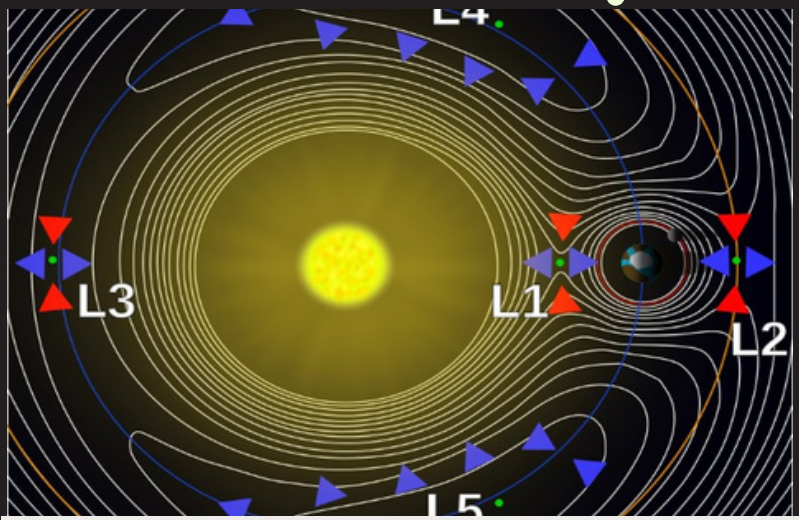
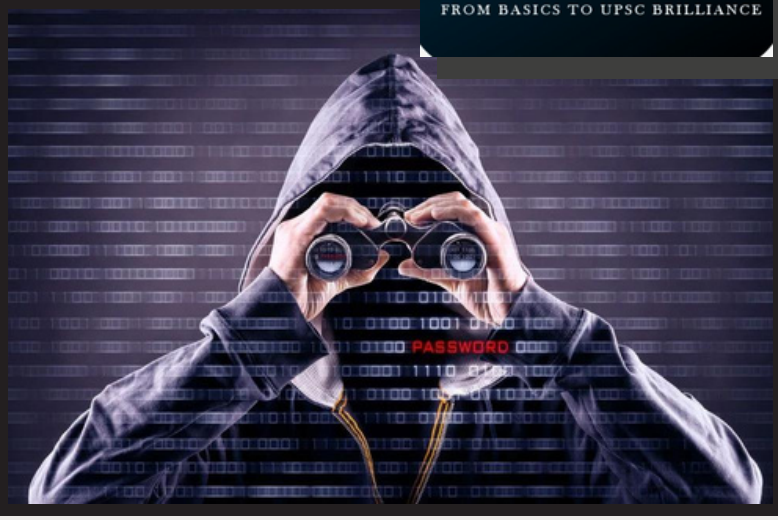
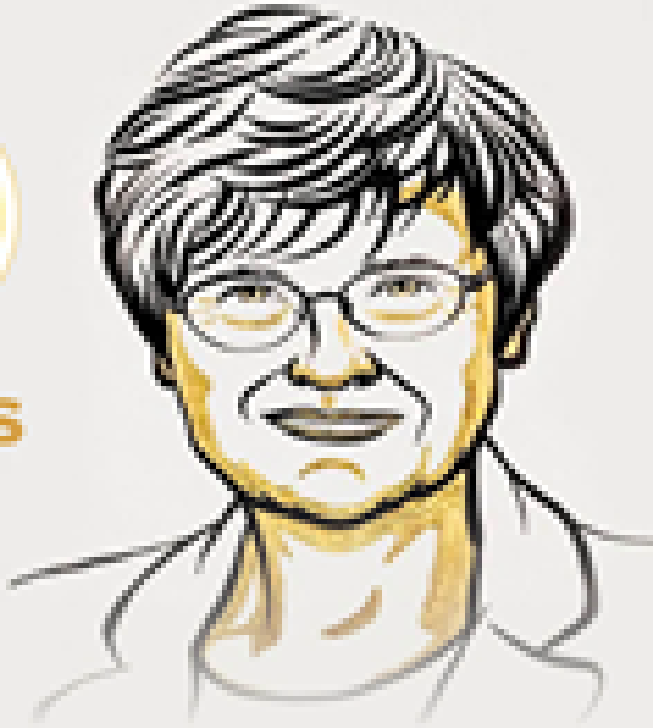
October 2023
GES Reporter





THE NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE 2023

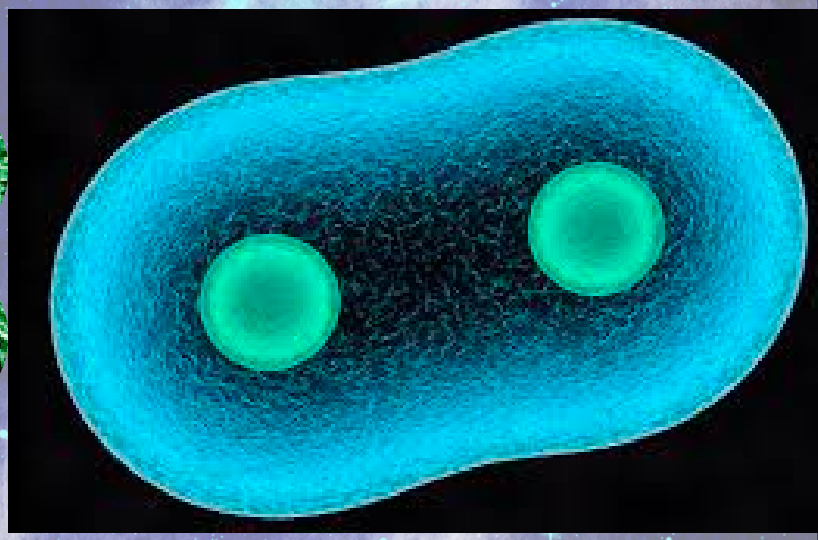
WINNERS

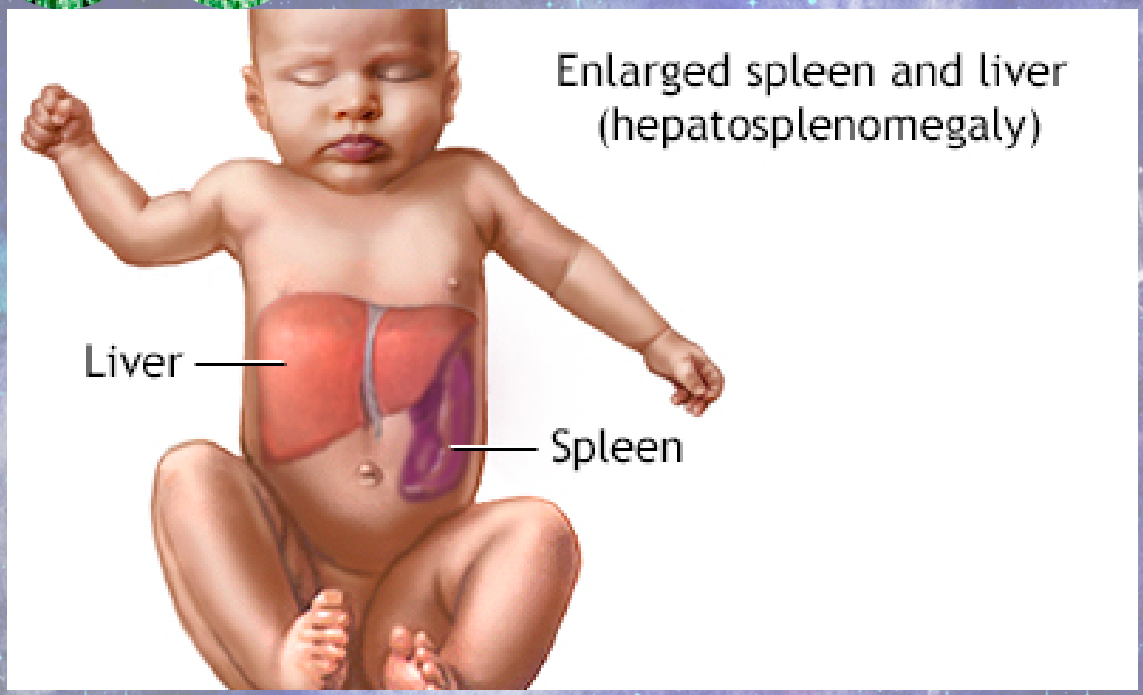


DREW **WEISSMAN**

KATALIN **KARIKÓ**

GES Reporter
October Month 2023





Saurabh Pandey — **Mentor**

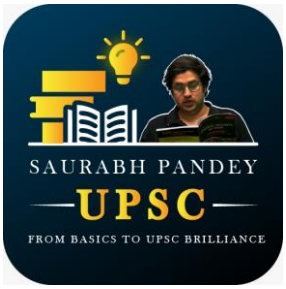
Vishali Sharma — **Editor**

About Author

Saurabh Pandey established Saurabh Pandey CSE Channel an online learning platform. He has 8 years of experience in teaching for the UPSC/IAS exam in various renowned institutes like Vision IAS, Study IQ, and Unacademy. He qualified for many exams like NET JRF. He appeared for a UPSC interview and wrote 3 civil services mains exams. He is MA in public administration. He did B.Tech in biotechnology.

Best Sources for UPSC CSE

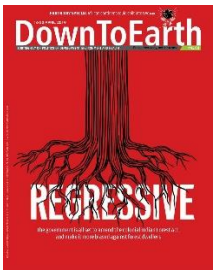
The Hindu



The Indian Express

PIB

Down to Earth



Physics.org

Upcoming Courses

1. Agriculture Optional

   Join Agriculture optional for UPSC civil services/Indian Forest Services (IoFS)

2. Download Saurabh Pandey UPSC app access following courses Agriculture optional
3. 2nd ARC report
4. Advance course on science and technology
5. Also access free magazine and attempt daily /weekly current affairs mock
6. Subscribe to Saurabh Pandey CSE channel on YouTube
7. Join आकलन Series
8. Join Prelims test series on Advance current Affairs

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CURRENT AFFAIRS PLUS

2 YRS COVERAGE

50 TEST

RS 1499

Target UPSC Prelims 2024

PRELIMS TEST SERIES ON ADVANCED CURRENT AFFAIRS

BY Saurabh pandey sir

DAILY ANSWER REVIEW

Target Mains 2024/25

आकलन Series

Daily answer checked

weekly Mains mock

सत्यमेव जयते
Goverment Of India

BY Saurabh pandey sir

Myristica Swamps of Kerala

- Dominated by Myristicaceae family members.
- Large-rooted trees in waterlogged soil.
- Primary in Western Ghats, India.
- Smaller presence in Andaman and Nicobar Islands.

Formation depends on valley shape, 3000 mm average rainfall, and consistent water availability.

Biodiversity:

- Diverse vertebrate and invertebrate species.
- Stable conditions support flourishing fauna.

केरल के मिरिस्टिका दलदल

- मिरिस्टिकेसी परिवार के सदस्यों का प्रभुत्व।
- जलयुक्त मिट्टी में बड़ी जड़ वाले पेड़।
- पश्चिमी घाट, भारत में प्राथमिक।
- अंडमान और निकोबार द्वीप समूह में छोटी उपस्थिति।

गठन घाटी के आकार, **3000** मिमी औसत वर्षा और लगातार पानी की उपलब्धता पर निर्भर करता है।

जैव विविधता:

- विविध कशेरुकी और अकशेरूकी प्रजातियाँ।
- स्थिर स्थितियाँ समृद्ध जीव-जंतुओं का समर्थन करती हैं।

"Chebrolu: Land of Temples and Ancient Epigraphs"

- Home to over 100 small and large temples.
- Some temples date back to the 9th to 12th centuries A.D.

Chebrolu is a town in the Guntur district of Andhra Pradesh, India.

Cultural and Historical Significance:

Known as the "land of temples." Encompasses the influences of various dynasties like Eastern Chalukya, Velanati Choda, Kakatiya, Pota Rajulu, and Paristchedi.

"चेब्रोलु: मंदिरों और प्राचीन अभिलेखों की भूमि"

- **100** से अधिक छोटे और बड़े मंदिरों का घर।
- कुछ मंदिर **9**वीं से **12**वीं शताब्दी के हैं।

चेब्रोलू भारत के आंध्र प्रदेश के गुंटूर जिले का एक शहर है।

सांस्कृतिक और ऐतिहासिक महत्व:

"मंदिरों की भूमि" के रूप में जाना जाता है। इसमें पूर्वी चालुक्य, वेलनाती चोडा, काकतीय, पोटा राजुलु और पेरिस्चेडी जैसे विभिन्न राजवंशों के प्रभाव शामिल हैं।

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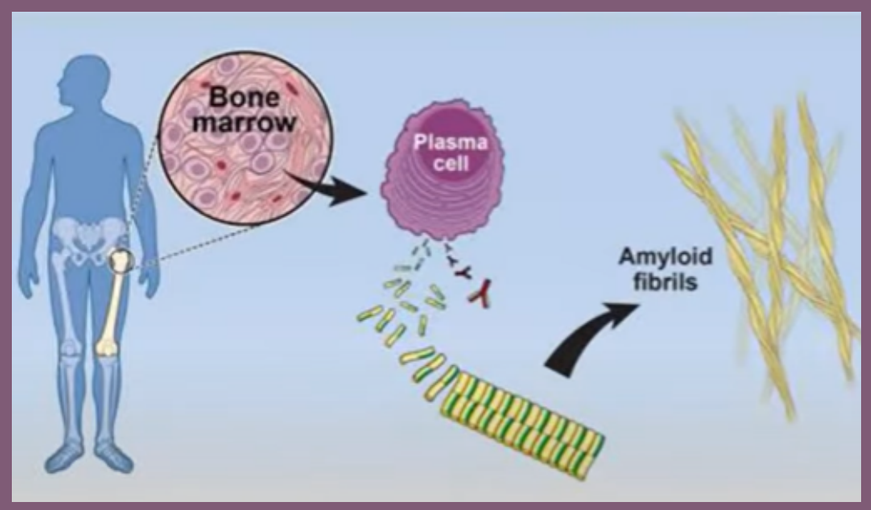
Successful fabrication of a 2D protein monolayer using lysozyme molecules



- Investigation of the physical properties of lysozyme molecules at the air-water interface.
- Analysis under varying surface pressure and subphase pH conditions

Lysozyme's Role:

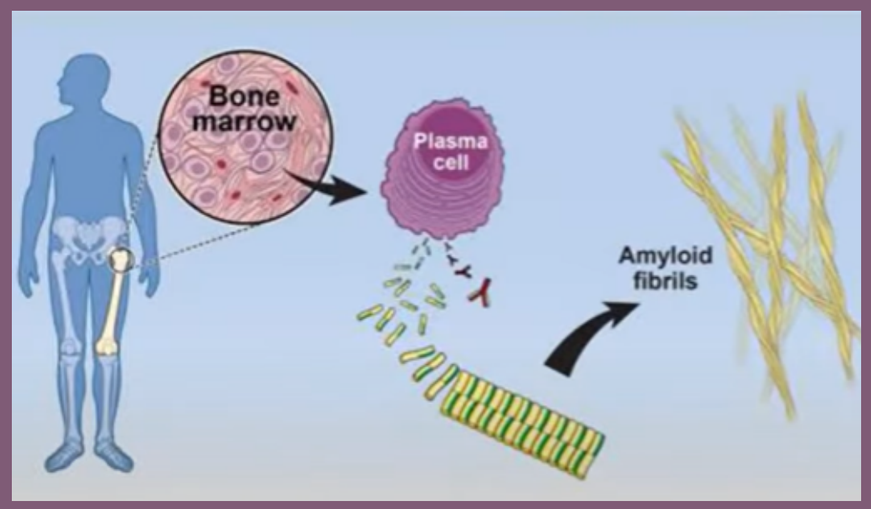
Lysozyme is a naturally occurring enzyme.

Found in bodily secretions, including tears, saliva, milk, sweat, mucus, egg white, nasal mucus, and gastric secretions.

Protective Function:

Lysozyme protects against bacteria, viruses, and fungi.

लाइसोजाइम अणुओं का उपयोग करके 2डी प्रोटीन मोनोलेयर का सफल निर्माण



- वायु-जल इंटरफेस पर लाइसोजाइम अणुओं के भौतिक गुणों की जांच।
- अलग-अलग सतह के दबाव और उपचरण पीएच स्थितियों के तहत विश्लेषण

लाइसोजाइम की भूमिका:

लाइसोजाइम एक प्राकृतिक रूप से पाया जाने वाला एंजाइम है।

आंसू, लार, दूध, पसीना, बलगम, अंडे का सफेद भाग, नाक का बलगम और गैस्ट्रिक स्राव सहित शारीरिक स्राव में पाया जाता है।

सुरक्षात्मक कार्य:

लाइसोजाइम बैक्टीरिया, वायरस और कवक से बचाता है।

Contents

Spyware

- Between May and September, former Egyptian MP Ahmed Eltantawy was targeted with Cytrox's Predator spyware sent via links on SMS and WhatsApp. Apple has since released an update for its products fixing the bug used in the attack.

- The attack on Mr. Eltantawy came after he publicly stated plans to run for President in the 2024 Egyptian elections, which is especially concerning since Egypt is a known customer of Cytrox's Predator spyware, Citizen Lab s

What is spyware?

- Spyware is loosely defined as malicious software designed to enter a device, gather sensitive data, and forward it to a third party without the user's consent.

- While spyware may be used for commercial purposes like advertising, malicious spyware is used to profit from data stolen from a victim's device.

- Spyware is broadly categorized as trojan spyware, adware, tracking cookie, and system monitors.

How have tech companies reacted?

- Tech giants including Meta, Google, and Apple have taken concrete steps to address the problem of commercial spyware firms exploiting bugs in their software.

- In the case of Mr. Eltantawy, Apple and Google updated their software to fix the bugs exploited by Cytrox's Predator spyware. Apple with its iOS 16 also released a 'Lockdown Mode', which the company called an "extreme protection" designed for high- risk individuals.

- While the Lockdown Mode in Apple's software limits the device's functionality, it has proven to be a viable option to protect against spyware attacks.

Hyper concentrated flow

- Based on these studies, the researchers have reported that climate- change-related and seismic events ravaging the planet today could create super-floods that could be catastrophic for people in the Gangetic plain, in a paper published in the journal Communications Earth and Environment on August 23.
- The findings signal that we need to urgently update India's disaster management strategy
- With the Ganga larger particles are restricted to areas around Haridwar and Rishikesh, in Uttarakhand.
- Large particles should not be usually found downstream. But in a 2014 study it was found that, around 11,000 years ago, in the Holocene era, there was coarse gravel in the Kosi river some 30-40 km downstream of the current gravel- sand transition
- The odds of an extreme monsoon event are expected to increase due to climate change.
- According to a 2021 study in western Nepal, the chance could increase by as much as 60%. More extreme rains could also mean more landslides, which in turn could mean hyper concentrated flows leading to floods downstream
- Extreme events are expected to have occurred along with a complementary cause called hyper concentrated flows.
- Hyper concentrated flows occur when some event of a trigger, such as a landslide or a glacial lake outburst causes the river to carry more sediments than usual.
- In such conditions, "high concentrations of sediments are distributed through the water column," according to the paper.
- Hyper concentrated flows can change the way rivers flow, so they often have devastating consequences.

