July 2024

Prelims Specific Topics

Distinguished Service Awards

Context (PIB): The President of India presented Distinguished Service Awards.

About Ati Vishisht Seva Medal (AVSM)

- It was originally instituted as "Vishisht Seva Medal, Class II" in 1960 & was renamed AVSM in 1967.
- **Eligibility:** Awarded for **distinguished service of an exceptional order** to all ranks of the armed forces.
- **Eligible persons:**
  - ❖ All ranks of the Army, Navy and Air Force, including Territorial Army Units, & other lawfully constituted Armed Forces.
  - ❖ Nursing officers and other members of the Nursing Services in the Armed Forces.
  - ❖ It can also be granted posthumously.
- It is a **peacetime equivalent** of the **Uttam Yuddh Seva Medal**.

About Uttam Yudh Seva Medal (UYSM)

- Instituted in 1980.
- **Eligibility:** Awarded for distinguished service of an **exceptional order during war/ conflict/ hostilities**.
- **Eligible persons:** Same as AVSM. It can also be granted posthumously.

About Param Vishisht Seva Medal (PVSM)

- Instituted in 1960 as VSM Class-I, it was renamed as PVSM in 1967.
- **Eligibility:** Awarded for **distinguished service of the most exceptional order**.
- **Eligible persons:** Same as AVSM.

Gulbenkian Prize for Humanity

Context (TH): The **Gulbenkian Prize for Humanity** for 2024 was presented**.**

- ❖ For 2024, the award was presented to **Andhra Pradesh Community Managed Natural Farming (India), Professor Rattan Lal (USA/India)** and **SEKEM (Egypt).**

About Gulbenkian Prize

- Gulbenkian Prize is instituted by Portugal-based **Calouste Gulbenkian Foundation (CGF).**
- It was First awarded in 2020, it rewards **individuals** and **organizations** contributing to global food security, climate resilience and ecosystem protection.

- **Prize:** The Gulbenkian Prize for Humanity, granted yearly, is worth **1 million euros**. If more than one laureate is distinguished, the award will be **equally divided**.
- It is **not** intended as a '**lifetime achievement'** award, **nor** is it intended to be **seed funding**.

Eligibility

- It is open to nominations of any **individuals**, **organisations**, or **groups of people** and organisations from around the world.
- Applications should be submitted by third parties; **self-nominations are not permitted**.
- The prize **cannot be granted posthumously** or to an **organisation after ceasing its activity**, nor to **former members** of the Jury of the Prize.
- The nominations and all accompanying documents must be submitted in English.
- **Greta Thunberg** was the first recipient of the award in 2020.

Order of Saint Andrew the Apostle

Context (IE): PM Narendra Modi has become the **first Indian leader** honoured with **Russia's highest state decoration**, the '**Order of St Andrew the Apostle**'.

- In **2019**, Russia **announced** this award for the Indian PM, citing his "exceptional services" in promoting the special and privileged strategic partnership between Russia and India.

History and significance of the award

- It was established by **Peter the Great**, the **first Emperor of Russia**, around **1699**. It is the **oldest** of Russia's state decorations. It was **discontinued** in 1918 (**Russian Revolution**).
- In **1998**, it was **re-established** by an Executive Order of the President of Russia).
- It can be awarded to
  - ❖ **Russians** for exceptional services contributing to the country's prosperity, might, and glory.
  - ❖ **Heads of foreign states** and **governments** for distinguished merits to the Russian Federation.
- **Includes:** Badge, a star, a light blue silk moire ribbon and a sword for combat distinction.
- **Notable recipients:** Heydar Aliyev (Former President of Azerbaijan), Nursultan Nazarbayev (first President of Kazakhstan), and China President **Xi Jinping**.

PRAISE and SPARK Awards

Context (PIB): MoHUA's "Utkrishtata ki Ore Badhte Kadam" event awards the top performers under the PM SVANidhi and DAY-NULM schemes.

- It is awarded to States, urban local bodies, and lending institutions.

Performance Recognition for Access to Financial Inclusion and Street Vendor's Empowerment (PRAISE) Awards

- The best performing states in **'loan performance'** are **Madhya Pradesh**, Andhra Pradesh, and Punjab, while **Canara Bank**, SBI, and Bank of India were the top **lending institutions**.

Systematic Progressive Analytical Real Time Ranking (SPARK) Awards

- In overall state performance, **Kerala** ranks first, followed by Uttar Pradesh and Rajasthan, while **Himachal Pradesh** leads the **Northeastern and hilly states category**, followed by Tripura and Uttarakhand.

Deen Dayal Antyodaya Yojana – National Urban Livelihood Mission

- Launched by the **Ministry of Housing and Urban Poverty Alleviation**, Government of India in **2013**.
- **Objectives:** To reduce urban poverty, promote self-employment, create jobs, and improve the quality of life for the urban poor.
- It is a **Centrally Sponsored Scheme** with funding shared between the **Centre and States** at a **75:25** ratio, and at a **90:10** ratio for **North Eastern and Special Category States**.

Agarwood

Context (TH): India has successfully prevented inclusion of **agarwood** (Aquilaria malaccensis*)* in the **Review of Significant Trade (RST)** of CITES.

- It is a **fast-growing evergreen tree species native to Northeast India**, often referred to as the **"Wood of the Gods**" for its aromatic properties.
- It has **anti-inflammatory, anti-rheumatic, analgesic, and antioxidant properties**, and is used in the **aroma industry, water-based perfumes, medicine preparations,** and in the preparation of **air fresheners** and **purifiers.**
- It is cultivated in various parts of India, especially in **Assam, Manipur, Nagaland, and Tripura.**
- Agar formation occurs when some **fungi infect** a tree, often following damage caused by stem borer larvae.
- **Major Export destinations: UAE, Kuwait,** and **Saudi Arabia**.
- It is listed as **Critically Endangered** and is also included in **CITES: Appendix II.**

Implications

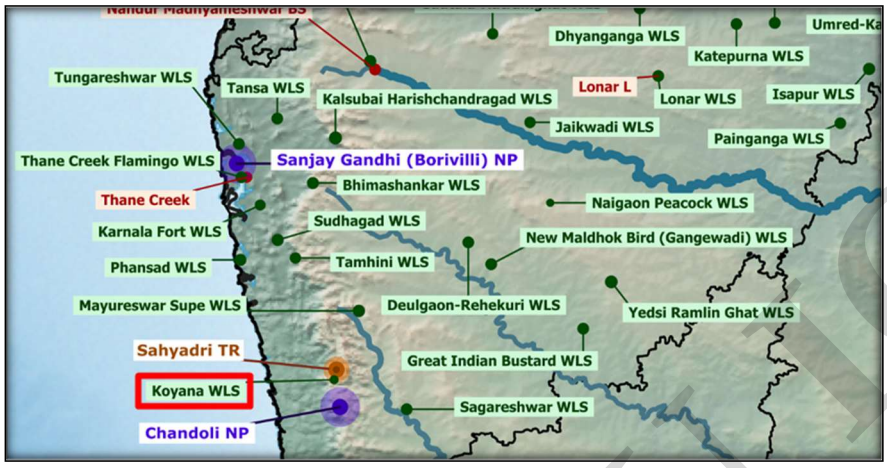
- **Benefits farmers** in Assam, Manipur, Nagaland, and Tripura as harvesting is allowed only from cultivated sources (not from existing wild populations).
- Allows the **legal trade** of agarwood and its derivatives, thereby curbing illegal trade and **reducing the cost of agarwood chips** in the global market.

Review of Significant Trade Management System

- It tracks the **progress of country/species combinations** selected for review, through the four stages of the Significant Trade Review.
- Species/country combinations currently subject to review are included, as well as those that have been eliminated from review, following satisfactory reports from the range State.

Brown Palm Civet *(Paradoxurus jerdoni)*

Context (PJ): A rare **brown palm civet** was seen in the **Koyna Wildlife Sanctuary**.



- The brown palm civet (*Paradoxurus jerdoni*) also called the **Jerdon's palm civet** is a palm civet **endemic to the Western Ghats** of India.
- **Physical description:** It has a uniformly brown pelage, darker around the head, neck, shoulder, legs, and tail. Unlike other civets, brown palm civets have **no distinct facial markings**.
- **Distinctive feature**: **Reversed direction of hair growth** on the nape, similar to the golden palm civet.
- **Distribution:** From Castle Rock in Goa to the southern tip of the Western Ghats in **Kalakkad Mundanthurai Tiger Reserve**.
- **Habitat:** They are **nocturnal**, arboreal, small carnivores that thrive in the high-altitude tropical rainforests of the Western Ghats in India. They prefer an altitudinal range of 500 to 1,300 m.
- **Diet:** They are predominantly **frugivorous**, with a diet consisting of 97% fruit.
- **Conservation Status:** **IUCN:** Least Concern | **CITES: Appendix III**
- **Ecological significance:** Their ability to disperse seeds over an extensive range and thrive in fragmented habitats could play a role in restoring patches of degraded forest in the Western Ghats.

