union Territories except Daman & Diu, Dadra and Nagar Haveli and Lakshadweep.
- The latest **Sixth MI Census** has been conducted with reference year **2017-18** in all States and Union Territories except Delhi, Daman & Diu, Dadra and Nagar Haveli and Lakshadweep.
- The **First census of water bodies** has also been taken up in convergence with the sixth **MI census**.

Key findings of the sixth MIC:

- **Significant increase in electricity usage-** From powering only **56%** of sources in **2011** to **70%** in **2017** shows electricity as powering **76%** of sources – a slower growth rate.
- This **electrification of groundwater withdrawal** corresponds to a **rise in the use of tube wells and borewells** that are capable of extracting water at greater depths.
- While **'dugwells'** or **ponds** that can draw water from a maximum depth of **15 meters**, remain the dominant source of groundwater, their number has declined from **87 lakh** to **82 lakh** between the **fifth** and **sixth editions.**
- **'Shallow' tube wells,** capable of drawing water from up to **35 metres** too, have **declined** from **59 lakh** to **55 lakh. 'medium-sized' wells** – capable of withdrawing water from up to **70 meters** – grew from **31 lakh** to **43 lakh** and **'deep' wells (beyond 70m)** rose from **26 lakh** to **37 lakh.**
- The report doesn't discuss the causes for the increase of more powerful, and deepreaching tubewells.

State wise analysis:

- The groundwater situation varies across the country. Because different state governments announce different schemes where farmers are incentivised or get access to loans to buy such tubewells.
- The **lower growth in electrification** is also likely to be a result of greater emphasis on energy efficient water extraction.
- Overall, **23.14 million Minor Irrigation (MI) schemes** were reported in the country from **695 districts** and **6, 47, 394 villages.** Out of all MI schemes, **21.93 million (94.8%)** were for groundwater (GW) and **1.21 million (5.2%)** for surface-water (SW) extraction.
- **Uttar Pradesh** had the largest number of MI schemes in the country **(17.2%)** followed by **Maharashtra (15.4%), Madhya Pradesh (9.9%)** and **Tamil Nadu (9.1%).**
- Leading States in GW schemes are **Uttar Pradesh, Maharashtra, Madhya Pradesh, Tamil Nadu** and **Telangana** whereas **Maharashtra, Karnataka, Telangana, Odisha** and **Jharkhand** have the highest share in SW schemes.
- The number of **MI schemes** increased by about **1.42 million** between the **fifth** and **sixth editions.**

- Most of the schemes **(96.6%)** were privately owned and small and marginal farmers, having less than two hectares of land, owned the majority of MI schemes.

Ownership Breakdown:

- Approximately **96.6%** of MI schemes are under private ownership. Among GW schemes, **98.3%** are owned by private entities, and in SW schemes, this share is **64.2%**.
- For the first time, data on the gender of MI scheme owners was collected. **18.1%** of individually owned schemes are owned by women.

Financing and Sources:

- Around 60.2% of schemes are financed through a single source. Own savings of individual farmers contribute significantly to single-source financing (79.5%).

Topic 60. AFTER LARGE RAINFALL DEFICIT IN AUGUST, HOW INDIA'S RESERVOIR LEVELS ARE FALLING CONSIDERABLY

Important for the subject: Geography

The **cumulative amount of water** in the **150 large and important reservoirs fell below the normal level** in August — the first time this has happened since the beginning of the current southwest monsoon season.

- The latest data from the **Central Water Commission (CWC)** show that these **150 reservoirs** across the country had about **113 billion cubic metres (BCM) of water**, which was about **10% below the normal**– or average of the last 10 years- storage at this time of the year.
- Biggest deficit is in the reservoirs of southern states, reduced to 49% of their original capacity.
- August is generally the rainiest month after July. Reservoir level should go up during August month.
- August 2023 was the driest August in the more than 120 years.
- August produced only about 162 mm of rain in the country as a whole, instead of the almost 255 mm that is expected, a deficiency of 36%.

Consequences of rainfall deficit:

- Unexpected increase in power demand mainly for irrigation activities. The share of coal in India's total power generation increased to 66.7% in August, the highest for the month in six years.

Significance of these reservoirs:

- Since the bulk of India's annual rainfall- nearly **75%**– comes during the **four-month southwest monsoon season,** these reservoirs are a **crucial source of water supply** for

the rest of the year, catering not just to **households** and **industrial uses**, but also for **power generation**.

Regional analysis:

- Central India had a rainfall deficiency of 47%. South India had a 60% deficit.
- The East and Northeastern region was the only one that received normal rainfall and the only region where water levels in the reservoirs did not show a declining trend in August.

Topic 61. INDIA THAT IS BHARAT

Important for the subject : History

A political row has erupted **after invites** for a dinner to be hosted by the President for world leaders, during the upcoming G20 Summit, were sent out in the name of the **'President of Bharat' instead of the customary 'President of India'.**

- A political row has erupted after invites for a dinner to be hosted by the President for world leaders, during the upcoming G20 Summit, were sent out in the name of the

'President of Bharat' instead of the customary 'President of India'

- There is speculation of an **official change in the name of the country from India to Bharat,** even though **Article 1 of the Constitution** uses the **two names interchangeably: "India, that is Bharat, shall be a Union of States."**

What is the history of the Nation's Names:

- The nation was known by different names. They are:

Bharat:

- The **roots of "Bharat", "Bharata", or "Bharatvarsha"** are traced back to **Puranic literature, and to the epic Mahabharata.**
- The **Vishnu Purana** describes Bharata as **the land between the sea in the south and the abode of snow in the north.**
- **'Bharata'** refers to the s**ubcontinental territory w**here the Brahmanical system of society prevails.
- Bharata is **also the name of the ancient king of legend** who was the **ancestor of the Rig Vedic tribe of the Bharatas,** and by extension, the progenitor of all peoples of the subcontinent.

Hindustan:

- The name Hindustan is thought to have **derived from 'Hindu'**, the **Persian equivalent form of the Sanskrit 'Sindhu' i.e Indus**, which came into currency with the Persian conquest of the Indus valley that began in the 6th century BC.

- By the time of the **early Mughals i.e 16th century**, the name **'Hindustan'** was used to describe the **entire Indo-Gangetic plain.**
- In the mid-to-late eighteenth century, Hindustan often referred to the **territories of the Mughal emperor**, which comprised much of South Asia.

India:

- The **Greeks used 'Indus' in place of 'Sindhu/Hindu'**. By the time the **Macedonian king Alexander** invaded India in the 3rd century BC, **'India' had come to be identified with the region beyond the Indus.**
- From the **late 18th century** onwards, British maps increasingly began to **use the name 'India', and 'Hindustan' started to lose** its association with all of South Asia.
- Part of the appeal of the term India may have been its **Graeco-Roman associations,** its long history of use in Europe, and its adoption by scientific and bureaucratic organisations such as the **Survey of India.**