- **"A major landslide combined with a heavy monsoon can generate hyper concentrated flows, which can actually move very large particles further downstream,"**
- **As a result, the river could be clogged, the water level could rise to dangerous levels, and cause a flood. Hyper concentrated flows can also change the course of the river in a process called avulsion, forcing thousands of people to move**
- **"If we keep looking at these hazards in an isolated and compartmentalized way, we will never be able to understand the entire cascading effect of a disaster," he said.**
- **Instead, we need an "integrated disaster management approach" where the relationship between instances of earthquakes, landslides, and floods along with the individual incidents themselves is used to frame risk -mitigation plans.**

Karman line

- **Boundaries play an important role in science because they help differentiate and define things that might otherwise blend together.**
- **One such boundary is the Kármán Line. Located at 100 km above sea level, it is an imaginary line that demarcates the earth's atmosphere from space.**
- **Though not all scientists and spacefarers accept it, a majority of countries and space organizations recognize this boundary between earth sky and space.**
- **It was established in the 1960s by a record keeping body called Federation Aéronautique International (FAI). Anyone individual who crosses this line qualifies as an astronaut.**

Yemen Sea

- **A genome wide survey of highly endangered staghorn coral in the Caribbean has identified 10 genomic regions associated with resilience against white band disease, an emergent infectious disease responsible for killing up to 95% of Caribbean Acropora species, including staghorn corals (A. cervicornis).**

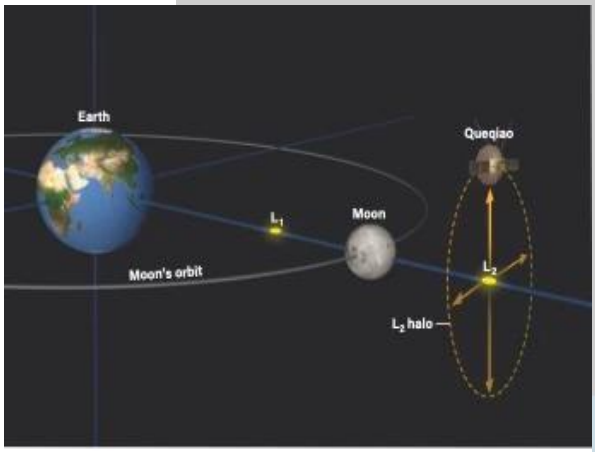
- **The findings could be used as a conservation tool to improve disease resistance in the wild and nursery stocks of staghorn corals used to repopulate damaged coral reefs throughout Caribbean waters.**

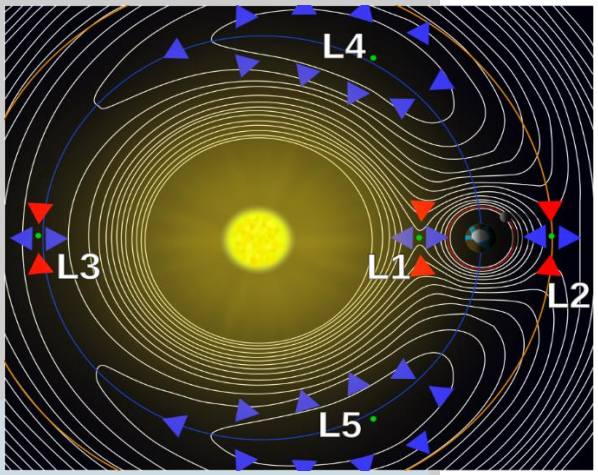
Staghorn coral

- **Staghorn coral is found typically in clear, shallow water (15–60 feet) on coral reefs throughout the Bahamas, Florida, and the Caribbean.**

The staghorn coral (*Acropora cervicornis*) is a branching, stony coral with cylindrical branches ranging from a few centimeters to over two metres in length and height. It occurs in back reef and fore reef environments from 0 to 30 m (0 to 98 ft) depth. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Fore reef zones at intermediate depths 5–25 m (16–82 ft) were formerly dominated by extensive single-species stands of staghorn coral until the mid-1980s.

Lagrange points





- **Lagrange points are found along the plane of two objects in orbit around their common center of gravity, where their gravitational forces cancel each other, so that a third body of negligible mass will remain at rest between them.**
- **For example, the combined gravitational force between the sun and the earth equals the centrifugal force required by a satellite or an asteroid to orbit the sun- earth center of gravity.**
- **At this Lagrange point, a satellite will keep its position constant relative to both the sun and the earth.**

The three-body problem

- **But Lagrange's most important contributions were related to the so- called 'three body problem', which investigated the motion of three bodies (with mass) relative to each other in space such as the sun, the earth, and the moon.**
- **The problem question itself is: if you know the starting positions of the sun, the earth, and the moon, can you predict their exact locations at a later date as they move under the influence of each other's gravity?**

- **Lagrange found that the problem could be solved if he assumed the third body was much smaller than the other two larger masses.**
- **This eventually led him to describe the famous five Lagrange points that we know today as L1, L2, L3, L4, and L5.**

Points of accumulation

- **Objects stay undisturbed at L4 or L5 because of a 'restoring force' – a force acting against any displacement that prevents them from being nudged away from the stable point.**
- **Because of their stability, however, L4 and L5 also tend to accumulate a lot of interstellar dust and asteroids called Trojans that zip around the points.**
- **Scientists have detected nearly 10,000 Trojans in the L4 and L5 points of the sun- Jupiter system alone, where gravitational and centrifugal forces prompt the space rocks to follow the giant planet's revolution around the sun.**
- **Aditya- L1 is a space- based observatory that ISRO launched on September 2. It is now enroute to its designated parking slot at L1 in the sun- earth system. Once it reaches L1 at a distance of 1.5 million km away from the earth the probe will settle into a 'halo' orbit around L1 to acquire an unobstructed view of the Sun.**
- **L1 is already home to four other robotic explorers: NASA's Solar and Heliosphere Observatory Satellite, Deep Space Climate Observatory, Advanced Composition Explorer, and the Global Geospace Science Wind satellite.**
- **The point will get even more crowded when three U.S. probes Interstellar Mapping and Acceleration Probe, Near Earth Object Surveyor, Space.**

BRICS FUTURE

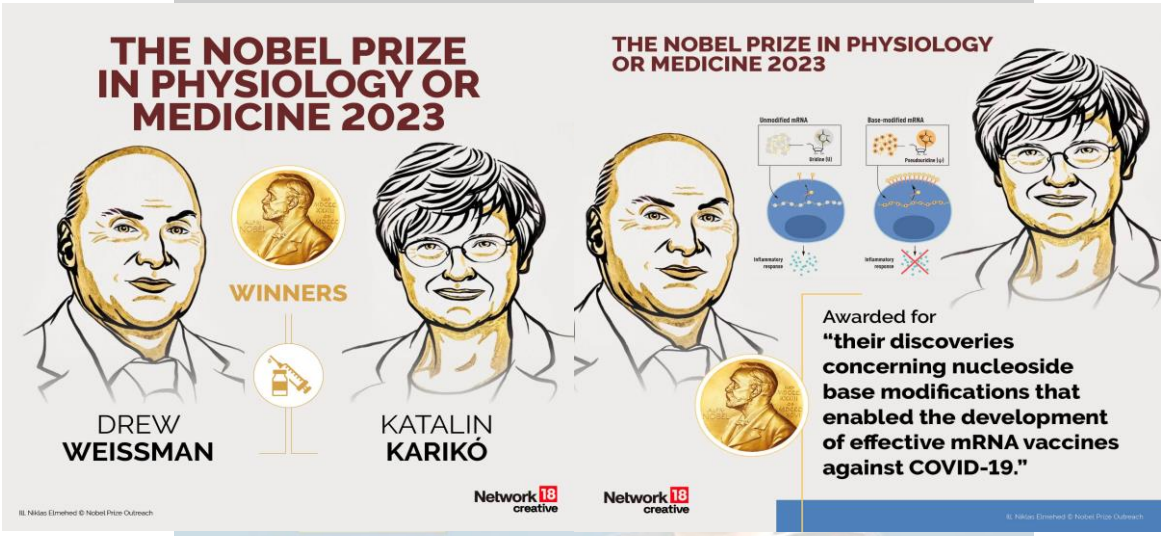
- **Six new members were inducted into the BRICS grouping, in South Africa.**
- **It does not provide military or security support to various countries, is not**

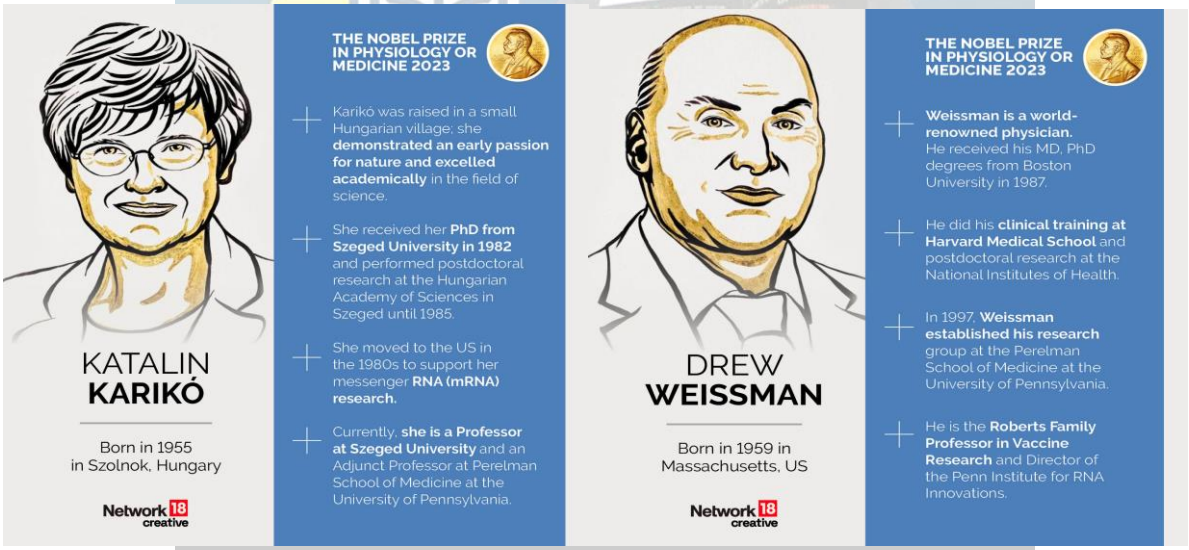
involved in the policing of nations, and does not provide peacekeepers.

- Compare this to, say, NATO: European Allies and Canada have invested an extra $350 billion since 2014, with eight consecutive years of increased defence spending
- Second, two members of BRICS are China and India, which together contain one- third of the world's population.
- The two countries are the fastest- growing economies and are expected to be among the top three economies of the world by 2030.
- Both countries understand that globally, bilateral ties have seen a transformation following the formation of economic blocs such as the European Union or ASEAN, as such blocs accelerate trade and investment.
- While India and China have bilateral challenges at the political and diplomatic levels since their stand-off at Doklam in 2017, trade between the two countries has continued to grow significantly
- Third, there has been some polarization between the U.S. and other parts of the world.
- The search for an alternative such as the Non-Aligned Movement to tackle Cold War challenges has given hope of a new order; thus, many countries are applying for membership to this group. Six new members were inducted in the last meeting
- Fourth, the U.S. dollar has been the dominant global currency all this time.
- Both India and China are pushing for more trade, investment, and business in their currencies and together, through BRICS, they can push their own currencies as alternative currencies to the dollar
- Finally, the continent that promises economic growth this century is Africa.
- The way France has intervened in Niger or the manner in which migrants

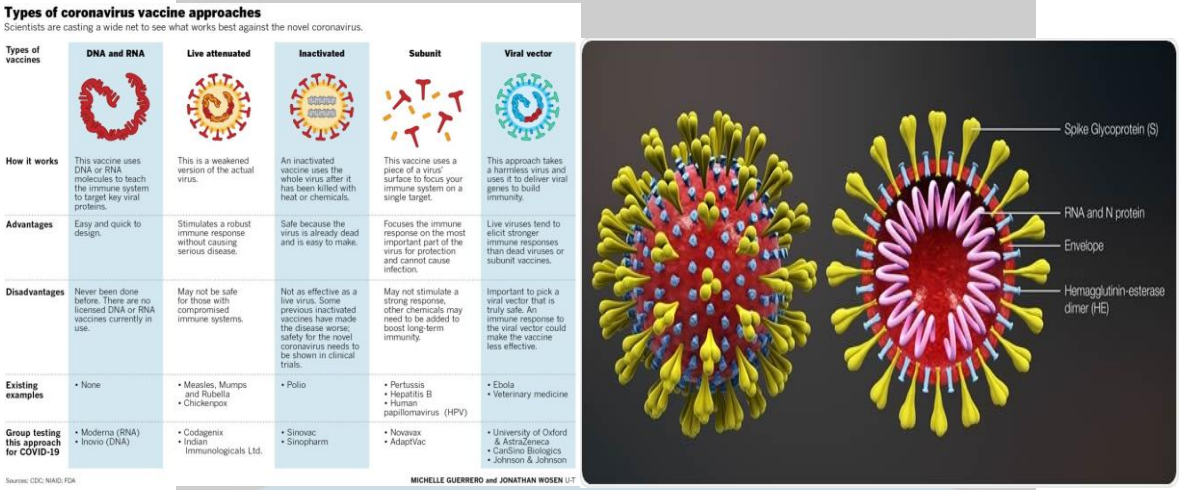
have been treated in Europe provide Africans with a negative image about Europe.

Nobel prize in medicine





- **The discoveries by the two Nobel Prize laureates were critical for developing effective mRNA vaccines against COVID-19 during the pandemic that began in early 2020.**
- **Through their groundbreaking findings, which have fundamentally changed our understanding of how mRNA interacts with our immune system, the laureates contributed to the unprecedented rate of vaccine development during one of the greatest threats to human health in modern times**



Types of coronavirus vaccine approaches

Scientists are casting a wide net to see what works best against the novel coronavirus.

Types of vaccines	DNA and RNA	Live attenuated	Inactivated	Subunit	Viral vector
How it works	This vaccine uses DNA or RNA molecules to teach the immune system to target key viral proteins.	This is a weakened version of the actual virus.	An inactivated vaccine uses the whole virus after it has been killed with heat or chemicals.	This vaccine uses a piece of a virus' surface to focus your immune system on a single target.	This approach takes a harmless virus and uses it to deliver viral genes to build immunity.
Advantages	Easy and quick to design.	Stimulates a robust immune response without causing serious disease.	Safe because the virus is already dead and is easy to make.	Focuses the immune response on the most important part of the virus for protection and cannot cause infection.	Live viruses tend to elicit stronger immune responses than dead viruses or subunit vaccines.
Disadvantages	Never been done before. There are no licensed DNA or RNA vaccines currently in use.	May not be safe for those with compromised immune systems.	Not as effective as a live virus. Some previous inactivated vaccines have made the disease worse; safety for the novel coronavirus needs to be shown in clinical trials.	May not stimulate a strong response, other chemicals may need to be added to boost long-term immunity.	Important to pick a viral vector that is truly safe. An immune response to the viral vector could make the vaccine less effective.
Existing examples	• None	• Measles, Mumps and Rubella • Chickenpox	• Polio	• Pertussis • Hepatitis B • Human papillomavirus (HPV)	• Ebola • Veterinary medicine
Group testing this approach for COVID-19	• Moderna (RNA) • Inovio (DNA)	• Codagenix • Indian Immunologicals Ltd.	• Sinovac • Sinopharm	• Novavax • AdaptVac	• University of Oxford & AstraZeneca • CanSino Biologics • Johnson & Johnson

Sources: CDC; NIAID; FDA

MICHELLE GUERRERO and JONATHAN WOSEN U-T

- **Unlike a usual vaccine, RNA vaccines work by the introduction of an mRNA sequence into the host's cells.**
- **This mRNA codes for a disease- specific antigen. Once inside a cell, the mRNA instructs the cell to produce the antigen, which is recognized by the immune system which makes an antibody or cellular response.**
- **It can take years to develop vaccines first in laboratories to show proof- of-concept, then developing a manufacturing process to make stable and a highly pure product to be tested in animals and humans, and finally.**
- **Instead, mRNA vaccine carries the molecular instructions to make the protein in the body through a synthetic RNA of the virus.**
- **The host body uses this to produce the viral protein that is recognized and thereby making the body mount an immune response against the disease. They are scientifically the ideal choice to address a pandemic because of their rapid developmental timeline.**

- **Considered safe as is non-infectious, non-integrating in nature, and degraded by standard cellular mechanisms. They are expected to be highly efficacious because of their inherent capability of being translatable into the protein structure inside the cell cytoplasm.**

- **Additionally, mRNA vaccines are fully synthetic and do not require a host for growth, e.g., eggs or bacteria.**

- **Therefore, they can be quickly manufactured in an inexpensive manner under cGMP conditions to ensure their "availability" and "accessibility" for mass vaccination on a sustainable basis.**

MT Semeru

- **Mt Semeru volcano in Indonesia East Java province. It is the highest mountain on the island of Java. The name "Semeru" is derived from Meru, the central world mountain in Hinduism, or Sumeru, the abode of gods. This stratovolcano is also known as Mahameru, meaning "The Great Mountain" in Sanskrit. It is one of the more popular hiking destinations in Indonesia.**

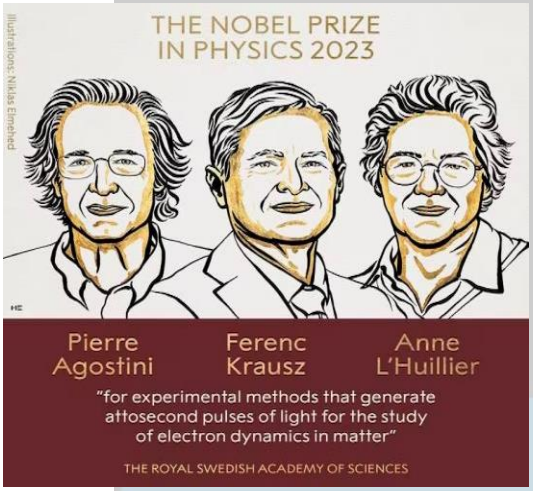

Pink diamond

- **More than 90% of all the pink diamonds ever found come from a single mine in the Kimberley region of Western Australia: Argyle.**
- **Diamonds are made of carbon atoms arranged in a compact, regular lattice. Clear, perfect diamonds sparkle because light reflects off their internal surfaces.**
- **However, when diamonds are subject to intense pressure deep inside Earth, the lattice of atoms can twist and bend. This causes small imperfections that diffract light and bring colour to the gem.**