Butterflies in India

Context (TH): Bannerghatta Butterfly Park highlights its role in conservation and the challenges of climate change and urbanisation on butterfly breeding.

- **Major Butterfly species found in India:** Kaiser-i-Hind, Malabar Tree-Nymph, Blue Pansy, Malabar Banded Peacock, Blue Mormon, Blue Duke, Tamil Yeoman, Common Birdwing, Common Peacock, Common Crow, Pioneer White, Dark Blue Tigers, Double-branded Crows, and Lime Swallowtail.

Jerdon's Courser *(Rhinoptilus bitorquatus)*

Context (TOI): Jerdon's Courser has not been visually spotted in over a decade.

- Jerdon's Courser, a **critically endangered** species, is exclusively **endemic to Andhra Pradesh**, specifically within the **Sri Lankamalleswara wildlife sanctuary** in Kadapa.
- It was considered extinct from the beginning of the 20th century until its rediscovery in 1986.
- **Physical appearance:** It has a yellow base to the black bill, a blackish crown, broad buff supercilium, and an orange-chestnut throat patch. A narrow white crown stripe runs on top of the head.
- **Habitat:** It inhabits open patches within scrub-forest.
- It is **crepuscular** and vocal at dawn and dusk.
- **Diet:** They are **insectivorous**, hunting invertebrates **by sight**.
- **Conservation Status: IUCN:** Critically Endangered | **WPA, 1972: Schedule I.**

Jumping spiders

Context (TH): Two **new species** of **litter-dwelling** jumping spiders from the evergreen forests of the southern **Western Ghats** were discovered.

- ***Habrocestum swaminathan***, discovered from river **Kunthi banks**, named after **M.S. Swaminathan**.
- ***Habrocestum benjamin***, collected from Thusharagiri, is named after **Suresh P. Benjamin**, a Sri Lanka-based jumping spider specialist.

> ⇨ ***Thusharagiri*** *is a waterfall near the foothills of the Nilgiri biosphere reserve.*

- **Significance:** It can reshape the understanding of the ecological dynamics and evolutionary processes within the spider communities of the Western Ghats.
- Jumping spiders, famed for their **extraordinary visual acuity** and **complex behaviours**, are the unsung heroes of **natural pest control** and vital indicators of **ecosystem health**.

Kharchi Puja

Context (PIB): Kharchi Puja, an ancient traditional **Hindu festival,** was celebrated in **Tripura**.

- **Festival of the 14 Gods:** Fourteen gods forming the dynasty deity of the Tripuri people are worshipped.
- On the day of the puja, deities are carried by members of **Chantai** (royal priest) to river **Saidra**, then bathed in the holy water and brought back to the temple.
- It is believed that **Tripura Sundari** (Mother Goddess), the presiding deity of Tripura, undergoes menstruation during the **Ambubachi** month in June. This event is believed to have impured the earth.
- Kharchi means "**cleaning of the sins**", conducted to cleanse the people's sins and purify the earth after the menstruation period concludes.
- **Originated** as a **tribal festival**, it is now celebrated in July by **both tribal** and **non-tribal** peoples.

Ancient Ostrich Nest Unearthed in Andhra Pradesh

Context (IE): Archaeologists have unearthed a 41,000-year-old **ostrich nest** in Prakasam, **Andhra Pradesh**. This discovery is considered the world's **oldest known** ostrich nest.

Megafauna

- **Megafauna** refers to animals weighing **over 50 kg**, a term first coined by **Alfred Russel Wallace** in 1876.
- These large animals are classified as **megaherbivores**, **mega carnivores**, or **mega omnivores** based on their diets. **Ostriches**, weighing 90-140 kg and 7-9 feet tall, fall into the mega omnivore category.

Co-evolution hypothesis

- A study by **Yale** and the Smithsonian's **National Museum of Natural History** (2020) suggests large animal extinction in India began around **30,000 years ago**, coinciding with **human arrival**.
- This research supports the "**co-evolution hypothesis**," which proposes that fauna's resilience to extinction may have resulted from coevolution with **hominins** (humans and their relatives).
- It proposes that **geographic isolation** and **environmental changes** may have accelerated extinction.

Previous Evidence of Ostriches in India

- 1884: Richard Lydekker found evidence of the **extinct Asian ostrich** (Struthio asiaticus) in the Dhok Pathan deposits of the **Upper Siwalik Hills** (now in Pakistan).
- 1989: Archaeologist S. A. Sali discovered **ostrich eggshell beads** and engravings (50,000-40,000 years old) at an Upper Palaeolithic site in **Patne, Maharashtra**.
- 2017: **CCMB** researchers in Hyderabad identified ostrich presence in Rajasthan, Madhya Pradesh, and Gujarat 25,000 years ago through fossilised eggshells linked to **continental drift** from **Gondwanaland**.

About Ostrich

- The ostrich is a **flightless bird** and the **world's largest** avian species.
- The ostrich is the **tallest** and **heaviest** bird in the world.
- They inhabit the **savannas** and **desert regions of Africa**.

- It derives most of its hydration from its plant-based diet.
- Ostriches are **exceptional runners** and can achieve sprint speeds of up to 43 miles per hour.
- Ostriches live in **small herds**, typically of fewer than a dozen birds. These groups are led by **alpha males** who mate primarily with the dominant hen.
- **IUCN Status: Least Concern**.

46th UNESCO World Heritage Committee Meeting

Context (TH): India, for the **first time**, will chair and host the **World Heritage Committee**.

- 45th session was held in **Riyadh**, **Kingdom** of **Saudi Arabia** (2023).

> ⇨ *India currently has **42 UNESCO World Heritage Sites**. Of these, 34 are cultural, 7 are natural, and 1 is mixed (cultural and natural).*
>
> ⇨ *The latest additions are:*
>
> - *42nd: Hoysala temples of Belur, Halebid and Somananthpura.*
> - *41st: Santiniketan (West Bengal) established by Nobel laureate Rabindranath Tagore.*

World Heritage Committee

- The World Heritage Committee comprises representatives from **21 States Parties** to the **World Heritage Convention (1972)** elected by the **General Assembly of UNESCO**.
- The **term** of office is **six years**, but most members **serve four years** to allow **rotation** among countries.
- **India** is a member of the World Heritage Committee from **2021-2025**.
- The Committee meets **annually** to discuss cultural and natural heritage site conservation.
- Its strategic objectives include the **"Five Cs"**

❖ **Credibility:** Strengthen the Credibility of the World Heritage List.

❖ **Conservation:** Ensure the effective Conservation of World Heritage properties.

❖ **Capacity-building:** Promote the development of effective Capacity-building measures.

❖ **Communication:** Increase public awareness, involvement and support through communication.

❖ **Communities:** Enhance the role of communities in implementing the World Heritage Convention.

Anand Marriage Act

Context (PIB): The National Commission for Minorities took the initiative to discuss the implementation and registration of Sikh marriages under the **Anand Marriage Act** with 18 States/UTs.

- The **Anand Marriage Act** for Sikhs had been initiated during the British Era in **1909** but had not been implemented till 2012.
- The Anand Marriage (Amendment) Bill was passed by India's parliament in **2012**, allowing **Sikhs to register their marriages** under the Anand Karaj Marriage Act **rather than the Hindu Marriage Act**.
- The Act aimed to acknowledge and **respect the customs and practices of the Sikh community**.
- While the central government approved the amendments, it was left for individual states and Union territories to frame respective rules for the registration of Anand marriages.

Araku Valley Coffee

Context (TH): Araku Valley Coffee was recently discussed in the Mann Ki Baat program.

Araku Valley Coffee

- It is grown in the **hilly tracts** of **Visakhapatnam district**, **Andhra Pradesh**, and the **Odisha** region.
- They are cultivated at an elevation of **900m-1100m** Mean Sea Level.
- It is produced by tribals who follow **organic farming**, emphasising organic manures, green manuring, and organic pest management practices.
- Araku Valley Coffee was awarded the **Geographical Indication** tag in 2019.

Coffee

- In India, the major coffee-producing states are **Karnataka**, **Kerala**, **Tamil Nadu**, **Andhra Pradesh**, and **Odisha**. **Karnataka** leads in production, accounting for over **70%** of the total output.
- **Predominnty two species of coffee:** ***Coffea Arabica*** (Arabica) and ***Coffea Canephora*** (Robusta).
- **Arabica** is **particularly sensitive** to **climate** variations.

Ideal climatic conditions for coffee growth

- It requires **hot** and **humid** weather. **Dry weather** during **berry ripening** is crucial.
- **Temperature range**: 15°C to 28°C, **Annual Rainfall:** 150 to 250 cm, **Elevation:** 600 to 1600 meters above sea level. It is typically grown **under shade trees**.
- **Soil:** Well-drained, loamy soil **rich in humus**, **iron**, and **calcium** is ideal.

Ariane 6 rocket

Context (TH): Europe's Ariane 6 rocket successfully placed satellites into orbit after a 4-year delay.

About Ariane 6 rocket

- The Ariane 6 rocket is a **heavy-lift launch vehicle** developed by the **European Space Agency (ESA)** and **Arianespace.**

- It provides a **cost-effective**, flexible launch system for **commercial** and **government** missions.
- A combination of liquid and solid propellant engines powers the rocket.
- The Ariane 6 rocket has **two variants**:

Ariane 62	Ariane 64
• Two P120 solid boosters.	• Four P120 solid boosters.
• Mainly for government and scientific missions.	• They are intended for commercial dual-satellite launches.
• It can launch up to 4,500 kg.	• It can launch up to 11,500 kg.

European Space Agency (ESA)

- It is an **intergovernmental organisation** that manages space activities for its member states.
- It was established in **1975** and is headquartered in **Paris, France**.
- It also cooperates with other space agencies and partners on joint missions and projects, like the **International Space Station** and the **Rosetta mission** to comet 67P/Churyumov-Gerasimenko.

Arianespace

- It is a **commercial** and **government** launch service provider based in **France**.
- It operates from two launch sites, the **Guiana Space Centre** in **French Guiana** & **Baikonur Cosmodrome** in **Kazakhstan**, and three primary launch vehicles, **Ariane, Vega, and Soyuz**.

Asia's 1st Pre-clinical Network

Context (PIB): Asia's first and globally **ninth** health research-related "**Pre-clinical Network Facility**" under the **Coalition of Epidemic Preparedness Innovations (CEPI)** was inaugurated.

- The other labs are in the **USA, Europe,** and **Australia**.

Genetically Defined Human Associated Microbial Culture Collection Facility

- The facility will serve as a **nodal resource center** under the aegis of the Translational Health Science & Technology Institute (THSTI) in **Faridabad**.
- It will also serve as a **repository** of **genetically characterised specific pathogen-free animals** (including cryopreserved embryos and sperm) for researchers within the country.

Coalition of Epidemic Preparedness Innovations (CEPI)

- CEPI was launched at the **World Economic Forum (WEF**) in **Davos** in **2017** by the governments of **Norway** and **India**, the **Bill & Melinda Gates Foundation, the Wellcome Trust**, and WEF.
- **Headquarters:** Oslo, Norway.
- It is a global partnership between **public, private, philanthropic** and **civil society organisations**.
- **Objective:** To accelerate the development of vaccines against emerging infectious diseases and enable equitable access to these vaccines for people during outbreaks.

- **Funding:** Funded by the Wellcome Trust, Bill and Milinda Gates Foundation, **World Economic Forum (WEF),** Government of Norway, Japan, **India (Department of Biotechnology)** and Germany.

Asian Disaster Preparedness Centre (ADPC)

Context (PIB): India has taken over the Chair of **Asian Disaster Preparedness Centre (ADPC)** from China for the year 2024-25 in **Bangkok**, Thailand.

- ADPC is an **autonomous** International Organization for cooperation in and implementation of **disaster risk reduction** and **building climate resilience**
- It operates in **Asia** and the **Pacific region**.
- **Founding members**: **India** and eight neighbouring countries (**Bangladesh**, **Cambodia**, **China**, **Nepal**, **Pakistan**, **Philippines**, **Sri Lanka** and **Thailand**).

Battir

Context (TH): Israeli settlement has boomed since the Isarel-Palestine war in the **Palestinian village** of **Battir**, which has been a UNESCO World Heritage Site since 2014.

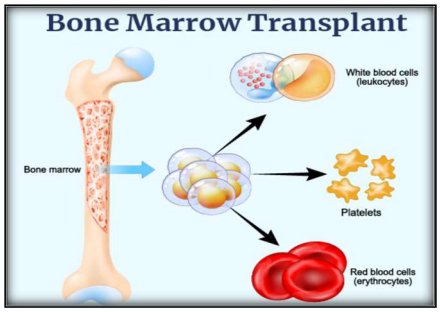
- In June 2024, Israel approved the settlement in **Heletz**, which is inside the protection zone for Battir.
- It is located a few kilometres **southwest of Jerusalem** and comprises a series of farmed valleys (**widian**).
- Terrace farming in this region is supported by an irrigation channel network fed by underground sources.
- **Other UNESCO World Heritage Sites in Palestine: Ancient Jericho** (Tell es-Sultan); **Birthplace of Jesus:** Church of the Nativity and the Pilgrimage Route; **Bethlehem** and **Hebron** (Al-Khalil Old Town).

Bone Marrow Transplant (BMT)

Context (TH): Call to make bone marrow transplant procedure available in Madurai Govt. Rajaji Hospital.

Bone marrow transplant (BMT)

- BMT involves **replacing diseased blood-forming cells** with **healthy ones**.
- **Blood-forming cells**, also known as **blood stem cells**, are **immature** cells located in the bone marrow, where they develop into red blood cells, white blood cells, and platelets.
- Once **mature**, these cells **exit the bone marrow** and **circulate** in the **bloodstream**.



Credit: Care Hospitals

Types of BMT

- **Autologous transplant:**
  - In this method, **blood-forming cells** are **harvested**, **preserved** by freezing, and stored.
  - Subsequently, they are **returned to your body** following **chemotherapy** (chemo) and sometimes **radiation therapy**.
- **Allogeneic transplant:**
  - In this method, **healthy blood-forming** cells are **donated** by **someone else**.
  - The donor **can be** a family member or someone **unrelated** to you.
- **Haploidentical transplant:**
  - A haploidentical transplant is a form of **allogeneic transplant** where healthy blood-forming cells from a **half-matched donor**, usually a family member, are used to replace unhealthy cells.

Stem Cells

- Stem cells are unique human cells with the ability to transform into various types of cells within the body, ranging from muscle cells to brain cells.
- Stem cell banking plays a crucial role in stem cell therapy.

Types of stem cell

- **Embryonic stem cells:**
  - These stem cells are present exclusively in the **earliest stages** of development.
- **Adult stem cells**
  - These are cells that proliferate to **repair adult organs** and **tissues** when needed.
  - They are found in **nearly all human body organs** and are **multipotent**, capable of generating a **limited range of mature cell types** specific to their residing tissues.
  - An example is **hematopoietic stem cells** in bone marrow, which produce various blood cells.
  - Certain tissue-specific stem cells, known as **unipotent** or **bipotent**, generate one or two types of mature cells; for instance, skin stem cells regenerate skin cells as unipotent cells.
- **Induced pluripotent stem cells, or iPSCs:**
  - These cells are **artificially created** in laboratories using cells from the body.
  - iPSC cells **exhibit characteristics** akin to **embryonic stem cells** and were first successfully generated in humans in 2007.

eSwasthya Dham portal

Context (PIB): The eSwasthya Dham portal is integrated with Ayushman Bharat Digital Mission (ABDM).

- It is a portal that helps monitor **the Char Dham Yatra pilgrim's health** parameters.
- It ensures the smooth journey of Yamunotri, Gangotri, Kedarnath, and Badrinath (Char Dham Yatra).
- Through the portal, the pilgrims can create their Ayushman Bharat Health Account **14-digit number**.

Char Dham

- Char Dham Yatra, or pilgrimage, is a tour of four **holy sites** - **Yamunotri, Gangotri, Kedarnath** and **Badrinath** –in the Himalayas.
- The **Yamunotri temple**, lodged in a narrow gorge close to the source of River Yamuna (the second-most sacred Indian river after River Ganga) in Uttarkashi district, is dedicated to **Goddess Yamuna**.
- The district of Uttarkashi is also home to Gangotri and is dedicated to **Goddess Ganga**.
- Kedarnath is located in the Rudraprayag district, which is dedicated to **Lord Shiva**.
- **Badrinath**, home to the sacred Badrinarayan Temple, is dedicated to **Lord Vishnu**.

Exercise MAITREE

Context (PIB): The **Indian Army** and **Royal Thailand Army (RTA)** will conduct their 13th joint Military Exercise MAITREE-2024 at **Fort Vachiraprakan** in **Tak Province**, **Thailand**.

About Exercise MAITREE

- It is an **annual** training event that has been held **alternately** in **India** and **Thailand** since 2006.
- Aims to practice joint **counter-insurgency** and **counter-terrorism** operations in jungle and urban environments under **Chapter VII** of the **United Nations Charter**.
- The exercise will focus on high physical fitness, joint planning, and joint tactical drills.

Human Space Flight Programme

Context (TH): Blue Origin has announced **India** as a **partner** nation in their **human spaceflight programme** for citizens.

More about the news

- **Blue Origin** will offer citizens from across the world **six seats** on a future mission of its reusable sub-orbital rocket, **New Shepard**.
- The selected astronauts will go for an 11-minute journey past the Kármán line (100 km), the internationally recognised boundary of space.
- Astronauts will experience several minutes of weightlessness during the controlled descent.
- The final candidate will be voted for by the public. They can garner votes by telling their story to the public, and voting will progress through candidate elimination across three phases.