Norman E Borlaug award

- **Swati Nayak became the third Indian agriculture scientist to win the prestigious Norman E Borlaug award for 2023.**
- **Fondly called as "Bihana Didi" (Seed Lady) by local communities in Odisha, Indian agriculture scientist Swati Nayak has perhaps begun to reap the fruits of having lived in tribal villages with farmers and understanding their actual needs.**
- **Nayak became the third Indian agriculture scientist to win the prestigious Norman E Borlaug Award for 2023. The other two Indian recipients are Aditi Mukherji (2012) and Mahalingam Govindaraj (2022).**

Nobel prize in physics



Blue Walker 3 satellite

- **Impact of the prototype Blue Walker 3 satellite on astronomy.**
- **The Blue Walker 3 is a prototype satellite, part of a satellite constellation planned by its owner AST Space Mobile, intended to deliver mobile or broadband services anywhere in the world.**
- **Observations of Blue Walker 3 showed it was one of the brightest objects in the night sky, outshining all but the brightest stars,**
- **Several companies around the world have envisaged such satellite constellations.**
- **However, owing to their location closer to the earth location and relatively large size, their potential to disrupt night sky observations is higher, which is why astronomers are raising concerns around these constellations, or groups of satellites**

Climate 'polycrisis'

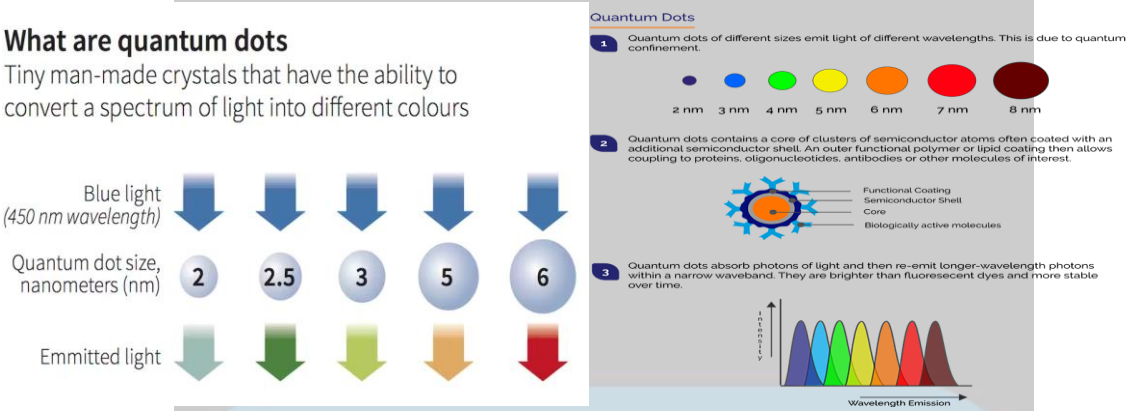
- **The climate 'polycrisis' a term made popular by Adam Tooze refers to the interconnected and compounding crises related to climate change that are affecting the planet not just in a few sectors but across several sectors and domains.**
- **It encompasses the physical impacts of climate change (rising temperatures, sea- level rise, and extreme weather events) and the social, economic, and political challenges that arise from these impacts.**
- **In India, one can see the interconnections between seemingly different sectors such as energy, infrastructure, health, migration and food production that are being impacted by climate change.**
- **Recognizing the complexity and interconnectedness of the climate polycrisis, it is crucial in developing a holistic approach that takes into account the diverse perspectives and priorities of different stakeholders, while ensuring resilience, equity, and justice**
- **A national carbon accounting (NCA) system is both an evolutionary and a revolutionary generalization of these ideas.**

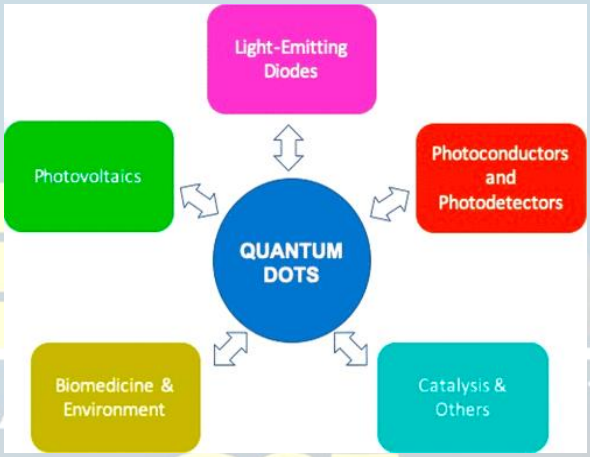
- **It will bring the entire nation, starting from individuals and households, under one carbon accounting framework. This will be a paradigmatic change in the way we look at all human and non-human "activities" in the world**
- **An NCA will bring the concept of carbon books to the nation and will make it mandatory for businesses and individuals to declare/report their carbon inflows and outflows**
- **An NCA will not only help India meet its commitment to becoming net zero by 2070 but also help it and other countries (if adopted globally) create new livelihoods and new forms of organizing its economy and society.**
- **Everyone understands GDP growth and, more recently, alternative measures such as Gross National Happiness.**

Nobel prize in chemistry- quantum dots

- **The Nobel Prize in Chemistry was awarded on Wednesday to Moungi G. Bawendi, Louis E. Brus and Alexei I. Ekimov for being pioneers of the Nano world**
- **The Nobel Laureates in Chemistry 2023 have succeeded in producing particles so small that their properties are determined by quantum phenomena.**
- **The particles, which are called quantum dots, are now of great importance in nanotechnology,"**
- **These tiny particles have unique properties and now spread their light from television screens and LED lamps.**
- **They catalyse chemical reactions and their clear light can illuminate tumours tissue for a surgeon.**
- **Quantum dots, also called semiconductor nanocrystals, are semiconductor particles a few nanometers in size, having optical and electronic properties that differ from those of larger particles as a result of quantum mechanical effects.**

- **They are a central topic in nanotechnology and materials science**



- 

Cabomba furcuta

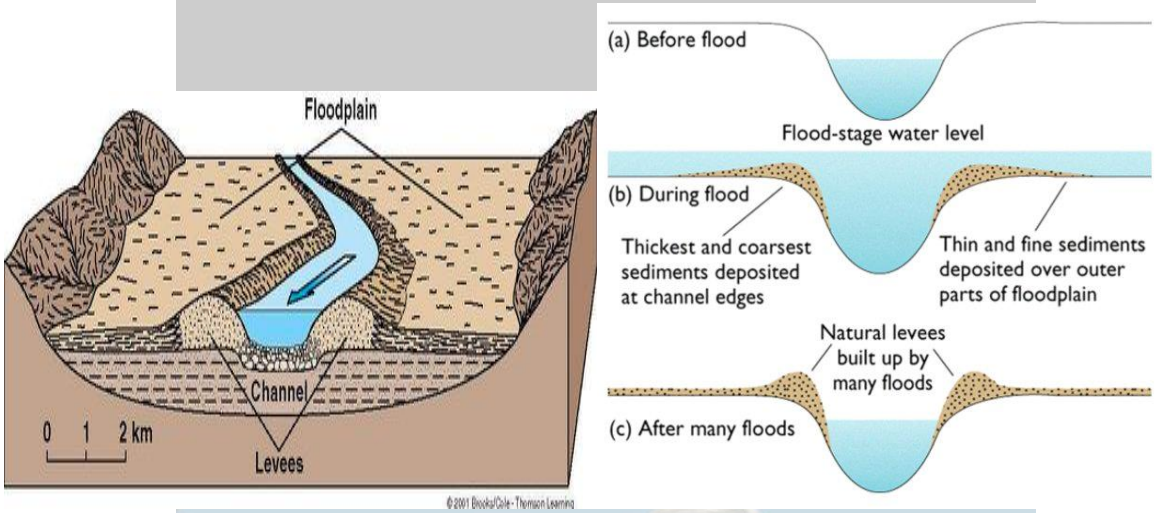
- **Popularly called as Pink Bloom due its massive flowering.**
- **The submerged perennial aquatic plant grows in stagnant to slow-flowing freshwater. The fast growing Cabomba is a visual treat but becomes a potential outspread in water bodies by active stem propagation, hindering penetration of light into the water.**
- **Cabomba, which requires a large quantity of oxygen for its growth will choke water bodies and drainage canals. It causes decline in diversity of**

native aquatic plants and causes economic losses by affecting yield of freshwater fishes. The key to controlling the species is to mechanically remove them from the waterbody and dry them in terrestrial spaces, the team notes.

New fungi species

- A tiny, fragile- looking mushroom sporting a honey- yellow 'cap' found on the campus of the Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) at Palode in Thiruvananthapuram has been identified as a new species.
- The new species has been named Candolleomyces albo squamosus - 'albosquamosus' for the white woolly scale like structures on its pileus or cap. Delicate in build, the mushroom grows to a height of just about 58 mm.

Flood plain

- 

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- **India's urban areas have been flooding more and more often, destroying lives and livelihoods.**
- **Yet, according to a study led by the World Bank and published in Nature on October 4, flood risk in many cities is rising because they are expanding into flood-prone areas.**
- **According to the paper, since 1985, human settlements in flood- prone areas**

have more than doubled.

- Experts say the findings spotlight the risk of unsustainable urbanization in India.
- The study also found that middle- income countries like India have more urban settlements in flood- prone zones than low- and high- income countries.

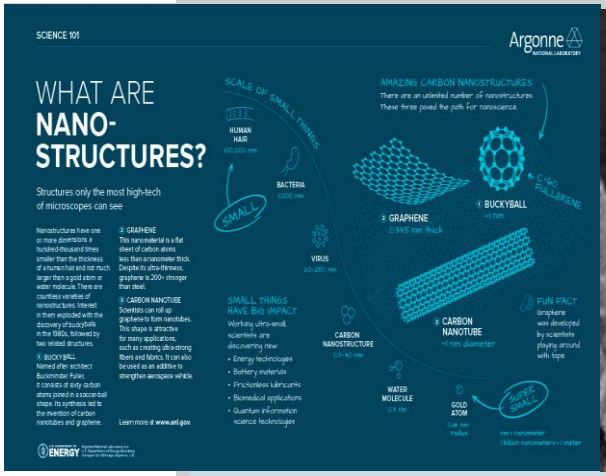
How is India at risk?

- India isn't among the 20 countries whose settlements are most exposed to flood hazards, but it was the third highest contributor to global settlements, after China and the U.S., and also third after China and Vietnam among countries with new settlements expanding into flood- prone areas, all from 1985 to 2015
- When environmental regulations are applied to new constructions, they are often applied only to big infrastructure projects and not to medium- and small- scale modifications of localities.
- This contradicts the notion that certain localities are more flood- prone and that flooding and flood- risk are locality -level issues

What is to be done?

- Market forces tend to push expansion into flood -prone areas,"
- Sustainable urban planning
- Urban governments need to make housing in such areas more flood-resilient and protect low income housing.
- Example of riverside settlements that use stilt houses, like those used by the Mishing and the Miyah communities along the Brahmaputra.

Nano florets



- **Carbon nanostructure that was “blacker than black”,**
- **The structure of the silicon particles 50-1,200 nanometers in size – resembled spikes arranged around a sphere**
- **The carbon nanoflorets’ high efficiency comes from three properties. First: the nanoflorets absorb three frequencies in sunlight infrared, visible light, and ultraviolet.**
- **Other common materials for solar-thermal conversion, like photovoltaic materials used in solar panels, absorb only visible and ultraviolet light. More than half of the energy in sunlight arrives to the earth as infrared radiation.**
- **So the nanoflorets can absorb much more energy from the sun.**
- **The other two properties responsible for the material’s high light- heat conversion efficiency are a result of its shape.**
- **As light falls on the material, the carbon cones ensure that very little is reflected back. Instead, most light is reflected internally.**
- **Second, one risk with a material that can convert sunlight into heat is that it can also lose it to its environment.**
- **The carbon nanoflorets don’t, however, thanks to long-range disorder: parts**

of the structure at some distance from each other possess different physical properties. A

- The researchers reported that a 1 m sq. coating of carbon nanoflorets on a surface could vaporise 5 litres of water in an hour. “India is a country that is blessed with a lot of light, but also has areas that have low temperatures,”
- In such regions, the nanofloret coatings can help heat up housing and sterilize surfaces in hospitals
- Given that the material can be coated on a vast variety of surfaces, it can heat up those using sunlight. If one were to use a coating of this material to heat up their homes, they would be doing so in an ecologically sound way while reducing the carbon footprint.
- The nanoflorets pose no risk of inhalation: “once coated, the adhesion is nearly as good as paint on a wall.

World Thrift Day

- World Thrift Day is observed on October 31 to promote saving money and developing a sense of financial prudence.
- Physicists generally attribute this to the principle of least action.
- Action in physics is defined by the change in energy of a system over time.
- The conservation laws in physics follow from the principle of least action.
- They imply that all energy is conserved, as is the total momentum. Nothing is deleted or destroyed, only conserved. All the phenomena that happen, from the subatomic world to the galaxies, follow the path of least action.
- The word ‘least’ here doesn’t mean minimality.

- **Instead, it means that a physical system between any two points in space -time evolves along a path that minimises or maximizes the action depending on the outcome of the process.**

Multi modal AI

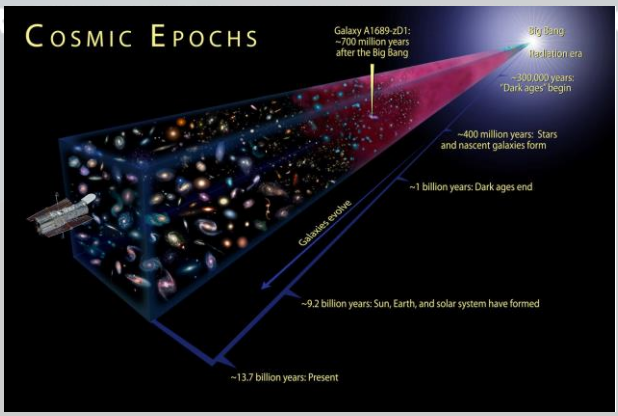
- **On September 25, ChatGPT-maker OpenAI announced that it had enabled its GPT-3.5 and GPT-4 models to study images and analyse them in words, while its mobile apps will have speech synthesis so that people can have full-fledged conversations with the chatbot.**
- **The Microsoft backed company had promised multimodality in March, during the release of GPT-4 and kept the addition on the backburner.**
- **Applications of multimodal AI Some of the earlier multimodal systems combined computer vision and natural language processing models or audio and text together to perform some of the simpler but rather important functions like automatic image caption generation etc.**
- **And even if these multimodal systems weren't an all- powerful model like GPT-4 gunning for the ultimate dream of artificial general intelligence (AGI), they carried enough value to address very real -world problems**
- **Meta announced a new open source AI multimodal system called Image Bind that had many modes text, visual data, audio, temperature and movement readings.**

James Webb telescope

- **Since beginning operations last year, the James Webb Space Telescope has provided an astonishing glimpse of the early history of our universe, spotting a collection of galaxies dating to the enigmatic epoch called cosmic dawn.**

James Webb Space Telescope (JWST)

- **The James Webb Space Telescope (JWST) is a space telescope designed primarily to conduct infrared astronomy.**
- **The U.S. National Aeronautics and Space Administration (NASA) led development of the telescope[] in collaboration with the European Space Agency (ESA), and the Canadian Space Agency (CSA).**
- **The JWST was launched 25 December 2021 on an ESA Ariane 5 rocket from Kourou, French Guianaand is intended to succeed the Hubble Space Telescope as NASA's flagship mission in astrophysics.**
- **The telescope is named after James E. Webb, who was the administrator of NASA from 1961 to 1968 during the Mercury, Gemini, and much of the Apollo programs.**
- **It provides improved infrared resolution and sensitivity over Hubble, viewing objects up to 100 times fainter than the faintest detectable by Hubble.**



Cosmic dawn

- **One of the most important gaps in our understanding of our Universe's history is the "Cosmic Dawn."**

- **The period from about 50 million years to one billion years after the Big Bang when the first stars, black holes, and galaxies in the Universe formed.**
- **One of the best ways to observe this era is with low-frequency radio telescopes, which can observe the "spin-flip" radiation from the hydrogen that pervades the Universe during the Cosmic Dawn.**

Nobel prize in economics

- **The Nobel Prize for economics was awarded to Harvard University professor Claudia Goldin on Monday for her research that has advanced the understanding of the gender gap in the labour market.**
- **Ms. Goldin is just the third woman to win the prize out of 93 economics laureates.**
- **She has studied 200 years of women's participation in the workplace, showing that despite continued economic growth, women's pay did not continuously catch up to men's and a divide still exists despite women gaining higher levels of education than men.**
- **Goldin's research does not offer solutions, but it allows policymakers to tackle the entrenched problem.**
- **What happens in people's homes reflects what happens in the workplace,**

with women often taking jobs that allow them to be on call at home work that often pays less.

- "Ways in which we can even things out or to create more couple equity also leads to more gender equality," she said.
- In Ms. Goldin's analysis, a woman's role in the job market and the pay she receives aren't influenced just by broad social and economic changes.
- They also are determined partly by her individual decisions about, for example, how much education to get.
- Often young girls make decisions about future work by looking at their own mother's participation, each generation "learning from the successes and failures of the preceding generation.
- The most significant of her observations was that female participation in the labour market did not exhibit an upward trend over the entire period, but rather a U- -shaped curve.
- In other words, economic growth ensuing in varied periods did not translate to reducing gender differences in the labour market.
- She demonstrated that several factors have historically influenced and still influence the supply and demand for female labour.
- These include opportunities for combining paid work and a family, decisions (and expectations) related to pursuing education and raising children, technical innovations, laws and norms, and the structural transformation in an economy
- She also observed that prior to the advent of industrialization in the nineteenth century, women were more likely to participate in the labour

force.

- **This was because industrialization had made it harder for married women to work from home since they would not be able to balance the demands of their family.**
- **Even though her research held that unmarried women were employed in manufacturing during the industrial era, the overall female force had declined.**
- **The beginning of the twentieth century marked the upward trajectory for female participation in the labour force.**
- **According to Professor Goldin, technological progress, the growth of the service sector and increased levels of education brought an increasing demand for more labour.**
- **However, social stigma, legislation and other institutional barriers limited their influence.**
- **Two factors are of particular importance here, namely, "marriage bars" (the practice of firing and not hiring women once married) and prevalent expectations about their future careers.**
- **The former, according to Professor Goldin, peaked during the 1930s' Great Depression and the ensuing years preventing women from continuing as teachers or office workers.**
- **About expectations, Professor Goldin notes that women at varied points were subject to different circumstances when deciding on their life choices**
- **According to Professor Goldin, pay discrimination (that is, employees being paid differently because of factors such as colour, religion or sex, among others) increased significantly with the growth of the services sector in the twentieth century.**

- This was surprisingly at a time when the earnings gap between men and women had decreased and when piecework contracts were being increasingly replaced with payments on monthly basis.