Human Space Flight Missions

- It aims to take astronauts beyond Earth's atmosphere.
- **Soviet Union's Vostok program** was the **first** human flight mission which took **Yuri Gagarin** to **lower earth orbit** in April 1961.
- **Project Mercury** was the **first U.S. human spaceflight** program.
- The **Apollo program** of the **U.S.** made the **first human landing** on the Moon in 1969.
- **India's Gaganyan** mission plans to conduct a 3-manned flight at low-earth-orbit in 2024.

Hydrogen sulfide on exoplanet

Context (TH): First time traces of **hydrogen sulfide** were detected in the atmosphere of **any exoplanet**.

- **James Webb telescope** data shows that exoplanet **HD189733b** also has **water** and **carbon dioxide**.
- The Webb observations also **ruled out** the presence of **methane** in the planet's atmosphere.
- It was discovered in **2005** and is an extreme place **larger than Jupiter** (which **also** has **hydrogen sulfide**).
- It is strikingly **cobalt blue** and has **molten glass rain** that blows sideways in its fierce atmospheric winds.
- It is a rare "**hot Jupiter**" **gas giant**. Such planets are **much hotter** due to their proximity to host stars.
- HD 189733b planet orbits **170 times closer** to its **host star** than **Jupiter** does to the **sun**. Its orbit is **13 times nearer** to its **host star** than our innermost planet, Mercury.
- This results in a temperature of around 1,700 °F (930 °C) on the star-facing side of it.
- **Orbital period**: **Two days** instead of the **12 years of Jupiter**.
- **Location:** 64 light-years from Earth within the **Milky Way galaxy**, in the constellation **Vulpecula**.
- Its host star is **smaller** & **cooler** than the sun, only about a third as luminous, and part of a binary system.

> ⇨ *A **light-year** is the distance light travels in a year, 5.9 trillion miles (9.5 trillion km).*

INCOIS Enhances Indian Ocean Monitoring System

❖ **Context (IE):** The **Indian National Centre for Ocean Information Services** (INCOIS), based in Hyderabad, has significantly upgraded its system for monitoring the health of the **Indian Ocean**.

- The improved version of the **Regional Analysis** of Indian Ocean, a **data assimilation system** developed by INCOIS, now incorporates **Sea Surface Height Anomaly (SSHA)** data.
- The previous version relied solely on **salinity** and **sea surface temperature** data, not SSHA data.
- The new system gathers observations from the ocean surface and depths ranging from **3 to 2,000 meters**, allowing for more accurate **ocean current analysis** within the models.
- The inclusion of sea surface height data has led to improvements in **temperature** and **salinity structure analysis** and has resulted in a more accurate **geostrophic circulation** model of the ocean.

Indian Army Dress Code

Context (IE): The **Indian Army** has recently reinforced its **dress code regulations**, emphasising adherence to official rules regarding wearing **trinkets** and **religious symbols** while in uniform.

- It comes after observing personnel wearing unauthorised accessories in social media posts.

General Dress Code Principles

- No unauthorised **ornaments** or **emblems** are permitted with the uniform, but
- **Signet rings** are an exception and are allowed.

- **Watch chains** and **trinkets** must not be visible when worn with the uniform.

Religious and Cultural Symbols

- Chains or sacred threads around the neck are prohibited.
- If worn for religious reasons, they must be completely concealed.
- **Bracelets** are not allowed.
- A **single sacred thread** on the wrist is permitted only on days of religious significance.
- '**Kada**' (Sikh religious bracelet) is allowed for **Sikh** personnel and non-Sikh officers commanding Sikh troops. **Tilak**, **vibhuti**, or other religious symbols are prohibited while in uniform.

Regulations for Female Personnel

- Married women may wear **mangalsutra**, but it must not be visible.
- Only small earrings (up to 5mm diameter) are allowed.
- **Nose piercings** are permitted, but studs can only be worn with mess dress.
- Lipstick, coloured nail polish, and **bindis** are prohibited.
- **Sindoor** is allowed only if not visible when headgear is worn.
- Facial makeup, false eyelashes, and henna on hands are not permitted.

General Jewellery and Accessory Rules

- Only engagement, wedding, eternity, or signet rings are allowed.
- Rings are not to be worn during **ceremonial parades**.
- Watches are generally not worn during ceremonial parades except by the senior parade controller.
- **Pocket watches** with visible chains are prohibited.
- Deodorants and perfumes are strictly prohibited in uniform. **After-shave lotions** are permitted.

Indo-French Liver and Metabolic Disease Network

Context (PIB): The Union Minister of Science and Technology launched the **Indo-French Liver and Metabolic Disease Network (InFLiMeN)**.

About Indo-French Liver and Metabolic Disease Network (InFLiMeN)

- InFLiMeN is a collaborative initiative between India and France that focuses on research and development in the field of **liver and metabolic diseases**.
- The joint research programme is being supported under the aegis of the **Department of Science and Technology**, GoI, and the **Ministry of Europe and Foreign Affairs**, Government of France
- It aims to address **non-alcoholic fatty liver disease (NAFLD)**, which can progress to cirrhosis and primary liver cancer.
- It focuses on developing **low-cost diagnostic tests** and India-specific solutions to manage liver diseases.

Interaction Maritime 2024

Context (TH): Russian warships have arrived in the **Chinese port of Zhanjiang** to participate in the joint naval exercise "**Interaction Maritime 2024**".

- The exercise aims to demonstrate the navies' capabilities in addressing security threats and preserving peace and stability globally and regionally.
- Two Russian Steregushchiy-class corvettes, **Gromky** and **Rezky** (meaning **loud** and **sudden**, respectively), will participate in the exercise occurring in the Pacific.

International Centre for Audit of Local Governance

Context (IE): Recently, CAG inaugurated International Centre for Audit of Local Governance in **Gujarat**.

- It is the **country's first initiative** to establish global standards for auditing local governance.
- It would be a collaborative platform for policymakers and auditors linked with local governments.
- **Objectives**
  - ❖ Enhance the local government auditors' independence to ensure improved financial performance assessment, service delivery, and data reporting.
  - ❖ Act as a **think tank** to address governance issues and introduction of global best practices.

Llama 3.1

Context (IE): Meta has released its 'biggest and best' AI model, **Llama 3.1 405B**

- It's an **open-source AI** model with advantages like quick adaptability to new domains, flexible transfer learning, strong few-shot learning abilities, and efficient use of resources.

Open-Source AI

- It is an **artificial intelligence technology** accessible to commercial and non-commercial users under several open-source licenses.
- It comes with datasets, ready-to-use interfaces, and prebuilt algorithms to help developers embark on their app development journey.

Max Take Off Weight (MTOW) Drone

Context (IE): NewSpace Research and Technologies successfully tested a **100-kg MTOW drone** setting a high-altitude record at Umling La Pass, Ladakh.

Umling La Pass

- **Location:** 19,300 feet in **Ladakh**, the **highest motorable road** globally, **surpassing Khardung La Pass**.
- It was constructed under **Project Himank**, initiated by the **Border Road Organisation** in 1985.
- It connects **Chisumle** and **Demchok villages**, located near the Indo-China border in the eastern sector.

NIRMAN Portal

Context (PIB): **Union Minister for Coal and Mines** launched the Noble Initiative for Rewarding Mains Aspirants of National Civil Services Examination **(NIRMAN) Portal** in alignment with Mission Karmayogi.

About NIRMAN Portal

- It is announced by **Coal India Limited (CIL)**.
- Aims to provide **Rs 1 lakh** to UPSC Preliminary examination **qualified candidates** with annual family **income less than 8 Lakh** and belonging to **SC**, **ST**, **female or third gender** and are **permanent residents of any of the 39 operational districts of CIL**.

PLI Scheme for Critical Mineral Recycling

Context (IE): The **Ministry of Mines** is considering a **Production Linked Incentive (PLI) scheme** to promote the recycling of **critical minerals** in India.

- It aims to strengthen **domestic supply chains** and foster a **circular economy**, especially in light of the slight response to recent critical mineral block auctions.
- It aligns with NITI Aayog's policy recommendations and complements the **Battery Waste Management Rules (BWMR) 2022**, which mandate phased recycling of used EV lithium-ion batteries from 2026.

> ⇨ *NITI Aayog suggests parameters such as cell chemistry, recovery efficiency, and domestic utilisation benchmarks for developing the incentive structure.*

- The scheme aims to incentivise **e-waste recycling** or "**urban mining**" to recover critical minerals such as lithium, copper, cobalt, graphite, chromium, and silicon.
- India's e-waste generation, especially **solar PV module waste** and **EV batteries** is expected to surge due to growth in renewable energy infrastructure and EV adoption.

Battery Waste Management Rules (BWMR), 2022

- The Battery Waste Management Rules (BWMR) addresses **battery waste management** due to the rise of electric vehicles (EVs) and renewable energy storage.
- It applies to **all batteries**, including lead-acid and lithium-ion, and covers **manufacturers, importers, assemblers,** and **re-conditioners**.
- **Extended Producer Responsibility (EPR):** Manufacturers and importers must collect and **recycle** end-of-life batteries, setting up collection mechanisms from consumers and dealers.
- The rules include provisions for **penalties** in case of non-compliance with the EPR obligations.
- **Phased targets** for battery collection, starting at **30%** for lithium-ion batteries in the **first two years**, increasing to **70%** by the **seventh year**.
- The rules mandate **minimum recovery rates** for various materials in batteries. Lithium-ion batteries' recovery rates are set at 70% for cobalt, 95% for copper, and 90% for nickel.
- Battery manufacturers and importers must register with the **Central Pollution Control Board (CPCB)**. They must submit **annual returns** on the collection and recycling of used batteries.

Project 2025

Context (IE): Donald Trump has recently tried to distance himself from Project 2025

- Project 2025 is "a broad **coalition of conservative organisations** that have come together to ensure a successful administration begins in January 2025". It was unveiled in April **2023**.
- The project is overseen by the **Heritage Foundation**, a right-wing think tank.
- The Project 2025 document sets out **four main policy aims**: restore the family as the centrepiece of American life, dismantle the administrative state, defend the nation's sovereignty and borders, and secure individual rights to live freely.
- Project 2025's policy suggestions range in topics from foreign affairs to education.

SAMADHAN Portal

Context (PIB): Ministry of Labour & Employment launched **SAMADHAN Portal** as a **grievance redressal mechanism for industrial disputes** by the workmen, employers and trade unions under the Industrial Disputes Act, 1947.

- It ensures **efficiency** and **transparency** through online filing, faster disposal, and internal monitoring.
- It also covers cases under the **Payment of Gratuity Act, 1972**, **Minimum Wages Act, 1948**, **Payment of Wages Act, 1936**, **Equal Remuneration Act, 1976**, and **Maternity Benefit Act, 1961**.

SATHEE - The Coaching Portal

Context (PIB): The **Department of Higher Education** and **IIT Kanpur** launched the **SATHEE (Self-Assessment, Test and Help for Entrance Examination)** portal to assist students in preparing for competitive exams.

- It provides **free, high-quality** educational content and guidance to students across India through a web portal, mobile application, and TV.
- The content is created by experts from **IITs** and **AIIMS**s and includes features such as the **"Solve with Me"** platform with over 60,000 questions, NCERT video solutions, live classes, and NCERT-based learning. It also has a feedback mechanism supported by AI integration.

Solar and Wind energy

Context (TH): China is building two-thirds of new wind and solar capacity globally.

Solar energy

- **India** ranks **5th** globally in **installed power capacity** and is the **third-largest producer of solar power**.
- **Countries with the highest installed solar energy capacity:** China> USA > Japan> Germany > India
- **Indian states with highest solar energy capacity:** Rajasthan> Gujarat> Karnataka

Wind energy

- India ranks **4th** globally in **installed wind power capacity.**

- **Countries with the highest installed wind energy capacity:** China > USA > Germany > India
- **Indian states with highest wind energy capacity:** Tamil Nadu > Karnataka> Maharashtra

  - As of May 2024, Renewable energy sources, including large hydropower, have a combined installed capacity of 193.57 GW.
  - **Installed capacity for Renewables:** Solar Power > Large Hydro > Wind power > Biomass/Co-generation > Small Hydro Power > Waste to Energy

Space MAITRI

Context (TH): ISRO's NSIL announced **SSLV's first dedicated commercial launch**, deploying the **Optimus satellite** by Australia's Space Machines Company.

Space MAITRI (Mission for Australia-India's Technology, Research and Innovation)

- The Optimus satellite, weighing 450 kg, is Australia's **largest domestically designed** and built spacecraft.
- **Scheduled for 2026**, the mission emphasises Australia-India collaboration in technology and R&D.
- The mission aims to enhance space debris management and promote sustainable space operations.

Tehri Hydro Power Complex

Context (PIB): A **2400 MW** Hydro Power Complex is under construction in **Tehri Garhwal**, **Uttarakhand**.

- It is a multipurpose scheme on **river Bhagirathi**, a tributary of river Ganges and consists of **Tehri Hydro Power Plant**, **Koteshwar** Hydro Electric Project and Tehri Pumped Storage Plant (Tehri PSP).

River Bhagirathi

- It originates from the **Gangotri Glacier** near Gaumukh in **Uttarakhand**'s Uttarkashi district.
- Bhagirathi becomes **Ganga** when it meets the **Alaknanda** at **Devprayag** in Garhwal, Uttarakhand.
- **Tributaries:** Kedar Ganga, Jadh Ganga, Kakora Gad, Jalandhari Gad, Siyan Gad, Asi Ganga, Bhilangna.
- **Operational hydroelectric dams:** Maneri Dam, Joshiyara (Bhali) Dam, Koteshwar Dam and Tehri Dam.

Tianlong-3 rocket

Context (TH): Private Chinese space rocket **Tianlong-3** crashes after accidental launches during test run.

Tianlong-3

- Tianlong-3 (Mandarin for "**Sky Dragon**") is a **medium-lift** orbital **launch vehicle** developed by the Chinese private aerospace manufacturer **Beijing Tianbing**, also known as **Space Pioneer**.
- It is **partially reusable** (up to ten times). The first stage can perform an **autonomous vertical landing**.
- It can launch medium-sized payloads to **low Earth orbit (LEO)** and **sun-synchronous orbit (SSO)**.

- The performance of Tianlong-3 is comparable to **SpaceX's Falcon 9**, which is also a two-stage rocket.

Tinzaparin

Context (TH): Recently, researchers found that **tinzaparin** significantly reduces cell damage caused by spitting **cobra venom**.

- It is a **drug for serious blood clots** and works by **producing antibodies** that inhibit the synthesis of **heparan sulfate** (an anticoagulant) **targeted by the venom**.
- It is **inexpensive** and **widely available**.

Heparan sulphate

- It is a sugar compound present in all animal tissues.
- It regulates the formation of blood vessels and blood clots in the human body.

Tirzepatide – A weight loss drug

Context (IE): Central Drugs Standard Control Organization (CDSCO) of India, has proposed the approval of tirzepatide, an antidiabetic medication used for the treatment of **type 2 diabetes** and for **weight loss**.

- Tirzepatide is administered via subcutaneous injections (under the skin).

Warkari Sect

Context (IE): The Maharashtra government announced a pension scheme for **Warkaris**, who take part in the annual pilgrimage procession to **Lord Vitthal temple in Pandharpur**.

About Warkari Sect

- The Warkari sect has been a part of Hindu culture in Maharashtra since it emerged as a 'Panth' during the **Bhakti Movement** in the 13th century CE.
- The term '**warkari'** is a combination of two words: "***war***" (short for "wari") meaning "**pilgrimage**," and "***kari***" meaning **person who performs the pilgrimage**.
- It is a **non-Brahmanical tradition** that worships **Lord Vitthal** or Vithoba (deity of Pandharpur), which is seen as a form of **Vishnu or Krishna**.
- They chant the name of the **Lord** (nam japa), sing **abhangs** (holy song), and read **haripath** (sacred text), along the journey.
- They conduct their **annual pilgrimage** known as '**wari'** on the auspicious occasion of **Ashadi Ekadashi**.
- **Tukaram, Namdev, Chokhamela, Eknath**, and **Dnyaneshwar** are among the saints and gurus of the bhakti movement associated with the Warkaris, and they are all given the dignified title of '**Sant**.'
- Warkaris are strict Vegetarians. They wear a mala, or rosary, around his neck made of Tulasi beads.
- Warkaris typically **travel in groups, regardless of caste and creed**. They practice Brahmacharya throughout student life.

Water Nanoparticle Formation

Context (TH): Water microdroplets can break down minerals into nanoparticles, potentially revolutionising agriculture by infusing the soil with **silica nanoparticles**.

Unique Properties of Water Microdroplets

- **Enhanced Chemical Reactivity:** Water molecules at the surface of microdroplets (Less than 5mm) participate more readily in chemical reactions due to their **packed nature** and **limited space**.
- **Electric Charge Carriers:** Microdroplets are effective electric charge carriers, potentially accumulating ions from their surroundings, like saltwater at the beach.
- **Formation of Hydroxyl Ions:** Shrinking microdroplets can produce **hydroxyl ions (OH-)** and **free protons (H+)**, which enhance **surface acidity** and support diverse **chemical reactions**.
- **Role in Biochemical Processes:** Microdroplets **enable amino acids** to utilise free protons to form peptide linkages, highlighting their role in biochemical pathways.

Experiment to convert Water Microparticle to Nanoparticle

- Battery terminals deliver thousands of volts to mineral particles suspended in water. This process generated a mist of microdroplets that **fragmented mineral particles** into **nanoparticles** within 10 ms.
- Potential causes include the **infiltration of free protons** into **crystal layers** and **electric fields** from charged surfaces providing energy.
- Surface tension dynamics & repulsive forces on charged surfaces contributed to microdroplet disruption.

Weapon Systems School

Context (PIB): Weapon Systems School was inaugurated by the Chief of the Air Staff at the Air Force Station **Begumpet**, **Hyderabad**.