WACE Pattern

- Climate scientists also use the term 'secular trend', which is to say that a variable has been increasing for a certain period within a longer span, such as for 30 years in a 100-year period.
- Then there is 'decadal variability', a common term that isn't entirely distinct from a shift.
- Decadal variability refers to an oscillation from a positive to a negative phase on the order of tens of years

Rainbow pattern

- If the rain has been heavy, the bow may spread across the sky and its two ends seem to rest on the earth below.
- The cause of this interesting phenomenon is the reflection and refraction of the sun's rays as they fall on drops of rain.
- As a ray passes into a drop of rain, the water acts like a tiny prism.
- The ray is bent, or refracted, as it enters the drop and is separated into different colours.
- As it strikes the inner surface of the drop, it is further refracted and dispersed.
- Each colour is formed by rays that reach the eye at a certain angle, and the angle for a particular colour never changes.
- The higher the sun the lower the bow. If the Sun is higher than 40 degrees, no bow can be seen.

Padma Bridge

- **Bangladesh Prime Minister Sheikh Hasina inaugurated the 82-km Padma Bridge Rail Link, the country's largest infrastructure project built under China's Belt and Road Initiative.**
- **Ms. Hasina unveiled the Dhaka-Bhanga section of the rail route between Dhaka and Jashore through the Padma Bridge from Mawa Railway Station in Munshiganj**

Sikkim flood

- **The voluminous outflow has destroyed the Chungthang dam, which is critical to the Teesta 3 hydropower project, and rendered several hydropower projects along the river dysfunctional.**

What is a glacier lake outburst?

- **Technically called a Glacier Lake Outburst Flood (GLOF), these are instances of large lakes formed from the melting of glaciers, suddenly breaking free of their moraine natural dams that are formed from rock, sediment and other debris.**
- **The South Lhonak glacier, located in north Sikkim, is reportedly one of the fastest retreating glaciers.**
- **The National Disaster Management Agency reports that "...the primary reason for the sudden surge appears to be a likely combination of excess**

rainfall and a GLOF event.

- **There is speculation that heavy rainfall might have tipped the moraine to collapse and trigger the flood but meteorological records don't reveal any evidence of such heavy rain**
- **There is also a suggestion that a series of earthquakes in Nepal on October 3, in the afternoon (whose tremors jolted several in the Delhi National Capital Region) might have played a role.**
- **While the Teesta river is a source of hydropower generation for several power projects, the risk of GLOF like events requires greater care in planning and executing dam and other infrastructure projects, which account for the huge amount of water that can potentially gush through the mountains.**
- **Early warning systems are implementable.**

Digital India Act 2023 (DIA)

- **The recent announcement of the Digital India Act 2023 (DIA) represents a significant step towards establishing a future ready legal framework for the country's burgeoning digital ecosystem.**
- **The primary motivation behind the DIA is to bring India's regulatory landscape in sync with the digital revolution of the 21st century.**
- **The IT Act of 2000, crafted during a time when the internet was in its infancy, has struggled to keep pace with the rapid changes in technology and user behaviour.**
- **Since its inception, India's internet user base has exploded from a mere 5.5 million to a staggering 850 million.**

Key provisions

- **Firstly, it places a strong emphasis on online safety and trust, with a commitment to safeguarding citizen's rights in the digital realm while**

remaining adaptable to shifting market dynamics and international legal principles.

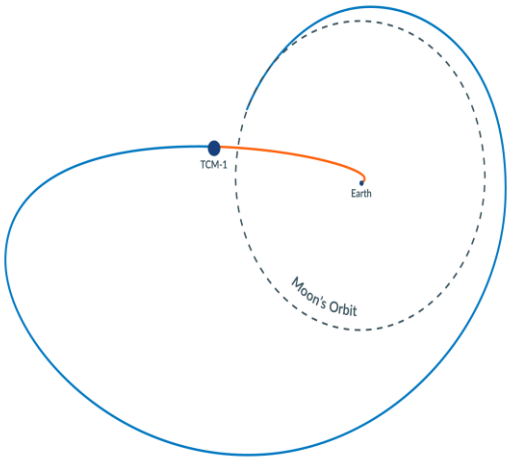
- **Secondly, recognizing the growing importance of new age technologies such as artificial intelligence and block chain, the DIA provides guidelines for their responsible utilization.**
- **Through this, it aims to not only encourage the adoption of these technologies but also to ensure that their deployment is in line with ethical and legal principles.**
- **Thirdly, it upholds the concept of an open internet, striking a balance between accessibility and necessary regulations to maintain order and protect users**
- **Lastly, it contemplates a review of the "safe harbour" principle, which presently shields online platforms from liability related to user- generated content, indicating a potential shift in online accountability standards.**

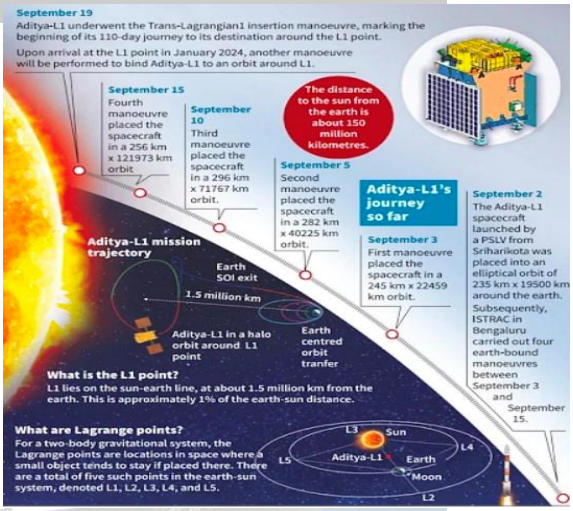
The myriad challenges

- **One key concern is the potential impact on innovation and the ease of doing business.**
- **Stricter regulations, particularly in emerging technologies, could inadvertently stifle entrepreneurial initiatives and deter foreign investments.**
- **Additionally, the review of the "safe harbour" principle, which shields online platforms from liability for user- generated content, could lead to a more cautious approach among these platforms, possibly impinging on freedom of expression.**
- **Furthermore, the DIA's success hinges on effective enforcement, which will require substantial resources, expertise, and infrastructure.**

Trajectory correction of Aditya L1

- **The Indian Space Research Organisation (ISRO) has performed a trajectory correction manoeuvres on the Aditya-L1 spacecraft which is headed to the Lagrangian-1 (L1) point between sun and earth.**





- **It was needed to correct the trajectory evaluated after tracking the Trans-Lagrangian Point 1 Insertion (TL1I) maneuver performed on September 19, 2023, it added.**

Dhole

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- **The dhole or Asiatic wild dog (Cuon alpinus) is the only endangered wild**

pack- living canid in the tropical Indian forests and is considered at high risk of extinction.

- **The study through camera traps by Urjit Bhatt and Salvador Lyngdoh at Manas National Park in Assam also revealed that the diurnal activity of the dholes had the highest temporal overlap with leopards and the lowest with clouded leopards.**
- **Sympatric refers to animals, plant species, and populations within the same or overlapping geographical areas.**
- **Dholes were once widespread across southern and eastern Asia.**
- **Factors such as habitat loss, declining prey availability, persecution, disease, and inter specific competition have contributed to the ongoing fragmentation of its populations.**
- **The global population of adult dholes, now classified as endangered on the International Union for Conservation of Nature's Red List, is estimated to be between 949 and 2,215.**
- **The hypotheses included conflict with humans on the periphery of protected areas as the primary threat to dholes, higher habitat utilization where small-medium prey species such as rodents, hares, and rhesus macaques are found, and a negative relationship between dhole habitat use and other large carnivores**

About dhole

- **Listed under the Endangered category of the IUCN Red List, the dhole is a wild canid found in the forests of central, south, and southeast Asia.**
- **Dholes have historically been overlooked, with very few studies that document their ecology and conservation requirements.**
- **Dhole population face threats primarily from human disturbances and habitat loss. Other threats include prey base reduction and retaliatory**

killings in some parts of North East India and Southeast Asia.

Consanguinity & Autosomal recessive Disorder

- Consanguinity is the characteristic of having a kinship with a relative who is descended from a common ancestor.
- Many jurisdictions have laws prohibiting people who are related by blood from marrying or having sexual relations with each other
- Consanguinity is the kinship of two individuals characterized by the sharing of common ancestor(s).
- Consanguinity is both a social and genetic concept.
- Generally, it refers to marriage or a reproductive relationship between two closely related individuals. The degree of relatedness between two individuals defines the proportion of genes shared between them.
- The offspring of consanguineous couples are at increased risk for autosomal recessive disorders due to their increased risk for homozygosity by descent.
- Autosomal recessive is a pattern of inheritance characteristic of some genetic disorders. "Autosomal" means that the gene in question is located on one of the numbered, or non-sex, chromosomes. "Recessive" means that two copies of the mutated gene (one from each parent) are required to cause the disorder.
- In a family where both parents are carriers and do not have the disease, roughly a quarter of their children will inherit two disease-causing alleles and have the disease. By contrast, an autosomal dominant disorder requires only a single copy of the mutated gene from one parent to cause the disorder. Sickle cell anemia is an example of an autosomal recessive genetic disorder.

Phonotaxis

- **The click of crickets in the evening or frogs croaking during the monsoon might sound random or even annoying, but they have a good reason for making these sounds.**
- **Scientists call it phonotaxis: the movement by an animal in response to a sound. It has mostly been observed among crickets, moths, frogs, toads, and a few other creatures.**
- **There are two types of phonotaxis: positive and negative. The purpose of positive phonotaxis is attraction.**
- **It usually happens when the females of a particular species – including those of crickets and frogs are attracted to the sounds made by the males.**
- **Negative phonotaxis, on the other hand, serves to repel or warn, such as when the sound of a predator nearby signals to an animal that it needs to move away.**

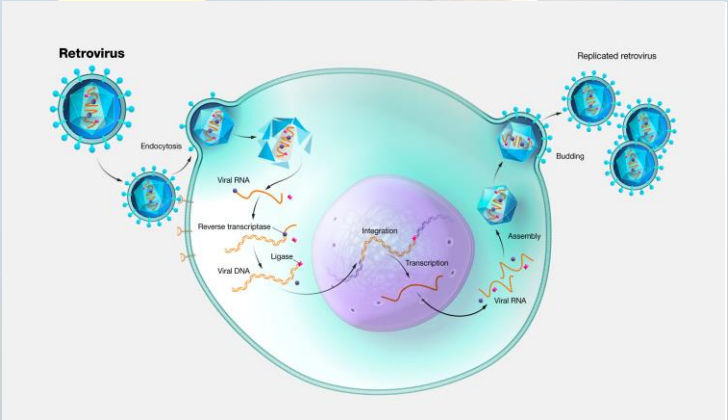
Xenotransplantation and Retrovirus

- **Modifying the pig genomes to remove antigen coding genes, add human genes and eliminate pig viruses, resulted in long- term survival of the monkey recipients, up to around two years.**

- **The transplantation of animal organs into humans (xenotransplantation) may offer a solution to the worldwide organ shortage.**
- **Previous work has identified three glycan antigens expressed in pigs that are recognized by human antibodies and attacked, leading to rejection of the organ.**
- **The porcine endogenous retrovirus has also been identified as a risk for transmission into humans.**

Retrovirus

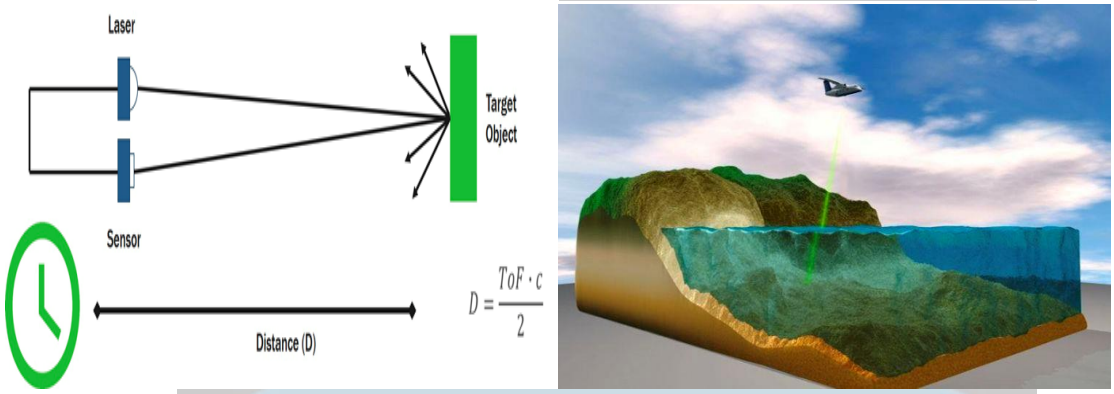
- **A retrovirus is a type of virus that inserts a DNA copy of its RNA genome into the DNA of a host cell that it invades, thus changing the genome of that cell.**



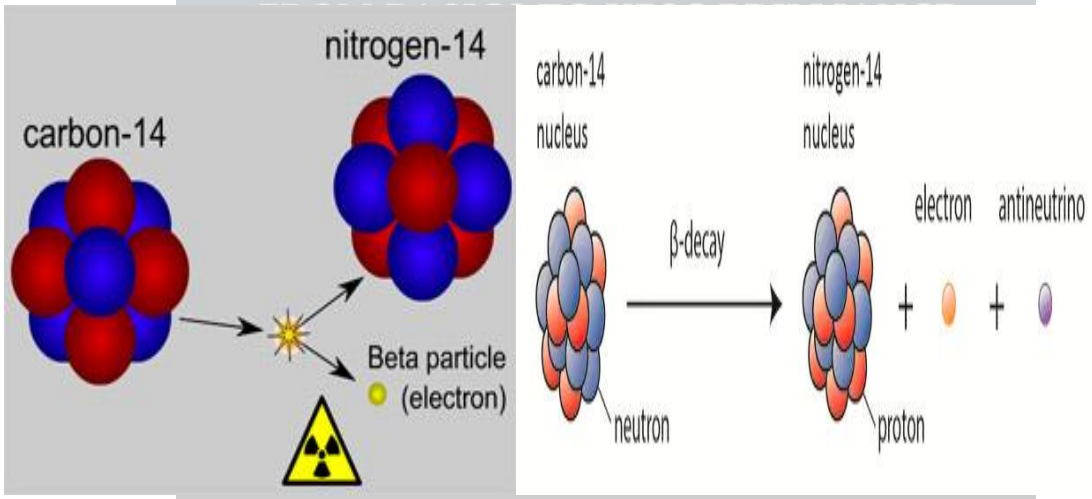
LIDAR Technology

- **Researchers searched 5,315 sq. km of LIDAR survey data and discovered 24 unreported human made earthworks, including fortified villages, in regions across the Amazon basin (Science).**
- **But the LIDAR survey data covered only 0.08% of the total area of Amazonia.**
- **LiDAR is an acronym for Light Detection and Ranging. In LiDAR, laser light is sent from a source (transmitter) and reflected from objects in the scene. The reflected light is detected by the system receiver and the time of**

flight (TOF) is used to develop a distance map of the objects in the scene.

- 

Carbon 14

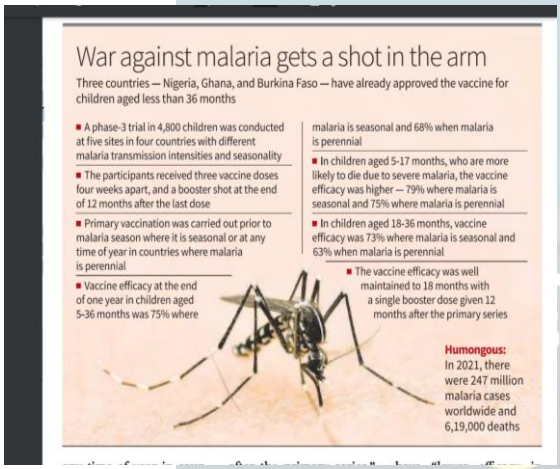
- **New radiocarbon (Carbon14) and optically simulated luminescence ages have confirmed the controversial antiquity of the ancient human footprints discovered in White Sands National Park, and reported in a study in 2021.**
- **Carbon-14, the longest-lived radioactive isotope of carbon, whose decay allows the accurate dating of archaeological artifacts.**
- **The carbon-14 nucleus has six protons and eight neutrons, for an atomic mass of 14.**
- 

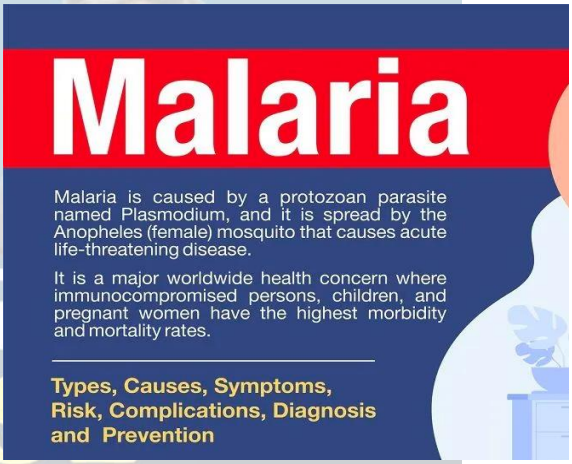
- **White Sands National Park is an American national park located in the state of New Mexico and completely surrounded by the White Sands Missile**

Range.

Malaria vaccine

- **A malaria vaccine R21/Matrix M developed by the University of Oxford, manufactured by the Pune- based Serum Institute of India and tested in a phase- 3 trial at five sites in four countries Mali, Burkina Faso, Kenya, and Tanzania in Africa was recommended (but yet to be pre-qualified) by the WHO on October 2.**
- **Three countries Nigeria, Ghana, and Burkina Faso have already approved the use of the vaccine to immunize children aged less than 36 months.**





Plastic pollution

- **It was in 1907 that the Belgian scientist Leo Baekeland synthesized the first plastic using formaldehyde and phenol, called it Bakelite, mass produced it and marketed it.**
- **The UN Environment Programme (UNEP) points out that every day, the equivalent of 2,000 garbage trucks full of plastic are dumped into the world's oceans, rivers, and lakes. Plastic pollution is a global problem.**
- **Every year, 19-23 million tonnes of plastic waste leaks into aquatic ecosystems, polluting lakes, rivers and seas.**

- **Plastic pollution can alter habitats and natural processes, reducing ecosystems' ability to adapt to climate change, directly affecting millions of people's livelihoods, food production capabilities and social well-being.**
- **The UNEP points out that the environmental, social, economic and health risks of plastics need to be assessed alongside other environmental stressors, like climate change.**
- **Recycling of plastics is a method for production of the vital resource of liquid and gaseous fuels.**
- **Thermal and catalytic degradation, and gasification are alternative methods for recycling of plastic waste to produce fuel having properties similar to commercial fuels.**

Umami as sixth taste

- **Japanese scientist Kikunae Ikeda first proposed umami as a basic taste in addition to sweet, sour, salty and bitter in the early 1900s.**
- **About eight decades later, the scientific community officially agreed with him.**
- **Now, scientists have evidence of a sixth basic taste.**
- **In a study published recently, researchers have found that the tongue responds to ammonium chloride through the same protein receptor that signals sour taste.**
- **Scientists have for decades recognized that the tongue responds strongly to ammonium chloride.**
- **That protein, called OTOP1, sits within cell membranes and forms a channel for hydrogen ions moving into the cell.**
- **amended the Information Technology Rules, 2021**

- **In April this year, the Ministry of Electronics and IT (MEiTY) promulgated the 2023 IT Rules, which amended the Information Technology Rules, 2021, and allowed the Ministry to appoint a fact checking unit**

What does the amendment say?

- **The amendment brings about significant changes to Rule 3(1)(b)(v) of the IT Rules, 2021, which deals with the responsibilities of intermediaries.**
- **They are now under an obligation to make "reasonable efforts" to ensure that users do not "host, display, upload, modify, publish, transmit, store, update, or share any information" which is "identified as fake or false or misleading by a fact check unit of the Central government" in respect of "any business of the Central government."**
- **Failure to comply with this puts intermediaries at risk of losing the safe harbour protection provided under Section 79 of the IT Act, 2000.**
- **The safe harbour safeguard exempts intermediaries from liability for any third- party information made available or hosted by them.**

What did the High Court say?

- **Early on in the proceedings, in April, the Bombay High Court observed that the amended Rules no matter how well-intentioned, lack necessary safeguards.**
- **The Court expressed the opinion that prima facie, the Rules do not seem to offer protection for fair criticism of the government like parody and satire.**
- **Highlighting the ambiguity surrounding the term "any business of the Central government," the Court wondered if speeches made ahead of the 2024 Lok Sabha elections would fall within its ambit.**
- **It then enquired if publications questioning the veracity of such political**

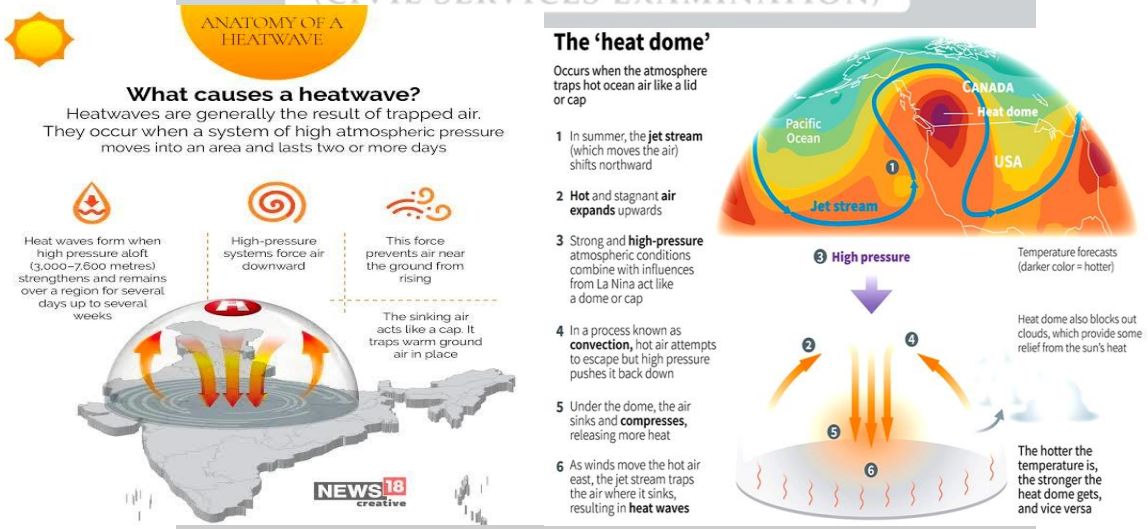
speeches would be covered by the amendment, thus empowering the government to identify "fake

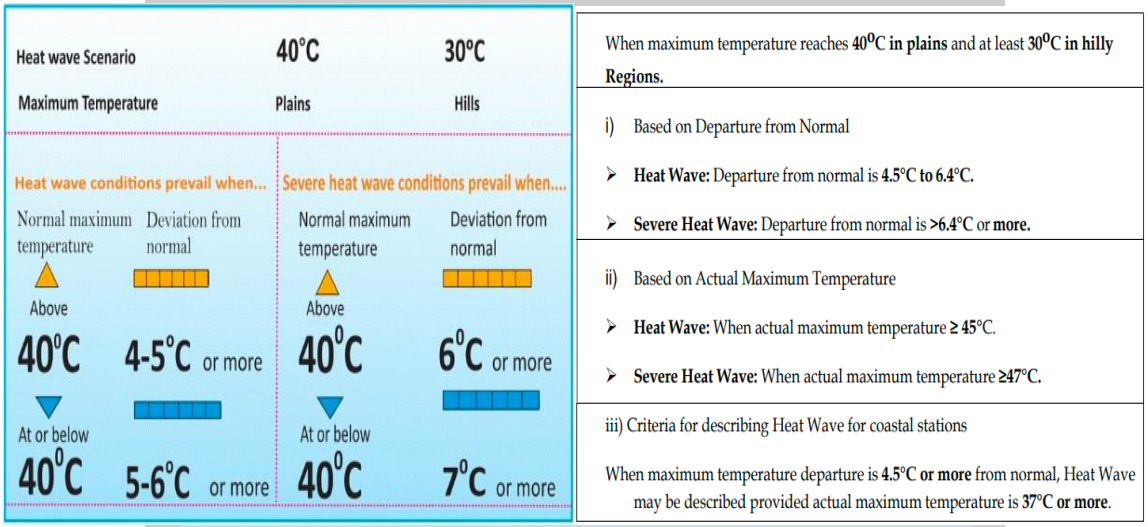
Surgical site infection

What is a surgical site infection?

- **A surgical site infection is a common complication in surgeries worldwide. It is an infection that occurs at the site of a surgery in the body.**
- **It could be a superficial skin infection or a deeper one, involving tissues. About 11% of patients who undergo surgery contract such infections, according to a 2018 WHO report.**
- **A substantial number of surgical site infections occur in semi -urgent and emergency surgeries, and the financial burden associated with these infections is significant for patients in India, where insurance coverage is low and out -of -pocket expenses are high.**

Heat waves





- **Billions of people could struggle to survive in periods of deadly, humid heat within this century as temperatures rise, particularly in some of the world's largest cities, from Delhi to Shanghai, according to research published.**
- **Towards the higher end of warming scenarios, potentially lethal combinations of heat and humidity could spread further including into areas such as the U.S. Midwest, the authors of the report said**
- **It found that around 750 million people could experience one week per year of potentially deadly humid heat if temperatures rise 2 degrees Celsius above pre- industrial levels.**
- **At 3C of warming, more than 1.5 billion people would face such a threat**
- **The world is on track for 2.8 C of warming by 2100 under current policies, according to a 2022 United Nations report.**
- **While India, Pakistan, and the Gulf have already briefly touched dangerous humid heat in recent years, the study found it will afflict major cities from Lagos to Chicago if the world keeps heating up.**

Operation Litani

- In March 1978, Israel invaded southern Lebanon to push the Palestinian militants north of the Litani River.
- The attack came a few weeks after the Coastal Road massacre in which Palestinian militants hijacked a bus and killed 38 Israelis.
- Israel pushed the Palestinian militants out of southern Lebanon and handed the territories to the South Lebanon Army, an Israeli proxy, and pulled back later in 1978.
- But as attacks into Israel continued from southern Lebanon, Israel decided to invade Lebanon again, in 1982, but this time, it set ambitious goals for itself.
- Israel wanted to eject the Palestinian Liberation Organisation (PLO) from Lebanon, remove Syrian influence from the country and establish a pro-Israel government (of Bashir Gemayel) in Beirut

All About semiconductors

- Six working groups, which had been formed to mull the Indian government's artificial intelligence (AI) roadmap, have submitted the first edition of their report, Minister of State for Electronics and Information
- the report's recommendations included public- private partnerships to make semiconductors for AI applications.
- In addition to this, the PPP model would be leveraged to build so- called "GPU clusters", masses of resource- intensive graphics processors that are used by AI applications.
- These clusters would be made available to Indian start-ups and researchers,
- Semiconductors are a critical part of almost every modern electronic device,

and the vast majority of semiconductors are made in Tawain.

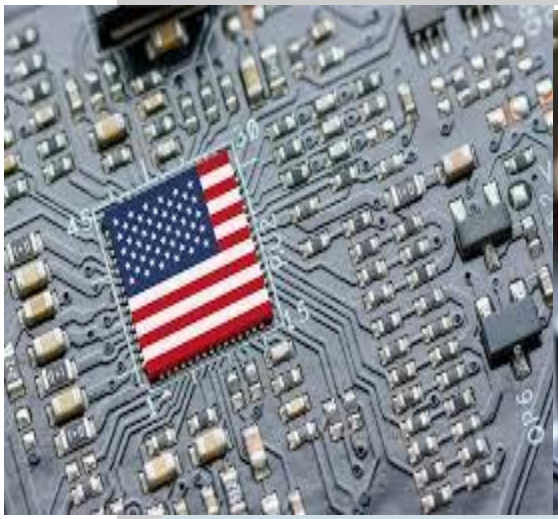
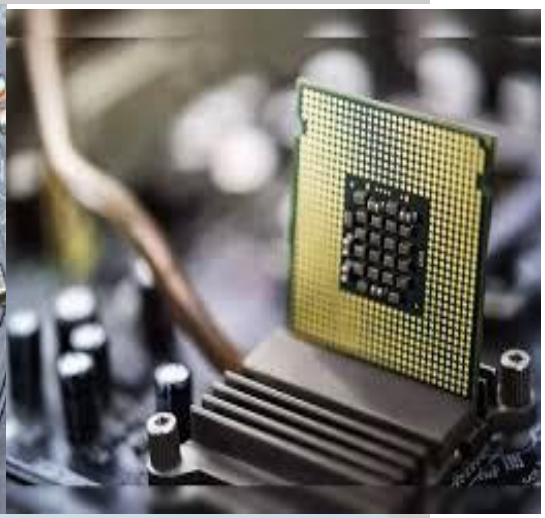
- Increasing concerns over the reliance on Taiwan for semiconductors especially given the tenuous relationship between Taiwan and China

What is a semiconductor?

- Generally speaking, the term semiconductor refers to a material like silicon that can conduct electricity much better than an insulator such as glass, but not as well as metals like copper or aluminum.
- But when people are talking about semiconductors today, they are usually referring to semiconductor chips.
- These chips are typically made from thin slices of silicon with complex components laid out on them in specific patterns. These patterns control the flow of current using electrical switches called transistors

What do semiconductors do?

- Semiconductors are how electronic devices process, store and receive information.
- For instance, memory chips store data and software as binary code, digital chips manipulate the data based on the software instructions, and wireless chips receive data from high-frequency radio transmitters and convert them into electrical signals.
- These different chips work together under the control of software

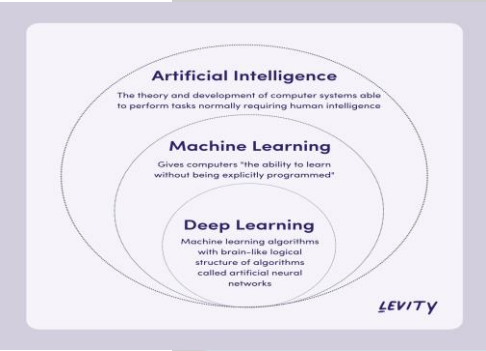
Clean energy projects of US

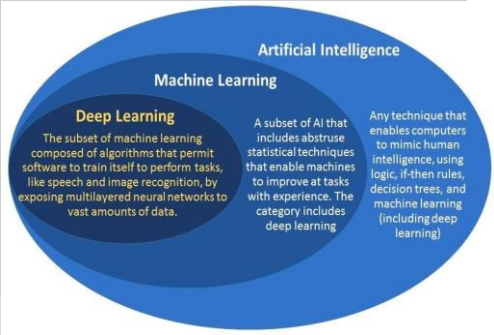
- **Clean- energy projects in seven states from Pennsylvania to California have been selected by the Biden administration for a $7 billion program to kick start development and production of hydrogen fuel, a key component of President Joe Biden's agenda to slow climate change.**
- **His goal is to establish seven regional hydrogen hubs to help replace fossil fuels such as coal and oil with cleaner- burning hydrogen as an energy source for vehicles, manufacturing and generating electricity.**

Deep learning

- **A method to quickly classify central nervous system (CNS) tumours, combining rapid sequencing and deep- learned AI models, may enable molecular diagnosis in less than 90 minutes, according to a study published in Nature.**
- **The Netherlands and others used a technology called Nano pore sequencing. This method is faster, but the data generated has much less coverage of genetic sites.**

- **To enable molecular classification of CNS tumours with such sparse data, the researchers developed a neural network tool named 'Sturgeon'.**





- **"We developed Sturgeon, a patient- agnostic transfer- learned neural network, to enable molecular sub classification of central nervous system tumours based on such sparse profiles.**

- **Deep learning is part of a broader family of machine learning methods, which is based on artificial neural networks with representation learning. The adjective "deep" in deep learning refers to the use of multiple layers in the network.**

Human brain

- **Researchers have developed an atlas of the human and non-human primate brain at the cell type level in unprecedented detail.**

- **The researchers' collective efforts characterized more than 3,000 human brain cell types, revealing features that distinguish us from other primates in some.**

- **Understanding the human brain at such resolution will not only help scientists pin down which cell types are affected by mutations, leading to neurological diseases.**

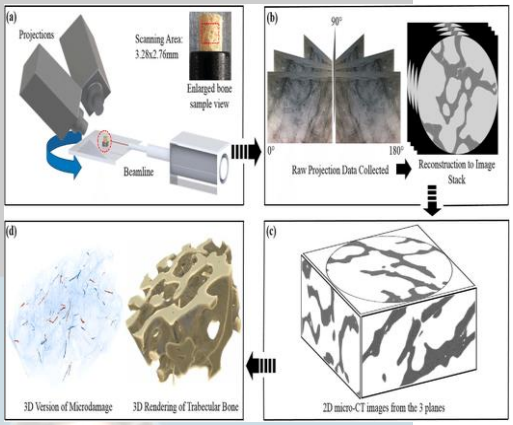
Arctic system and climate change

- Arctic ecosystem impacts grey whale population
- Even highly mobile, large, and long--lived species are sensitive to dynamic and changing conditions as the Arctic warms.
- As per a new study, population swings in eastern North Pacific grey whales, some of which have resulted in recent mass mortality events, are driven by changing prey biomass and ice cover in the Arctic.
- Climate change is driving rapid change in Arctic ecosystems, including the shallow basins of the Pacific Arctic, which are critical marine areas that support various migratory marine species.

Synchrotron imaging

- Homo erectus had expanded beyond the lowland savanna environments of East Africa and into the high- altitude regions of the Ethiopian highlands, where they produced both Oldowan and Acheulean tools, according to a new study.
- The study presents a reanalysis of an early hominin fossil. Using synchrotron imaging to examine the internal morphology of the unerupted teeth in the Garba IV mandible, researchers confirm that it belonged to H. erectus.
- Synchrotron imaging has a long history, dating back to the 1800s. Modern synchrotron radiation (SR) sources such as Diamond Light Source have dramatically fostered the use of SR-based X-ray imaging.

- **Vital information such as density, chemical composition, chemical states, structure, and crystallographic perfection can be mapped in two, or, increasingly, in three dimensions.**

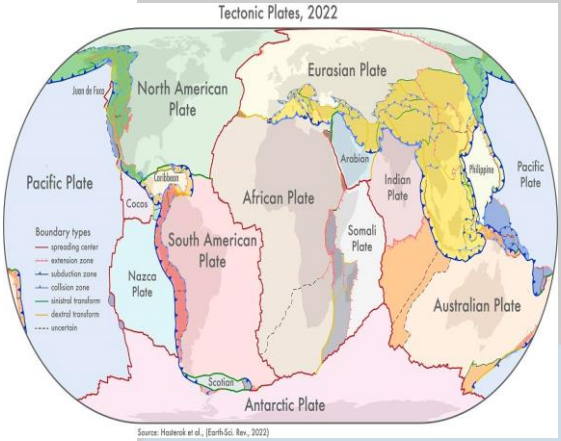


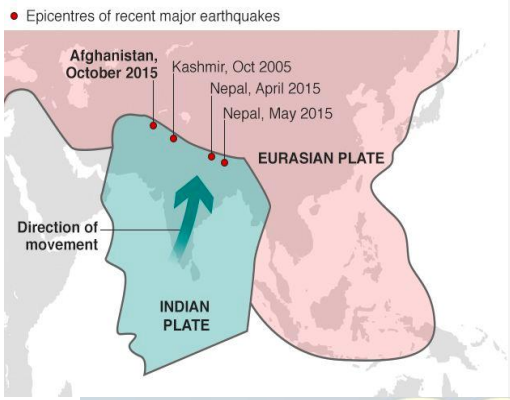
- **The ongoing developments in this field have led to a dramatic increase in both the speed and resolution of X-ray imaging techniques pushing spatial resolution down towards the nanoscale.**
- **X-ray imaging visualizes samples, frequently the internal or hidden components of a sample and is applicable to nearly all fields of science from the life sciences to engineering to archaeology.**
- **It can probe the interior structure of materials, cells and molecules to address problems in areas such as cell biology, Nano magnetism, chemical identification and molecular identification, environmental science and soft matter.**

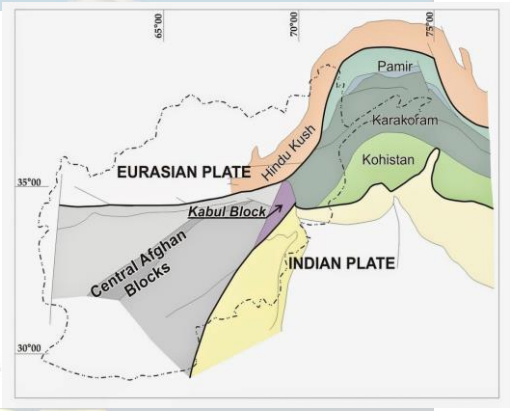
Why an earthquake in Afghanistan?