- The **Weapon Systems School (WSS)** aims to recalibrate and transform the Indian Air Force into a future-oriented force.
- The WSS will impart **effect-based training** that is contemporary in nature and prepare officers of the newly formed branch in line with the requirements of the IAF.
- Flight Cadets of WS Branch will undergo their second semester of training at this institute.

Weapon Systems (WS) Branch

- The Weapon Systems Branch was announced in **2022**.
- It will bring **ground based** and **specialist weapon systems** under one umbrella, enhancing the war capabilities of IAF.
- It offers four specialised streams to cadets to prepare them to handle surface-to-air weapons, remotely piloted aircraft, surface-to-surface weapon systems, and space-based intelligence.

World Heritage Young Professionals Forum (WHYPF) 2024

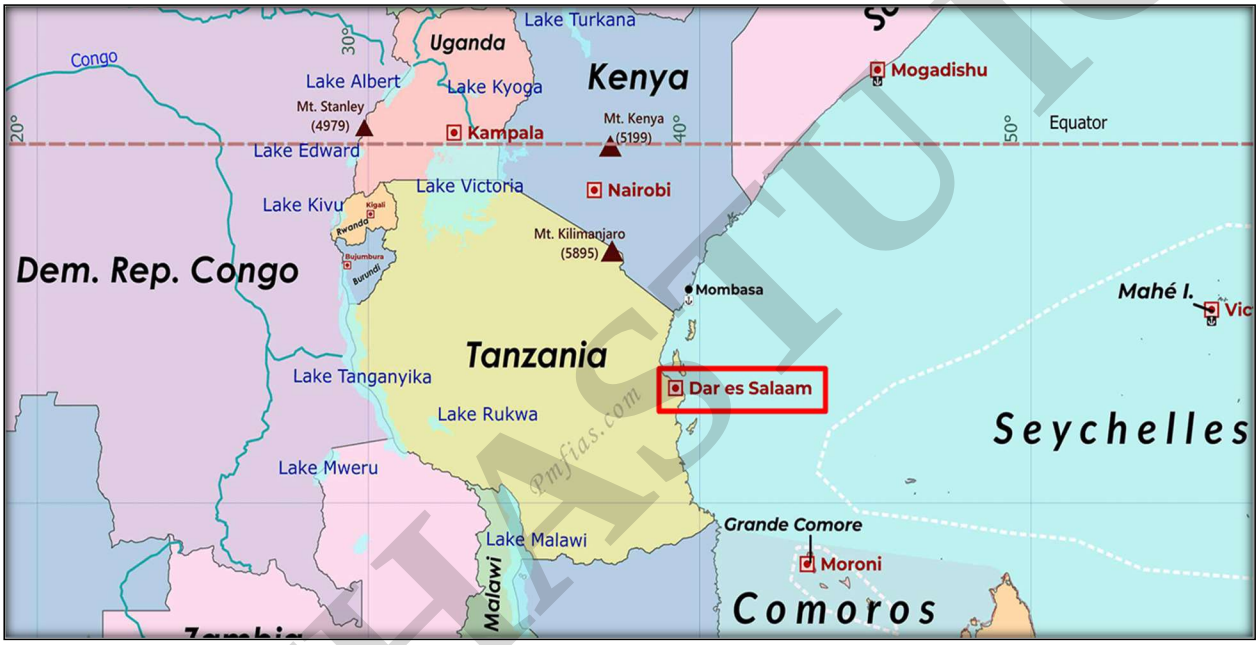
Context (PIB): The **Ministry of Culture** is hosting the **2024 World Heritage Young Professionals Forum** under the **UNESCO World Heritage Education Programme**.

- It is part of **UNESCO**'s prestigious World Heritage Committee meeting hosted by India.
- **Theme of WHYPF 2024:** "World Heritage in the 21st Century: Building Capacities and Exploring Opportunities for Youth."
- This year's sub-themes will focus on tackling **climate change** along with sustainable development.

Dar es Salaam

Context (DTE): Dar es Salam's residents face severe water shortages due to ageing infrastructure, rapid urbanisation, and inadequate government response.

- Dar es Salaam, **Tanzania's largest city**, is located in a bay along the **Indian Ocean** and has become a crucial **economic centre** for the **entire East African region**.



E.coli infestation in Seine River

Context (IE): Paris' outdated sewage system severely **infested** the **Seine River** with **E. coli**.

Seine River

- **Location**: **Paris,** empties into the **English Channel** at Le Havre.
- **Length**: 775 kilometres, **France's second-longest** river after the Loire.
- **Source**: Rises 446 meters above sea level near **Dijon in Burgundy**.
- **Course**: Flows through Paris for about 13 kilometres from west to east, joined by the **Marne River**.
- **Drainage Basin**: Covers approximately 79,000 square kilometres, draining **northern France**.
- **Geology**: The river basin comprises **permeable rocks**, which help reduce flood risk.
- **Precipitation**: Receives **modest annual rainfall** (650 to 750 millimeters).

Escherichia Coli (E. coli)

Aspect	Details
What is E. coli?	It is a **rod-shaped bacterium** found in the **intestines** of humans and most mammals.
Harmful Strains	Certain strains produce a **toxin (Shiga)**, which can damage the intestinal lining.
Symptoms	Tiredness, severe abdominal cramps, diarrhoea, urinary tract infections, nausea, vomiting, and, in severe cases, gastrointestinal perforation, high fever, bloody diarrhoea, and kidney failure.
Transmission	Via **contaminated food** & **water** tainted by faecal waste from humans & animals.

Brain-eating amoeba

Context (TH): Recently, **three deaths** have been reported in **Kerala** due to the rare and fatal infection of **primary amoebic meningoencephalitis (PAM)**.

Primary amoebic meningoencephalitis (PAM)

- PAM is caused by ***Naegleria fowleri***, an **amoeba** that thrives in **warm freshwater** lakes, ponds, rivers and poorly maintained **swimming pools**.
- This free-living microorganism primarily **feeds on bacteria** but can become **pathogenic in humans**.
- This **one-celled organism** can infect the **brain** and destroy the tissues, also called 'brain-eating amoeba'.
- These rare infections are fatal, with **97% mortality**. Most people die within one to 18 days.
- **Symptoms:** Headache, fever, nausea, and vomiting. Later symptoms include a stiff neck, confusion, lack of attention to people and surroundings, loss of balance, and hallucinations.
- **Conditions for infection**
  - ❖ During summer, swimming in lakes, ponds, or rivers can lead to infection.

- ❖ **High atmospheric temperatures** and **low water levels** increase the probability of spread.

- The amoeba enters the body through the **nose** and reaches up to the brain to infect it.
- In recent cases, children are found more **vulnerable** to it.
- **Treatment:** No standard treatment methods.

Wild Poliovirus Type-1

Context (TH): The goal of eradicating **wild poliovirus type-1 (WPV1)** by 2026 is more challenging now.

- **Reason:** WPV1, which is **endemic only in Pakistan and Afghanistan**, has been showing signs of a resurgence since 2023.

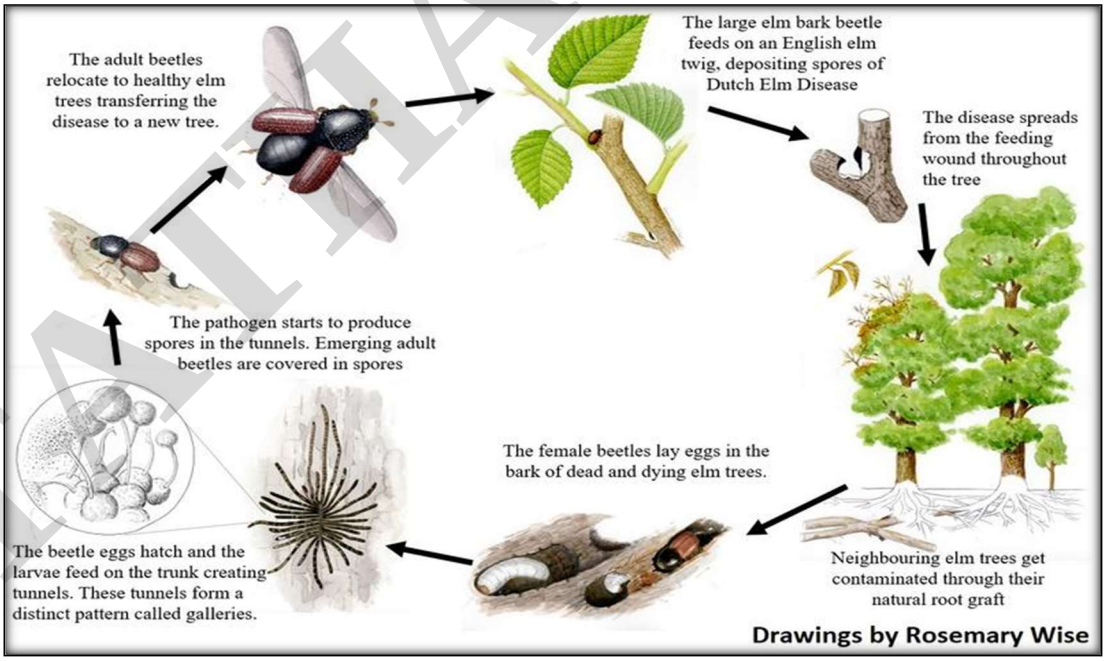
> ⇨ ***Endemic*** *refers to the constant presence and regular occurrence of a disease or condition within a specific geographic area or population group*.

Polio (Poliomyelitis)

- ***Polio (Poliomyelitis)*** is a disease caused by **poliovirus**.
- It causes **mild or no symptoms** in most people, but in some people, it can **cause paralysis or death**.
- There are three variations of poliovirus, called wild poliovirus types 1, 2 and 3 (**WPV1**, **WPV2** and **WPV3**).

Dutch Elm Disease

Context (DTE): The Dutch Elm disease has adversely impacted the Elm trees in the UK.



- **Dutch elm disease** is caused by two closely related **fungi**, *Ophiostoma ulmi* and *Ophiostoma novo-ulmi*.
- It is known as **vascular wilt** disease because the fungus blocks the **vascular (water transport) system**, causing the branches to wilt and die.

- **Transmission:** It is spread by **elm bark beetles**.
- **Symptoms:** Trees infected by root grafts wilt, their leaves turn brown, and the trees die rapidly, usually in the spring.

Elephant Endotheliotropic Herpesviruses (EEHVs)

Context (IE): Kerala has experienced a significant decline in the population of juvenile elephants due to **Elephant Endotheliotropic Herpesviruses (EEHVs)** over the last year.

- **Elephant Endotheliotropic Herpesviruses (EEHVs)** are a class of novel **double-stranded DNA herpesviruses** that cause acute haemorrhaging in juvenile Asian and African elephants. Severe cases cause death within 24 hours of infection.
- The disease has coexisted with elephants for millions of years; however, **young elephants** are particularly **vulnerable** because they have **lower EEHV-specific antibody levels**.
- EEHV is **not zoonotic** and does not pose a risk to public health.

Why are juvenile elephants in Kerala more exposed to EEHVs?

- **Calves in large herds** of elephants benefit from **shared immunity** through exposure to different EEHV strains, enabling them to develop the antibodies to fight the virus effectively.
- Kerala has **smaller herds**, with most elephant sightings (56%) reported as individuals and pairs.

Reasons for the small size of herds

- Decline in forest cover and sub-optimal elephant habitats.
- 'Biological invasions,' mainly the cultivation of alien species of plants like ***Acacia mangium*** and **eucalyptus** in forest tracts.
- **Lack of fodder** attracts herbivores to farmlands around the forest, leading to human-elephant conflict.

Herpes

Context (DTE): A study finds that high-income and upper-middle-income nations sustained the highest economic burden from herpes infections in 2016.

About Herpes Simplex

- Herpes disease is a group of **viral infections** caused by **herpes simplex viruses (HSV)**.
- Herpes simplex virus lives inside the **nerve cells** and alternates between inactive and active.
- **Transmission:** Through **direct contact** with infected person or by **contact with contaminated surfaces**.
- **Symptoms:** Development of painful sores or blisters, typically on the lips, mouth, genitals, and anus.
- **2 Types:**
    1. **Type 1 (HSV-1)**
        - Spread mainly by **oral contact**.
        - Causes infections in or around the mouth (oral herpes or cold sores).
        - It can also cause genital herpes.
        - Most adults are infected with HSV-1.

2. **Type 2 (HSV-2)**
    - ❖ Spreads by **sexual contact**.
    - ❖ Causes genital herpes.
    - ❖ Most people have no symptoms or only mild symptoms.
    - ❖ The infection can cause painful blisters or ulcers that can recur over time.

- **Treatment:** There is **no permanent cure** for herpes, but medications are available that suppress the symptoms and decrease the spreading of the infection to others.
- **Prevention:** Promotion of safe sexual practices can help prevent the transmission of genital herpes (HSV-2). Education on the risks associated with oral-genital contact for HSV-1 transmission is also emphasised.

Prevalence

- According to the 2016 data (last available estimates), **67% of the global population under 50** had **HSV-1** infection (oral or genital). Most HSV-1 infections are acquired during childhood.
- **HSV-2** type affects an estimated **13% of people aged 15–49 years** worldwide. HSV-2 **infects women almost twice** as often as men since sexual transmission is more efficient from men to women.

In India

- The National AIDS Control Organization (NACO) reported that the prevalence of herpes in India is between **3 to 10%**. It is higher in states like **Karnataka**, **Maharashtra**, and **Gujarat**.

Plague behind Neolithic decline

Context (IE): A new study, "**Repeated plague infections across six generations of Neolithic Farmers**", suggests that **plague** may have been the primary driver behind the '**Neolithic decline**'.

- Around **5,000 years ago**, the population in **northern Europe** collapsed, decimating **Stone Age** farming communities across the region.
- Researchers determined that the last strains of the plague-causing **bacterium Yersinia pestis** may have been more virulent to cause the epidemic.
- A later form of this same pathogen caused the **Justinian Plague** of the 6th century AD and the 14th-century **Black Death**, ravaging Europe, North Africa, and the Middle East.

Chimeroids

Context (TOI): Scientists have successfully grown **3D brain models**, known as **chimeroids**, for the first time, using **cells from multiple individuals**.

- The aim is to **replicate human brain biology more accurately** than traditional 2D cellular or animal models like lab mice.
    - ✓ **Advantage:** Brain organoids, typically derived from a single donor's cells, **lack genetic diversity** (which affects **brain development** and **drug responses**). Chimeroids **overcome this limitation.**
- Chimeroids exposed to **neurotoxic chemicals** like **ethanol** and **valproic acid** showed varied responses in growth inhibition among cells from different donors.

- To create the chimeroids, researchers collected **stem cells** from individuals and formed brain organoids from each person's cells using growth-inducing chemicals. Then, the cells were disassembled and recombined to ensure each chimeroid contained an equal number of cells from each donor.

> ***Stem cells*** *are cells with the* ***potential to develop into many different types of cells*** *in the body. They serve as a* ***repair system*** *for the body. Two main types of stem cells:* ***embryonic*** *and* ***adult stem cells****.*

- **Uses of chimeroids:** Disease modelling, drug testing, neural development studies, etc.

Cognitive Test

Context (IE): Amid concern over Joe Biden's fitness to stay in the race for the White House, there have been calls for the President to take a **cognitive test** to determine the level of his mental acuity.

- A **cognitive test** checks for **problems with certain brain functions** called "cognition" (**cognitive impairment**). Cognition includes thinking, learning, remembering, and using judgment and language.
- Cognitive testing is a structured and validated process that seeks to **identify deficits**, the **reasons for their occurrence**, and the **spheres of the subject's brain they affect**.
- It is recommended for people who have **memory deficits**, think they are losing memory or becoming forgetful, have difficulty focusing or in judgment, etc.
- Cognitive testing is often used to screen older adults for **mild cognitive impairment**).
- The test is basically like an exam in which a psychologist **checks functions** such as memory, retention, language functioning, calculating ability, and special organising ability to **evaluate the functioning of individual brain parts** responsible for each of these mental functions.

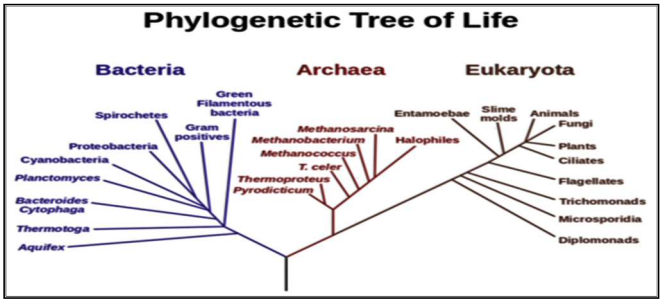
Last Universal Common Ancestor (LUCA)

Context (TH): In a new study, scientists have said the **last universal common ancestor (LUCA)** could have formed just 300 million years after the earth formed.

What is LUCA?

- The Last Universal Common Ancestor (LUCA) has been normally considered the **ancestor of cellular organisms** that originated in the three domains of life: Bacteria, Archaea, and Eukarya.
- It is the **node on the tree of life** from which the fundamental prokaryotic domains diverge.
- Genes in **all main branches of life** may have been passed down in an unbroken line from LUCA.

Key findings of the recent study



- LUCA could have originated around **4.2 billion years ago**, just 300 million years after the earth formed. Previous studies have suggested that life on the rocks emerged around 3.4 billion years ago.
- LUCA may have had a **small genome** of some 2.5 million bases and encoding around 2,600 proteins, all just enough to help it survive in a unique environmental niche.
- Metabolites produced by LUCA — compounds produced due to their metabolism — could have created a **'secondary' ecosystem** in which other microbes could have emerged.