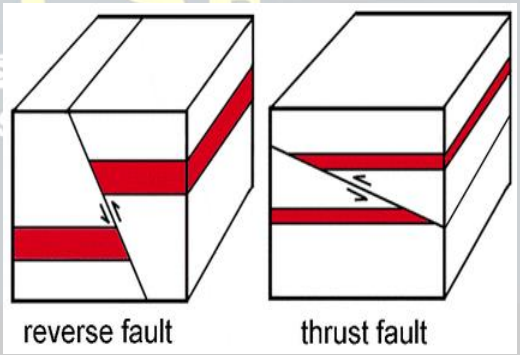
- **What can be termed as unusual, a shallow focus (14 km depth) earthquake of 6.3 magnitude struck about 40 kms northwest of Herat in Afghanistan at around 11:00 am local time on October 7 (Saturday).**

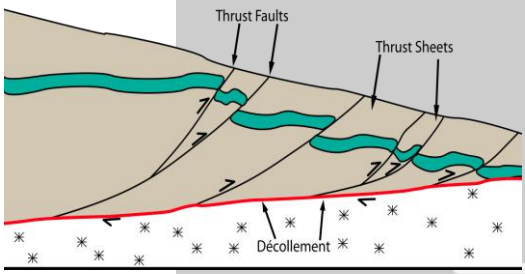
The earthquake occurred as the result of thrust faulting near the far western terminus of the Hindu Kush Mountain range.









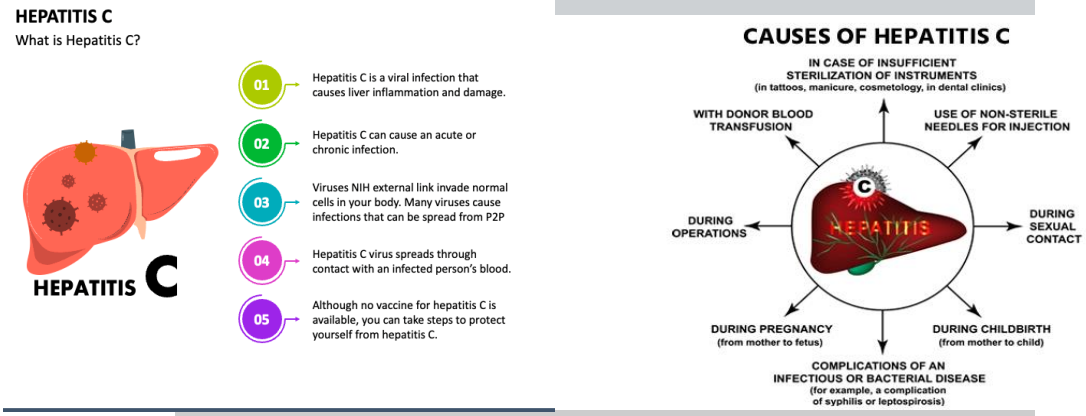


- **Earthquakes occurred on east west striking fault planes that dip to either the north or south. The earthquakes occurred within the Eurasia plate in an intracontinental mountain belt".**
- **All three earthquakes have been thrust faults, otherwise known as reverse faults. Thrust faults form due to horizontal compressive stresses and so cause shortening of the crust.**
- **Here one block or wall (the hanging wall) moves up relative to the other (called the footwall)**
- **"To call a quake and aftershock, the magnitude has to be lesser than the magnitude of the main event [quake],"**
- **A quake of 6.3 magnitude was followed by another of the same magnitude. This can happen when a fault at one place ruptures resulting in an earthquake that releases the stress.**
- **The release of stress in one fault results in the loading of stress at another fault.**
- **The loading of stress can result in another earthquake which can be of similar magnitude or even higher magnitude.**
- **But the magnitude will not be smaller than the first quake."**
- **"In subduction zones and in the Himalayas where there is interaction between two continental plates, the fault lengths can be very large and also very wide.**
- **That is the reason why an earthquake in the fault can trigger another in the**

same fault," he says.

- The second earthquake occurred quite close to the first one (about 20 km distance) in the same fault
- Earthquakes are quite common in Afghanistan due to active interactions between three tectonic plates the Arabia, Eurasia, and India plates.
- According to the USGS, earthquakes in western and central Afghanistan are "primarily influenced by the northward movement of the Arabia plate relative to the Eurasia plate
- "Shallower crustal earthquakes in the Pamir Hindu Mountains occur primarily along the Main Pamir Thrust and other active Quaternary faults, which accommodate much of the region's crustal shortening.
- The western and eastern margins of the Main Pamir Thrust display a combination of thrust and strike slip mechanisms.

Hepatitis c



- On October 9, WHO announced that Egypt had made "unprecedented progress" towards eliminating hepatitis C.

- **According to the WHO, Egypt became the first country to achieve "gold tier" status on the path to elimination of hepatitis C as per the global health body criteria.**

- **The "gold tier" status to reach the stated goal of eliminating hepatitis C includes meeting specific criteria such as ensuring 100% blood and injection safety, maintaining a minimum of 150 needles/syringes per year for people who inject drugs (PWID),**

- **Diagnosis of over 80% of people living with chronic hepatitis C virus (HCV), treating of over 70% of individuals diagnosed with HCV, and the establishing of a sentinel surveillance programme for hepatitis sequelae, including liver cancer.**

- **Hepatitis C infection is unevenly distributed globally, with these regions accounting for the most European (22%), Southeast Asia (20%) and the Eastern Mediterranean (17%).**

- **According to a 2023 WHO document, in 2019, there were 1.5 million new infections, with one third of new HCV infections occurring in the Eastern Mediterranean Region.**

Indian ocean rim association (IORA)

- **'Inforcing Indian Ocean Identity' was the banner theme at the Indian Ocean Rim Association's (IORA) Council of Ministers (COM) held in Colombo on October 11, that was attended by foreign ministers and senior officials of the 23-nation grouping of countries.**

- **This year's conference was marked by a lot of interest from other countries,**

especially those who are "dialogue partners' ' or would like to become dialogue partners, putting a spotlight on the 26-year-old organisation, believed to be the brainchild of former South African President Nelson Mandela.

What is the IORA and how was it formed?

- The Indian Ocean Rim Association includes 23 countries from Africa, West Asia, South Asia, South East Asia, Australia and littoral states situated in and around the Indian Ocean.
- The grouping, whose apex body is the Council of Foreign Ministers that meet once a year, moves by rotation through members every two years.
- Sri Lanka took charge as Chair this year from Bangladesh, and India is Vice Chair, meaning that the troika of IORA is within the South Asian region.
- IORA's membership includes 23 countries: Australia, Bangladesh, the Comoros, France, India, Indonesia, Iran, Kenya, Madagascar, Malaysia, the Maldives, Mauritius, Mozambique, Oman, Seychelles, Singapore, Somalia, South Africa, Sri Lanka, Tanzania, Thailand, the UAE and Yemen.
- It also has 11 dialogue partners: China, Egypt, Saudi Arabia, Germany, Italy, Japan, South Korea, Russia, Türkiye, the U.K. and the U.S.
- While the IORA was formed in 1997 (then called the Indian Ocean Region Association for Regional Cooperation) in Mauritius, its genesis came from a speech Nelson Mandela gave in Delhi in 1995.
- He was invited by then Prime Minister P.V. Narasimha Rao as the guest for Republic Day, and said at a ceremony that India and South Africa should

explore "the concept of an Indian Ocean Rim of socioeconomic cooperation and other peaceful endeavours" that could help developing countries within multilateral institutions "such as the United Nations, the Commonwealth and the Non-Aligned Movement

Why does the Indian Ocean Region matter?

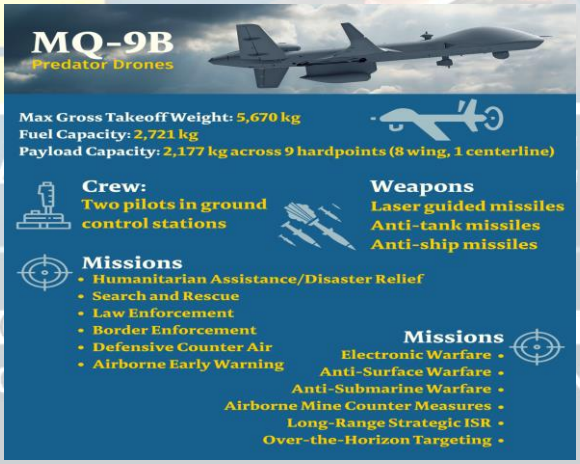
- **A third of the world's population (2.6 billion people) live in the region, and 80% of global oil trade, 50% of the world's containerised cargo and 33% of its bulk cargo passes through it.**
- **The region produces a combined total of $1 trillion in goods and services and intra-IORA trade is billed at around $800 billion.**
- **India's other regional organizations, like SAARC (South Asian Association for Regional Cooperation) and BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation), face their own challenges.**
- **While the QUAD (Quadrilateral Security Dialogue), has made progress, it remains U.S.-led, along with military allies Australia and Japan.**
- **Meanwhile, China is actively trying to rope in India's neighbours with groupings like the Belt and Road Initiative (BRI), China- Indian Ocean Region Forum on Development Cooperation, China- South Asian Countries Poverty Alleviation and Cooperative Development Centre, which exclude India. IORA, however, remains a "safe space" for India and other countries of the region that wish to keep out the constant challenge of big power rivalries.**
- **IORA membership is based on consensus, and Pakistan has not been**

admitted to the grouping since it first applied in 2001, on the basis that it has not extended MFN (most favoured nation) status to India, making the IORA a less contentious space for India as well, compared to groupings like the Shanghai Cooperation Organisation (SCO).

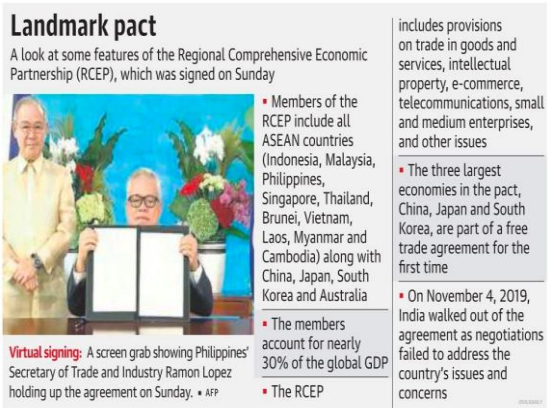
31MQ9B

The Ministry has only accorded the Acceptance of Necessity to acquire 31 MQ 9B HALE Drones. Only the United States has these drones. China has been trying to acquire it but has not been able to do so.

India has formally requested the acquisition of 31 top-grade MQ-9B Reaper or Predator-B drones from the United States.



Four years after India walked out of the Regional Comprehensive Economic Partnership (RCEP) agreement, neighbours Sri Lanka and Bangladesh are now considering their chances of membership in the 15- nation trading bloc



Radiation detection equipment (RDE)

Radiation detection equipment (RDE) will soon be installed at eight land crossing points along India's borders with Pakistan, Bangladesh, Myanmar and Nepal to check the trafficking of radioactive materials for its possible use in making nuclear devices, officials said. The RDE will be installed at the integrated check posts and land ports of Attari (Pakistan border), Petrapole, Agartala, Dawki and Sutarkandi (all on the Bangladesh border), Raxaul and Jogbani (Nepal) and Moreh (Myanmar).

The Union government has taken the initiative to install the RDE so that the trafficking of radioactive materials across international borders can be checked.

Aestivation

Felt the urge to sleep through a hot day? Some animals do exactly that to beat the heat, but for a whole season.

This is called estivation (or aestivation). It is a biological phenomenon whereby the animal enters a long period of dormancy, or inactivity, in response to high temperature or maybe even drought -like conditions.

It is a survival strategy that helps the animal conserve energy and water in a difficult time.

During estivation, the animal often seeks shelter in a cool underground burrow, crevice or cocoon, where it will remain in a state of reduced metabolic activity, which in turn reduces the rate at which the body consumes energy.

Estivation can also be a way to avoid desiccation extreme dryness of the skin and also lower the risk of being preyed on by a predator.

For example, the West African lungfish (Protopterus annectens) burrows into the mud of a drying water body and secretes a cocoon of mucus around itself during a drought. Desert tortoises (Gopherus agassizii) dig burrows

and retreat into them in hot summer months.

Pauli principles

Physicists in Germany have come up with a way to convert the energy difference between two quantum states of a group of atoms into work.

The device adapts the principles of the familiar classical engine to the subatomic realm, giving physicists a way to study the nascent field of quantum thermodynamics in more detail as well as, possibly, build better quantum computers.

Pauli's principle All subatomic particles can be classified as either fermions or bosons.

Fermions are the building blocks of matter; bosons are particles that carry the forces acting between them.

Now, when a bunch of particles are cooled to very nearly absolute zero, so that their quantum nature comes to the fore, they would all like to have the lowest energy possible but they can't.

This is known as Pauli's exclusion principle.

All particles in a system are distinguished by four quantum numbers, sort of like their Aadhaar numbers. The values of the four numbers together tell us something about how much energy a particle has.

The exclusion principle states that, in a given system, no two particles can have the same four quantum numbers, that is, they can't occupy the same energy level.

Fermions are particles that are bound by this rule.

Bosons are not bound by the exclusion principle principle: they can all occupy the same lowest energy level at a given low temperature. Fermions to bosons and back

Classical engines convert heat into work.

For example, the internal combustion engine in a car uses the heat released by the combustion of petrol or diesel to push a piston. Overall the engine has four steps: the fuel is compressed, ignition causes the fuel air mix to expand and push the piston out, the mix cools and stops expanding, and the piston is brought back to the first step.

The quantum engine, or what the researchers are calling a 'Pauli engine', has a similar set of four steps. First, the atoms collected in the trap are compressed and kept in a bosonic state. Second, the strength of a magnetic field applied on the atoms is increased by a small amount.

Interactions between the atoms and the field cause the former to slip into a fermionic state:

They are forced to move out of the lowest energy level and progressively occupy higher levels.

Third, the compression applied in the first step is eased.

Fourth: the magnetic field strength is reduced to its original value.

The energy of the atoms increases during the third step and this can be converted to work.

Cancer cells

A characteristic feature of cancer cells is that they divide rapidly, in

uncontrolled fashion. Anti-cancer drugs i.e. chemotherapeutic agents work by stalling or blocking this proliferation.

When the division of a cancer cell is arrested, it generally responds by triggering a pathway of programmed cell death, called apoptosis.

So in this way, chemotherapy eliminates the cancer cells without affecting other non-cancerous cells nearby that are not dividing.

But this is also why chemotherapy deals a lot of collateral damage.

Any tissue with a significant number of normal cells that are also dividing such as cells in the digestive tract, the bone marrow, and hair follicles are also affected by chemotherapeutic agents and suffer apoptosis.

This cell death underlies the unpleasant side- effects of chemotherapy, such as painful inflammation of the oral cavity and the gut, and nausea, diarrhoea, anaemia, and hair loss

An oncologist's challenge is to find the dose of a drug that effectively kills cancer cells but whose side- effects are not unbearable for the patient.

One way researchers have tried to achieve this is by developing antibody -drug conjugates (ADCs) against some cancers.

An ADC is a drug attached to an antibody that recognizes a protein found only on, or at least preferentially on, the cancer cells. This way, the antibody guides the chemotherapeutic drug to the cancer cells, where the drug begins its work

A small subset of cancer cells can still escape confrontation with the anti-cancer drug. This happens when these cells express elevated levels of a protein called P-gp short for permeability glycoprotein.

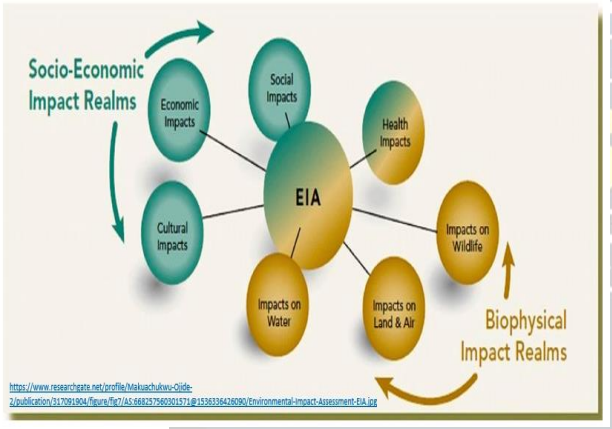
For a cell to produce P-gp, it uses information encoded in a gene called ABCB1.

To identify what tethered the ABCB1 gene to the nuclear envelope in sensitive cells, the researchers turned different genes 'off' to see which one affected the proteins that the cell uses to make the envelope.

They zeroed in on a protein called lamin B receptor (LBR). According to the researchers, when the LBR protein was absent, a cell could activate the ABCB1 gene when it was exposed to Taxol.

But when they deleted the gene used to make LBR, the cells didn't increase ABCB1 expression right away; they had to be exposed to Taxol as well.

Environment impact assessment



Environment Impact Assessment (EIA) is one such process defined by the United Nations Environment Programme (UNEP) as a tool to identify the environmental, social, and economic impacts of a project before it is implemented.

This tool compares various alternatives for the proposed project, predicts and analyses all possible environmental repercussions in various scenarios

The EIA process would need comprehensive, reliable data and would deliver results only if it is designed to seek the most appropriate, relevant and reliable information regarding the project.

In India, a precursor to the EIA began in 1976-77 when the Planning Commission directed the Department of Science and Technology to assess the river valley projects from the environmental point of view.

On January 27, 1994, the Union Ministry of Environment, Forests and Climate Change under the Environment (Protection) Act 1986 (EPA), promulgated the first EIA notification making Environmental Clearance (EC) mandatory for setting up some specified new projects and also for expansion or modernization of some specific activities.

The notification of 1994 saw 12 amendments in 11 years before it was replaced by the EIA 2006 notification.

The hallmark of the 2006 notification was the decentralization of the process of EC. State governments were also given powers to issue EC in certain cases.

The 2006 notification has also been amended, in the name of fine- tuning the process several times.

The EIA 2006 notification lays down the procedure as well as institutional set-up to give environmental clearance for the projects that need such clearance as per this notification.

Only projects enumerated in the schedule attached to the notification require prior EC.

An EIA is not required for many projects as they do not fall within the ambit of this notification.

This notification has categorized projects under various heads such as mining, extraction of natural resources and power generation, and physical infrastructure.

Despite all levels of government being acutely aware of the special needs of the Indian Himalayan Region (IHR), the region's vulnerabilities and fragility have not been considered separately

Even the draft 2020 notification which was floated for public discussion does not treat the IHR differently than the rest of the country and is not cognisant of the special developmental needs of IHR.

The Indian regulatory system uses a graded approach, a differentiated risk management approach depending on whether a project is coming up within a protected forest, a reserved forest, a national park, or a critical tiger habitat.

Despite this understanding of the fragility and vulnerability of the Himalayas, there is no mention of a different set of environmental standards needed if the project is located in the IHR.