Molecular clock/ Evolutionary clock

- The molecular clock concept was first put forward in 1962 by chemist Linus Pauling and biologist Emile Zuckerkandl.
- The molecular clock is a method that uses **biomolecular data** (generally mutation rates) to estimate the time needed for a certain amount of evolutionary change.
- The theory argues that DNA and protein sequences **mutate constantly** over time among different organisms and that the number of **genetic differences** between organisms can give us an **estimation of the last common ancestor**.
- It can be used to put a series of evolutionary events **chronologically**.

Role of Zinc in Nitrogen Fixation

Context (DTE): Research reveals zinc has a crucial role in making **legumes resilient to climate change**.

Leguminous plants

- Leguminous plants, also known as legumes, are a family of plants (Fabaceae).
- It includes various species such as beans, peas, lentils, chickpeas, and peanuts.
- Legumes have a wide range of uses, including as **food crops**, **forage for animals**, **green manure**, and in the **production of biofuels**.
- Legume crops can form **symbiotic relationships with rhizobia**, a bacteria that **fixes atmospheric nitrogen in root nodules**. This helps them capture nitrogen from the air and convert it into a form the plants can use. This process is called **nitrogen fixation**.

Nitrogen Fixation

- It is a biological process in which **nitrogen gas (N2)** is converted into **ammonia (NH3)** or other nitrogen-containing compounds.
- It is essential for life on Earth, as most organisms, including plants and animals, require nitrogen in the form of amino acids and nucleotides to build proteins and nucleic acids.

Zinc and Nitrogen Fixation

- Zinc is an essential **micronutrient** for plants. It helps in growth and development, photosynthesis, protein synthesis and transcription, etc.
- Researchers have discovered that zinc plays a crucial role in the **nitrogen fixation process** of legumes.
- Legumes use **zinc** as a **secondary signal** to integrate environmental factors and **regulate nitrogen fixation efficiency**. The mechanism works due to a transcriptional regulator called **Fixation Under Nitrate (FUN)**.
- FUN is **inactivated by zinc** through the formation of large filament structures, which are dismantled to release active FUN when zinc levels are low.

- The fixation of nitrogen **increases nitrogen availability**, both for legumes and for crops that rely on nitrogen left in the soil after legumes are grown.
- It ensures a more **stable crop yield**, **reduces the need for artificial fertilisers** and enables the cultivation of legumes in new, previously unsuitable areas.

Sexual Dimorphism in Nociceptors

Context (TH): A study for the first time functional **sexual dimorphism** in nociceptors.

> ⇨ *Sexual dimorphism is the condition where the sexes of the same species exhibit different morphological characteristics.*

Nociceptors

- **Nociceptors** are the **nerve cells responsible for perceiving pain**.
- Nociceptor cells have bare nerve endings and are found across our skin, bones, joints, and muscles.
- The receptors detect extreme pressure, temperature, and chemical signals released by the body when injured, turn them into electrical signals, and relay them to the brain via the spinal cord.
- The brain finally reads the message and perceives pain.

Why Nociceptors are Exhibiting Sexual Dimorphism?

- Nociceptors in males and females can be **sensitised differently**, affecting how they respond to pain. For instance, **female nociceptors** often have a **lower activation threshold than males**.
- The reasons behind this difference in sensitisation are:
  - ❖ **Peripheral nociceptor sensitisation:** A phenomenon in which the threshold for pain is **lowered by external factors**, causing the receptors to respond to stimuli that they'd otherwise ignore.
  - ❖ **Biological factors:** Hormonal influences such as **prolactin** (a hormone responsible for breast tissue growth) and **orexin-B** (a neurotransmitter that regulates wakefulness).

Impact of the Finding

- Understanding sexual dimorphism in nociceptors is crucial for developing **sex-specific pain therapies**.
- Currently, pain management often overlooks sex differences, despite conditions like migraines and endometriosis being more prevalent in women and cluster headaches and gout more common in men.

New Metal Oxide Nanocomposite

Context (PIB): A new metal oxide nanocomposite has been developed to help **photocatalytic degradation** of organic pollutants like dyes and pharmaceuticals.

Metal Oxide Nanocomposite

- It was developed by the **Institute of Advanced Study in Science and Technology (IASST)**, an autonomous **Department of Science and Technology (DST) institution**.
- It consisted of **Ni-doped TiO_2** on **Fuller's earth** (NiTF), tested as a **photocatalyst** for **methylene blue decolourisation**.

- Fuller's earth improved TiO_2 adsorption in dark, suggesting cost-effective environmental photocatalysts.

Metal Oxide Photocatalysis

- It involves using metal oxide materials as catalysts that light can activate to promote chemical reactions.
- These photocatalysts absorb light energy and produce pairs of electrons and holes, which can take part in redox reactions that degrade pollutants into harmless by-products.
- Titanium dioxide (TiO_2), Zinc oxide (ZnO), and Tungsten trioxide (WO_3) are common catalysts used in photocatalysis due to their stability and absorption properties.
- **Factors affecting efficiency of Metal oxide Photocatalysis:** Choice of metal oxide, Crystal structure, Light parameters, Pollutant concentration, pH, Catalyst loading.

Applications

- **Photocatalysis**: Helps in removing organic pollutants from water bodies.
- **Energy storage:** Used in solar cells.
- **Sensors**: Used in ultra trace-level gas sensors.
- **Biomedical fields**: Used as an alternative to conventional antimicrobial agents.
- **Coatings and optoelectronics.**
- **Renewable energy** production through water splitting.

Photocatalytic degradation

- Photocatalytic degradation is an advanced **oxidation** process that can degrade pollutants with high concentrations, complexity, and low biodegradability.
- It uses light to activate a catalyst, degrading organic pollutants.

NiFe System for Water Splitting

Context (PIB): Indian scientists suggest that a **bimetallic Nickel-Iron (NiFe)** layered **double hydroxide system** is sufficient for efficient oxygen production through water splitting.

- **Water splitting** is a chemical process that **breaks down** water to generate **H_2 and O_2**.
- **NiFe system** acts as an efficient **catalyst** when electricity is used to split water.
- Green Hydrogen can also be produced using this process.

Perovskite Quantum Dots (PQDs)

Context (TH): Scientists from the Centre for Nano and Soft Matter Sciences, Bengaluru, have developed a better way to **produce light-emitting diodes (LEDs)**.

- PQDs are a novel class of materials with unique properties suitable for creating vibrant LED displays.
- By precisely controlling the size and composition of perovskite quantum dots during synthesis, scientists can adjust their emission to produce the desired colours for full-colour displays.

Perovskite Quantum Dots (PQDs)

- Perovskite quantum dots (PQDs) are a class of quantum dots based on perovskite materials.
- Perovskites share a **crystal structure similar** to the **perovskite mineral**, which consists of **calcium titanium oxide** ($CaTiO_3$).
- While these are relatively new, they have already been shown to have properties matching or surpassing those of the metal chalcogenide QDs.
- PQDs are more **defect tolerant** with **better photoluminescence quantum yields** & **high colour purity**.
- Such attractive properties are **highly suited** for **electronic** and **optoelectronic** applications.
- Real-world applications include LED displays and quantum dot solar cells

Challenges in Perovskite Quantum Dot Research

- ➢ Their susceptibility to moisture and heat can compromise performance and lifespan within LEDs.
- ➢ When **different-coloured perovskite quantum dots** are layered to produce white light, anion migration, a reaction occurs, causing them to lose their individual colours.

Solution

- ✓ Scientists have found a way to **mitigate anion migration** between distinct perovskite quantum dot films.
- ✓ They achieved this by embedding an ultrathin **alumina layer**, grown via atomic layer deposition (ALD), within the perovskite quantum dot layers.

Time Crystals

Context (Phys): Scientists successfully created a **time crystal** made of giant atoms.

> ⇨ *A **crystal** is an arrangement of atoms repeating itself in space in regular intervals: At every point, the crystal looks the same.*

About Time Crystal

- Time crystals represent a **new phase of matter**, first theorised in **2012** by Nobel laureate **Frank Wilczek**.
- **Regular crystals** have a repeating **pattern in space**, while time crystals have a repeating **pattern in time**.
- This means that regular crystals have a **fixed structure** that **does not change over time**, while time crystals have a structure that **changes and repeats itself over time**.
- They **defy the traditional laws of thermodynamics** that govern equilibrium in most systems.
- They **oscillate between states without using energy**. They exhibit **'time-translation symmetry breaking'** property, which means they oscillate between different states in a **time-periodic manner**.
- Time crystals are created by using a process called "driving". This involves applying a periodic force to a system of particles, causing them to move in a specific pattern.
- This pattern then repeats itself over time, creating a time crystal.

Potential applications

- Time crystals could be used to create more **stable qubits**. The stability could pave the way for **more reliable quantum computers**, capable of solving complex problems.
- The intrinsic temporal regularity of time crystals makes them ideal candidates for **enhancing the precision of timekeeping devices**. They may improve data storage and encryption techniques.