The needs of these mountains could be addressed at all four stages of the EIA screening, scoping, public consultation, and appraisal

LIMITATION OF EIA

There is no regulator at the national level, as suggested by the Supreme Court of India in 2011 in Lafarge Umiam Mining (P) Ltd.; T.N. Godavarman Thirumulpad vs Union of India to carry out an independent, objective and transparent appraisal and approval of the projects for ECs and to monitor the implementation of the conditions laid down in the EC

The EIA process now reacts to development proposals rather than anticipate them. Due the fact that they are financed by the project proponent, there is a veering in favour of the project.

The process now does not adequately consider cumulative impacts as far as impacts caused by several projects in the area are concerned.

AI RISK

Yuval Noah Harari has expressed concerns about the amalgamation of AI and biotechnology, highlighting the potential to fundamentally alter human existence by manipulating human emotions, thoughts, and desires

Essential infrastructure such as water and electricity increasingly rely on AI.

Any malfunction or manipulation of such AI systems could disrupt these pivotal services, potentially hampering societal functions and public well being.

Similarly, although seemingly improbable, a 'runaway AI' could cause more harm such as the manipulation of crucial systems such as water distribution or the alteration of chemical balances in water supplies, which may cause catastrophic repercussions even if such probabilities appear distant

The evolution to human- level AI that is capable of outperforming human cognitive tasks will mark a pivotal shift in these risks.

Such AIs might undergo rapid self- improvement, culminating in a super-intelligence that far outpaces human intellect.

The challenge lies in aligning AI with universally accepted human values.

The lack of a unified global approach to AI regulation can be detrimental to

the foundational objective of AI governance to ensure the long term safety and ethical deployment of AI technologies

One of the most celebrated regulations out of these is the European Union's AI Act. It adopts a 'risk based' approach, tying the severity of risk to the area of AI deployment.

This makes sense when considering AI applications in critical infrastructures, which demand heightened scrutiny

While the area specific approach is valuable, a more holistic view of AI risks is necessary to ensure comprehensive and effective regulation and oversight.

However, there is a conspicuous absence of collaboration and cohesive action at the international level, and so long term risks associated with AI cannot be mitigated

The confluence of technology with warfare amplifies long term risks. Addressing the perils of military AI is crucial.

The international community has formed treaties such as the Treaty on the Nonproliferation of Nuclear Weapons to manage such potent technologies, demonstrating that establishing global norms for AI in warfare is a pressing but attainable goal. Treaties such as the Chemical Weapons Convention are further examples of international accord in restricting hazardous technologies.

Nations must delineate where AI deployment is unacceptable and enforce clear norms for its role in warfare.

Collegium vs government

The Court has been vocal about the Centre's selective treatment of its recommendations. There are instances of the government returning names that had been reiterated more than once.

In recent times, it has shown that it can have its way by merely ignoring some of the Collegium's decisions.

For instance, it ignored the proposal to appoint Justice S. Muralidhar, now retired, as CJ of the Madras High Court for so long that the Collegium ultimately rescinded its recommendation.

In the case of Justice T. Raja, who was Acting CJ in Madras for an unusually long period, the recommendation to transfer him to the Rajasthan High Court was ignored by the government until his retirement.

The conflict between the government and the Collegium over the appointment process is quite pronounced and often reaches a flashpoint.

It is time the process was streamlined to give effect to the Supreme Court's April 2021 order that set timelines for the government to process names recommended by the Collegium and express its reservations, if any.

Once the Collegium reiterates any recommendation, it should be implemented within three to four weeks.

Pygmy hogs

It is the smallest species of pig in the world.

Populations of pygmy hogs were once widespread in the tall, dense, wet grasslands in a narrow belt of the southern Himalayan foothills from north-

western Uttar Pradesh to Assam, through southern Nepal and North Bengal, and possibly extending into contiguous habitats in southern Bhutan. Due to human encroachment and destruction of the pygmy hogs' natural habitat, the species was thought to have gone extinct in the early 1960s.

With an estimated population of less than 250 mature individuals, the pygmy hog is listed as an Endangered species on the IUCN Red List, and conservation efforts such as captive breeding and re-release programs are currently being employed.

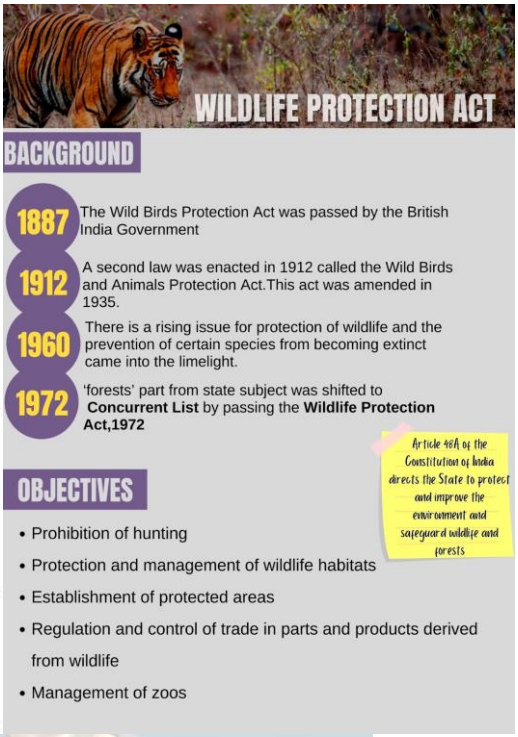
Sycamore tree

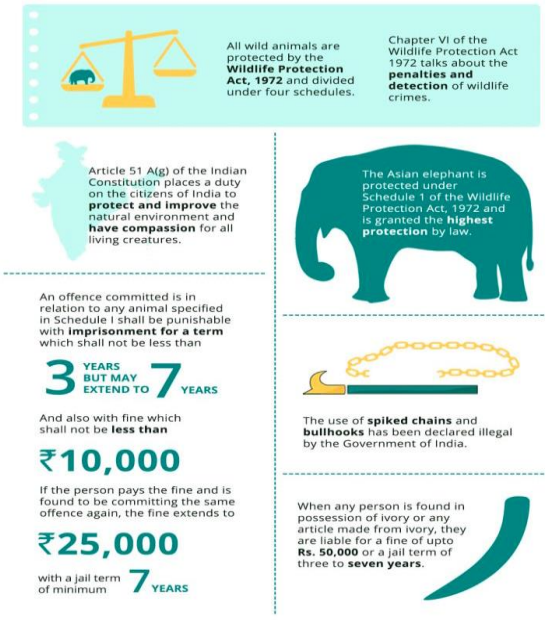
The sycamore tree was located in a dip between two hills, at a gap in the Hadrian Wall, an old stone structure that is close to the border between England and Scotland in Northumberland, northern England.

They are commonly found in the UK and have leaves similar to that of a maple tree.

Wild life protection act

Schedule I and part II of schedule II	Animals which are in the category of **endangered species. These are given absolute protection from hunting. Eg Tiger**
Schedule III and IV	These also have roughly the same provisions of Section I and II, but cover animals that are not in danger of becoming extinct.
Schedule V	Delineates animals that can be hunted **like ducks and deers** with the prior permission of **chief wildlife warden. (Vermins)**
Schedule VI	Concerns cultivation and plant life and gives teeth to setting up more protected animal parks.





- **Schedule 1, which confers the highest protection, contains about 600 species of vertebrates and hundreds of invertebrates, while Schedule 2 contains about 2,000 species (with 1,134 species of birds alone).**

- **The WLPA was originally intended to regulate the use of various species (including hunting), restrict trade, and police the trafficking of species.**
- **The new Act goes one step further by aligning itself with CITES, and including the CITES appendices as well.**
- **Listing hundreds of species of mammals and over 1,000 species of birds and innumerable other taxa means that it is unclear where resources should be allocated on the basis of this list.**
- **The same level of protection is offered to tigers and jackals, to the great Indian bustard and common barn owls, to the king cobra and rat snakes**
- **Consequence of listing has been the presence of the spotted deer (chital) in Schedule 1.**
- **Common throughout India, these are invasive in the Andaman Islands and have caused untold harm to the vegetation and herpetofauna.**
- **But they cannot be legally culled or removed because of the WLPA.**
- **Various Schedule 1 species pose enormous physical, mental and economic harm to people.**
- **Crocodiles in the Andamans, leopards in certain pockets, and elephants everywhere kill people, destroy their livelihoods, and leave lasting psychological impacts.**
- **And yet people are told glibly by elite conservationists that they should learn 'co-existence'.**

- **The WLPA serves to enforce this viewpoint.**
- **The new Act elevates wild pigs and nilgai to Schedule 1, which means that the few States that have now allowed limited culling of problematic animals may not be able to retain that policy.**
- **The third issue is that despite the support of many individuals in the forest bureaucracy, the paperwork involved in getting permits for research is tedious and time consuming.**
- **Environmental NGOs will have a harder time getting permits for research and conservation, even of common species such as barn owls.**

List of Environmental Acts in India

S. No	Act	Action
1	National Green Tribunal Act, 2010	Environmental protection and conservation of forests and other natural resources
2	Biological Diversity Act, 2002	To provide for conservation of biological diversity
3	The Environment (Protection) Act, 1986	Providing for the protection and improvement of the environment.
4	Forest (Conservation) Act, 1980	Check deforestation and encourage afforestation of non-forest areas.
5	Water (Prevention and control of pollution) Act, 1974	Provides maintenance and restoration and quality of all types of surface and groundwater.
6	Wildlife Protection Act, 1972	Providing protection to wild animals and birds.

SDGS

- **lack of progress on various Sustainable Development Goals (SDGs), world leaders at the SDG Summit in New York on September 18 and 19, once again reaffirmed their shared commitment to eradicate poverty and end hunger.**
- **They recognized that the world was on track to meet only 15% of its 169 targets that make up the 17 goals and have committed to an SDG stimulus of $500 billion annually**
- **A 2023 report of the United Nations Conference on Trade and Development estimated the investment gap in SDGs in developing countries to be greater than $4 trillion.**
- **Of this, nearly $2 trillion needs to be directed towards energy transition alone.**
- **five types of (dis)synergies that can be estimated along the value chain of an SDG intervention those arising from resource allocations; creation of**

enabling environments; co benefits; cost- effectiveness; and saturation limits.

- A recently launched UN Expert Group Report, entitled 'Synergy Solutions for a World in Crisis: Tackling Climate and SDG Action Together', also laments the lack of synergistic action in the face of significant (modelled) evidence.
- Every new investment we initiate today leading to a high- carbon outcome will likely result in higher dis-synergies or trade-offs in our ability to achieve our energy and climate goals.
- Establishing the domestic energy resources, we have for reasons of enhancing resilience to shocks is a worthwhile goal but exploiting those resources without a full cost estimation including weighing
- India's own vulnerability to climate-change impacts of alternative pathways with their synergistic opportunities is detrimental to both national and global efforts.
- On the other hand, investing in clean energy options could have a significant synergistic impact on air pollution and human health, increasing the attractiveness of such interventions.

Dolorimeters

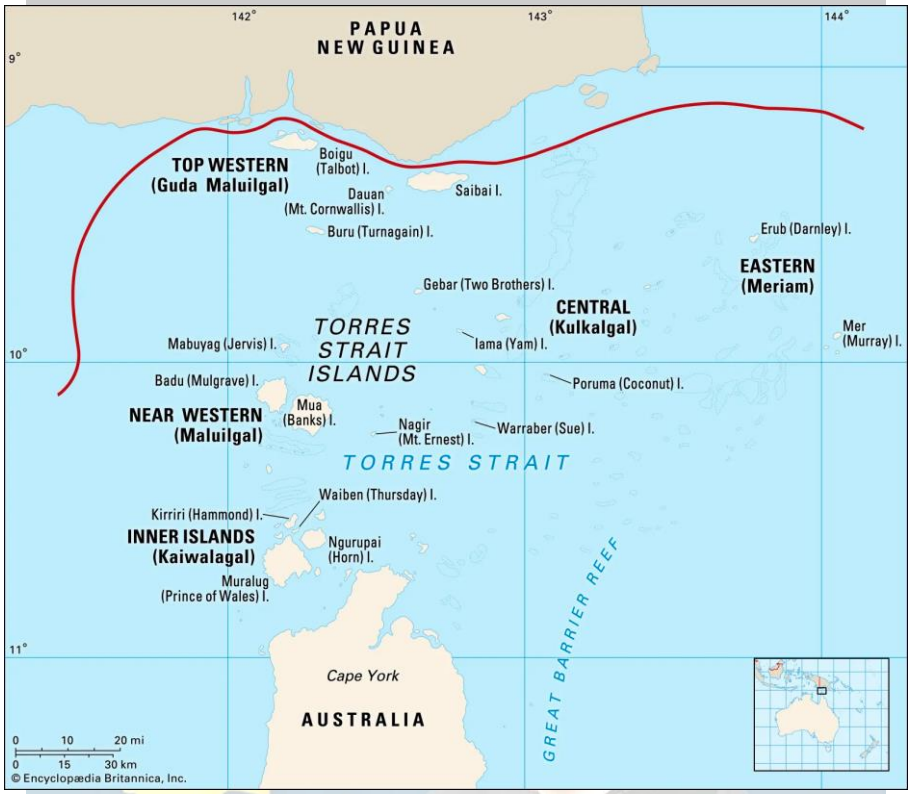
- A Dolorimeters is an instrument used to measure pain threshold and pain tolerance. Dolorimetry has been defined as "the measurement of pain sensitivity or pain intensity".
- Dolorimeters apply steady pressure, heat, or electrical stimulation to some

area, or move a joint or other body part and determine what level of heat or pressure or electric current or amount of movement produces a sensation of pain.

Torres strait

Torres Strait Islanders

- **Torres Strait Islanders are the Indigenous Melanesian people of the Torres Strait Islands, which are part of the state of Queensland, Australia.**



Quantum computers vs classical computer

- **An algorithm is a sequence of logically connected mathematical steps that solve a problem.**
- **A quantum algorithm is also a series of steps, but its implementation requires quantum gates. Some problems may need fewer steps on the part of a quantum algorithm than the number of steps required by a classical algorithm.**
- **That is, the quantum algorithm can speed up the computation. One factor that controls this speed-up is the possibility of superposition of the states of quantum bits, or qubits, that encode information.**
- **Whereas a classical computer uses semiconductor -based gadgets as bits to encode information, quantum computers use qubits.**
- **In both cases, the bit or the qubit can have two distinct states, 0 or 1; but**

qubits have the additional ability to be partly 0 and partly 1 at the same time.

- One of the earliest quantum algorithms is the factorization algorithm developed by Peter Shor.
- It requires fewer steps to factorise a number than one that operates with classical principles.
- Shor's algorithm identifies the factors of a given integer
- Another popular quantum algorithm is the quantum search algorithm developed by Lov Grover.
- It looks for a numerical pattern in a large list of numbers.

AI and wildlife

- When scientists want to measure reforestation, they can survey large tracts of land with tools like satellite and lidar.
- But determining how fast and abundantly wildlife is returning to an area presents a more difficult challenge sometimes requiring an expert to sift through sound recordings and pick out animal calls
- bioacoustics, which uses sound to learn more about animal life and habitats.
- It is a long- standing research tool, but more recently is being paired with computer learning to process large amounts of data more quickly.

Cognitive warfare

- Cognitive warfare truly ranks alongside other elements of modern warfare such as the domains of maritime, air and space.

- **Cognitive warfare puts a premium on sophisticated techniques that are aimed at destabilising institutions, especially governments, and manipulation, among other aspects, of the news media by powerful non- state actors.**
- **It entails the art of using technological tools to alter the cognition of human targets, who are often unaware of such attempts.**
- **The end result could be a loss of trust apart from breaches of confidentiality and loss of governance capabilities.**
- **Even more dangerous is that it could alter a population's behaviour using sophisticated psychological techniques of manipulation**
- **As firms, large and small, spend billions of dollars to migrate to the Cloud, and more and more sensors constantly send out sensitive information, the risks go up in geometrical progression.**
- **All this portends a dark, rather than a brave, new world order that we hope to inhabit.**
- **Hence, digital uncertainty is morphing into radical uncertainty and rather rapidly.**
- **Today, government and government agencies are spending significant resources to undo the impact of misinformation and disinformation, but this may not be enough.**
- **There is not enough understanding of how the very nature of information is being manipulated and the extent to which AI drives many of these drastic transformations.**
- **All this contributes to what can only be referred to as 'truth decay'**

The emergence of AGI

- **As growing numbers of people cognitively and psychologically become dependent on digital networks, AI is able to influence many critical aspects of their thinking and functioning.**

- **What is simultaneously exhilarating and terrorizing is the fact that many advances in AI are now being birthed by the machine itself.**

- **Sooner rather than later, we will witness the emergence of Artificial General Intelligence (AGI) Artificial Intelligence that is equal and or superior to human intelligence, which will penetrate whole new sectors and replace human judgement, intuition and creativity**

- **It has an inherent capacity to flood a country with fake content masquerading as truth, and for imitating known voices with false ones that sound eerily familiar.**

- **This could lead to a breakdown of the concept of trust of what is said, read, or heard and could lead to overturning the trust pyramid with catastrophic consequences.**

- **AGI will enable highly autonomous systems that outperform humans in many areas, including economically (valuable) work, education, social welfare and the like.**

- **AGI systems will have the potential to be able to make decisions that are unpredictable and uncontrollable which could have unintended consequences, often with harmful outcomes**

- **Digital data could in turn become converted into digital intelligence, enlarging the scope for disruption and the reining in of entire sectors.**

- **It would enhance inequalities and exacerbate social disparities, and worsen**

economic disparities

- AGI could prove to be as radical a game changer in the world of the 21st century as the Industrial Revolution was in the 18th century.
- It is almost certain to lead to material shifts in the geo-political balance of power, and in a way never comprehended previously.
- The spectre of digital colonisation looms large with AGI -based power centres being based in a few specific locations.
- Consequently, AGI- driven disruption could precipitate the dawn of the age of digital colonialism. This would lead to a new form of exploitation, viz., data exploitation.
- Israel's massive intelligence failure is attributed by some experts to an overindulgence of AI by it, which was skillfully exploited by Hamas.
- AI depends essentially on data and algorithms, and Hamas appears to have used subterfuges to conceal its real intentions by distorting the flow of information flowing into Israeli AI systems.

Why Earthquakes are prone to Afghanistan?

How do earthquakes occur?

- The earth is made up of chunks of solid rocks called tectonic plates. Discontinuities in these rock masses, along which they have moved, are called fault lines.
- These fractures are a result of tectonic forces and stress that builds up in the earth's lithosphere, causing the rocks to break and slip.

- **An earthquake occurs when blocks of lithosphere suddenly slip past one another, releasing energy and sending seismic waves through the ground.**
- **The surface where the lithosphere chunks slip becomes a fault plane.**
- **The point within the earth where the fault rupture starts and produces an earthquake is called the focus or the hypocenter.**
- **The point on the surface of the earth directly above it is called the epicentre.**
- **Tectonic plates are slow moving but are always in motion, mostly due to the heat energy generated inside the earth.**
- **The edges of these plates are called plate boundaries and consist of faults this is where most earthquakes occur.**

Why do frequent earthquakes occur in Afghanistan?

- **Afghanistan is located over multiple fault lines in the region where the Indian and the Eurasian tectonic plates meet.**
- **These plates collide often, leading to significant tectonic activity. Afghanistan is located on the Eurasian plate.**
- **Towards western Afghanistan, the Arabian plate sub ducts northward under Eurasia, and towards eastern Afghanistan the Indian plate does the same.**
- **In southern Afghanistan, the Arabian and Indian plates adjoin and both sub duct northward under the Eurasian plate.**
- **The Hindu Kush mountain range and the Pamir Knot are geologically complex regions where tectonic plates meet.**
- **The collision and convergence of the Indian Plate and the Eurasian Plate**

result in the folding and faulting of the Earth's crust.

- This geological complexity contributes to the occurrence of earthquakes in the region.
- The ongoing northward movement of the Indian Plate towards the Eurasian Plate also results in compression, leading to the uplift of the Himalayas and the transmission of tectonic stress across the entire region, including Afghanistan.
- The compression causes the crust to deform, and creates faults and fractures that can slip and generate earthquakes. These interactions at plate boundaries generate significant tectonic stresses and result in earthquakes.
- Afghanistan is also criss-crossed by various active fault systems like the Chaman Fault and the Main Pamir Thrust.

AI in health

- There are certain aspects of artificial intelligence that make it particularly useful in medicine.
- For instance, AI can analyse data from sensors and predict when equipment or machinery will require maintenance, reducing downtime.
- This, as you can imagine, will be massively useful in hospitals and clinics, particularly in procedures and diagnostics, where we constantly use some form of machinery to treat patients.
- Additionally, AI can be used, with machine learning, to analyse and interpret images and videos, making it useful in reading and coming up with interpretations of scans and other diagnostics, based on the data we have fed it already.
- Already, robotics has been employed in precision surgery, with good

outcomes, and faster recovery periods.

- AI has made significant advancements in the field of ophthalmology, offering a range of potential applications that can improve patient care and enhance the efficiency of eye disease diagnosis and treatment.
- In fact, we are among the early adopters of AI for health care, and some of the key uses are:

Retinal disease diagnosis

Automated screening:

- AI is also being used to discover new drugs for ophthalmic conditions by analyzing vast datasets to identify potential therapeutic targets and compounds and in predicting whether individuals may develop eye diseases, based on their health records, lifestyle factors, and genetic data.

India food system

- The primary goal of a food system is to ensure nutrition security for all, it can only be achieved sustainably if the producers producing the food make reasonable economic returns that are resilient over time.
- India faces a double burden of malnutrition
- A sizable proportion of Indians exhibit nutrient deficiencies. As in the National Family Health Survey, 2019-21, 35% of children are stunted, and 57% of women and 25% of men are anaemic.
- At the other end, due to imbalanced diets and sedentary lifestyles, 24% of adult women and 23% of adult men are now obese.
- India has been stepping up efforts to reduce malnutrition, which has included even the Prime Minister calling for a mass movement to eradicate it.

- **On the production side, farm incomes are insufficient to meet the ends of marginal and small farmers.**
- **According to a report by the Transforming Rural India Foundation, more than 68% of marginal farmers supplement their incomes with non-farm activities.**
- **The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and other forms of casual labour are picking up the slack,**
- **Further, depleting natural resources and changing climate are making India's food production highly vulnerable.**
- **As in the 2023 soil health survey, almost half the cultivable land in India has become deficient in organic carbon, which is an essential indicator of soil health. Groundwater, the largest source of irrigation, is rapidly declining.**
- **In States such as Punjab, more than 75% of the groundwater assessment locations are over-exploited, threatening the resilience of farm incomes**

Steps needed

- **First, consumer demand needs to be shifted towards healthy and sustainable diets. We need to shift to a food plate that is healthier for people and the planet.**
- **Second, to ensure resilient incomes, we must support farmers' transition towards remunerative and regenerative agricultural practices.**
- **The National Mission on Natural Farming is a step in this direction, but the overall funding for sustainable agriculture is less than 1% of the agricultural budget**
- **Third, shift farm-to-fork value chains towards more sustainable and**

inclusive ones.

- **A critical approach to enhance rural (farm) incomes is to enable more value addition of agricultural produce in rural areas.**
- **Middlemen, such as corporations supplying raw and processed food to consumers, should prioritise direct procurement from farmers, incentivise procurement of sustainably harvested produce, and implement well-established approaches such as fair trade.**

Test Vehicle Abort Mission- 1 (TV-D1)

- **The Indian Space Research Organisation (ISRO) on October 21 will conduct the Gaganyaan's first Flight Test Vehicle Abort Mission- 1 (TV-D1), which will demonstrate the performance of the Crew Escape System.**
- **The TV-D1 will lift off at 8 a.m. from the first launch pad of the Satish Dhawan Space Centre in Sriharikota. According to ISRO, the test vehicle developed for this abort mission is a single- stage liquid rocket.**
- **The payloads consist of the Crew Module (CM) and Crew Escape Systems (CES) with their fast acting solid motors, along with CM fairing (CMF) and Interface Adapters.**
- **The CM is where the astronauts are contained in a pressurized earth-like**

atmospheric condition during the Gaganyaan's mission

- The objectives of this mission is flight demonstration and evaluation of test vehicle sub systems, evaluation of CES including various separation systems and CM characteristics and deceleration systems demonstration at higher altitude and its recovery.

Avian influenza

- A recent study published in Nature reveals major changes in the ecology and evolution of highly pathogenic avian H5 influenza viruses, including a shift in global distribution.
- The findings suggest that the epicentre of these viruses has extended beyond Asia to new regions including parts of Africa and Europe.
- Highly pathogenic avian H5N1 virus activity has intensified globally since 2021, infecting and killing increasing numbers of wild birds and poultry, as well as posing a risk to mammals (including humans).
- increasing persistence of avian influenza in wild bird populations is driving the evolution and spread of new strains.
- "These results highlight a shift in the Highly Pathogenic Avian Influenza (HPAI) H5 epicentre beyond Asia and indicate that increasing persistence of HPAI H5 in wild birds is facilitating geographic and host range expansion.

Serotonin

- A study published recently in the journal Cell, researchers from the University of Pennsylvania, Philadelphia, who led the study, have found reduced levels of serotonin, a neurotransmitter, being associated with Long

COVID.

- **Memory problems, brain fog, and the inability to focus on tasks that people with Long COVID seem to suffer from might be due to reduced serotonin, the authors say.**

- **The scientific name for serotonin is 5-hydroxytryptamine (5-HT) and is present in the nervous system, bowels, and blood platelets.**

- **Serotonin is a neurotransmitter, and some also consider it a hormone. The body uses it to send messages between nerve cells.**

- **Serotonin has a wide variety of functions in the human body. People sometimes call it the "happy" chemical because it contributes to well-being and happiness.**

- **Serotonin appears to affect mood, emotions, appetite, and digestion.**

- **As the precursor for melatonin, it helps regulate sleep-wake cycles and the body clock.**

Cicada emergence

- **The periodical mass emergence of cicadas in eastern North American forests can "rewire" forest food webs and initiate a cascade of impacts that propagates throughout the food chain, as per a study that quantified effects of the 2021 Brood X cicada emergence.**

- **The cicadas are a superfamily, the Cicadoidea, of insects in the order**

Hemiptera

Maximum temperature and nesting

- **Maximum temperature extremes reduce the nesting success of birds across the United States by nearly 50% in agricultural landscapes but not forests.**
- **The findings show that future warming may exacerbate the negative effects of habitat conversion on bird fitness, among species of conservation concern in human- dominated landscapes.**
- **By removing insulating tree canopies or other complex microhabitats, many forms of habitat conversion can expose species to more pronounced climate extremes.**

FRBs and Redshift movement

- **An unusually high- energy fast radio burst from a high -redshift galaxy has offered new insights into the distant universe, challenging current models of FRB emission.**
- **FRBs are brief pulses of radio emission originating from distant extragalactic sources.**
- **Researchers have localised the source of the particularly luminous burst**

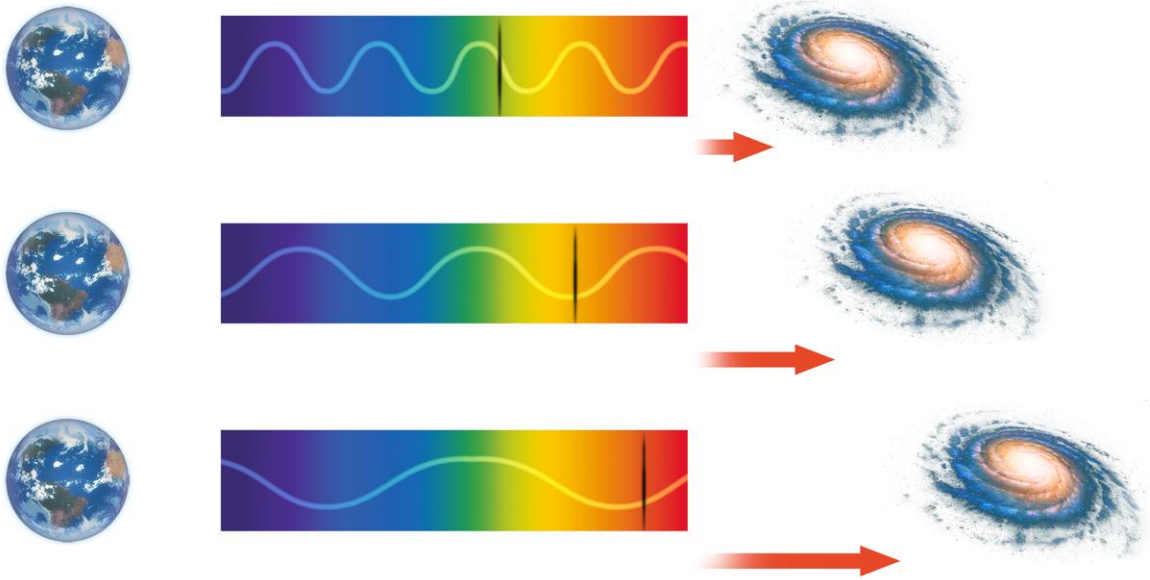
FRB 20220610A to a galaxy with a complex morphology located at redshift about 1.01.

- **This FRB is higher than what is predicted by the Macquart relation.**

What are FRBs??

- **In radio astronomy, a fast radio burst (FRB) is a transient radio pulse of length ranging from a fraction of a millisecond to 3 seconds, caused by some high-energy astrophysical process not yet understood.**
- **Astronomers estimate the average FRB releases as much energy in a millisecond as the Sun puts out in three days.**
- **Radio waves are a type of electromagnetic radiation with the longest wavelengths in the electromagnetic spectrum, typically with frequencies of 300 gigahertz (GHz) and below.**

- **What is Red shift in economy**



- **The Universe is expanding in the aftermath of the Big Bang explosion 13.7 billion years ago.**
- **During the time that light from an astronomical object has been travelling across space to the Earth, the Universe has grown in size.**
- **The effect of this is to stretch the 'wavelength' of the light, much as a wave drawn on the fabric of a balloon would be stretched if the balloon were inflated.**
- **The wavelength of red light is about twice that of blue light, so the stretching of visible light shifts it towards the red end of the spectrum: thus the term 'redshift'.**
- **Macquart relation: This relation has been used to measure the cosmic baryon fraction and the expansion rate of the Universe.**

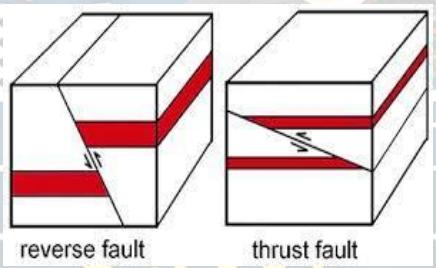
Mars quake

- **The quake, which had a magnitude of 4.7 and caused vibrations to reverberate through Mars for at least six hours, was recorded by NASA's InSight lander on May 4 2022.**

- **Because its seismic signal was similar to previous quakes known to be caused by meteoroid impacts, the team believed that this event (dubbed 'S1222a') might have been caused by an impact, and launched an international search for a fresh crater.**

- **They conclude that the event was instead caused by the release of enormous tectonic forces within Mars' interior. The results (Geophysical Research Letters), indicate that the planet is much more seismically active than previously thought.**

Multiplete - earthquake



- **All four earthquakes occurred on east west striking fault planes that dip to either the north or south.**

- **The earthquakes occurred within the Eurasia plate in an intracontinental mountain belt.**

- **Aftershocks, by default, have magnitudes less than the main event. However, all the four earthquakes near Herat have the same magnitude**

- **two subsequent earthquakes [on October 11 and October 15] are all approximately the same magnitude, we would call them 'multiplets' rather than main shocks, foreshocks, or aftershocks,"**

- **all the four earthquakes occurred due to thrust faulting, where one block**

moves up relative to the other, the area where the earthquakes had occurred would experience upliftment.

Sikkim floods

What triggered the floods?

- Experts point out that the floods in the Teesta river in Sikkim and West Bengal was triggered by a phenomenon called GLOF (Glacial Lake Outburst Flood).
- GLOF is a sudden release of water from a lake fed by glacier melt that has formed at the side, in front, within, beneath, or on the surface of a glacier
- South Lhonak lake is one of the most studied lakes for GLOF.
- Sikkim government point out that the collapse of the hydel power dam at Chungthang added to the devastation.
- Central Water Commission while approving the project had said that it would be a concrete gravity dam whereas the dam constructed was a rock-filled dam that would not be able to withstand huge floods.
- The Chungthang dam, which has a majority stake of the State government under Sikkim Urja, has stopped generating electricity and has filed an insurance claim
- 87 hydroelectricity projects (HEP) of installed capacity of 22,982 (MW) are operational across the Himalayan belt.
- Another 30 large HEPs (above 25 MW) with an installed capacity of 11,137 MW are being developed across the Himalayan belt.
- Five projects are proposed in Sikkim on the Teesta and other rivers. In Sikkim, the assessed hydro power potential is of 4,248 MW of which about

53.7 % (2,282 MW) has been developed and 24.4 % (1,037 MW) is being constructed, according to a PIB release of March, 2023.

Dams safety bill

- **India has almost 6,000 large dams and about 80% of them are more than 25 years old and carry safety risks.**
- **A new Dam Safety Act (DSA) was passed in late 2021.**

What are the provisions of the Act?

- **The Dam Safety Act was tabled in the Rajya Sabha in December 2021, as a response to deficient surveillance and maintenance causing dam failure-related disasters.**
- **The Act listed key responsibilities and mandated that national and State-level bodies be established for implementation.**
- **It said a National Committee on Dam Safety would oversee dam safety policies and regulations;**
- **A National Dam Safety Authority would be charged with implementation and resolving State level disputes;**
- **The Chairman of the Central Water Commission (CWC) would head dam safety protocols at the national level;**
- **A State Committee on Dam Safety (SCDS) and State Dam Safety Organisation (SDSO) would be set up.**
- **Sikkim formed an SCDS on August 17 with nine members and experts in hydrology and dam design.**

What do the States need to do?

- **Provisions require States to classify dams based on hazard risk, conduct**

regular inspections, create emergency action plans, institute emergency flood warning systems, and undertake safety reviews and period risk assessment studies.

- Importantly, States were asked to report and record incidents of dam failures.
- Until now, no statutory provision required systemic reporting of failures and no single agency was tasked with tracking this data.

Is any action taken for failing to comply?

- Failure to comply with any provision of the Act is punishable with imprisonment and/or fines,
- and "if such obstruction or refusal to comply with directions results in loss of lives or imminent danger thereof, [entity] shall be punishable with imprisonment for a term which may extend to two years.
- The Sikkim GLOF reveals poor compliance at all levels, from the dam's design to the spillway capacity (which controls the release of water from a reservoir).

Bat immunity

- Bats are extraordinary organisms in many ways.
- They are the only mammals on the earth that can maintain sustained flight.
- They also have relatively long life-spans and are relatively more protected from a variety of diseases, including cancer.
- They also have a unique ability in echolocation, whereby they use sound to navigate and locate objects, freeing them from being constrained by the availability of light like humans are.
- By population, bats make up 20% of all mammals

- **There are more than 1,400 species of bats today around the world; more than 60 are endangered and 170- odd are classified as vulnerable.**
- **The bumblebee bat weighs only 2 grams whereas the flying foxes, which have a wingspan of 1.5 metres, weigh up to 1.6 kg.**
- **In all, bats play crucial roles in maintaining the ecological balance, and are essential for pollination, insect control, et**
- **Bats do host a wide variety of pathogens, including ones deadly to other mammals, but they themselves don't get infected.**
- **One watershed moment came in 2013. In a paper published in the journal Science, scientists compared the genomes of a fruit eating and an insect eating species and found that genes involved in metabolism and immune response had been positively selected.**
- **The ambitious Bat1K global genome consortium to sequence all the 1,400 or so species' genomes is also currently underway.**
- **Emerging evidence also suggests that a set of immune- related genes have been undergoing positive selection in bats, adapting them to control the spread of viruses while mitigating the antiviral inflammatory response**
- **One of the first Bat1K genome consortium papers described six high-quality bat species genomes in the journal Nature.**
- **It suggested that echolocation, loss of pro- inflammatory genes, and expansion of antiviral genes are ancestral traits of bats. This suggests that bats have molecular mechanisms that allow them to host a range of deadly viruses but evade clinical disease**
- **Long read sequencing technologies are those that can 'read' thousands to**

tens of thousands of bases of a genome at a time. With their advent, it has become possible today for scientists to quickly assemble the nearly complete whole- genomes of organisms.

- Another benefit to them is that they no longer had to use more complex, time -consuming, and expensive molecular technologies in the pursuit of building complete genomes.
- The researchers reported that subsets of genes involved in mounting an immune response which encode proteins called interferons (IFN) had contracted significantly.
- This in turn changed the relative proportions of two subsets, interferon -alpha (IFN-α) and interferon omega (IFN-ω), relative to each other.
- The researchers attributed bats' immune properties to these changes.
- By shedding the genes for IFN-α, bats can dampen the pro- inflammatory response against a number of viruses, thus protecting themselves from clinical disease.

Fluorescence

- Matter and radiation interact in a variety of ways.
- The sky is blue because air molecules scatter light, and they scatter light of shorter wavelengths more strongly.
- Since blue light has the shortest wavelength (in the visible spectrum), it is scattered the most and the sky appears blue. This is called Rayleigh scattering.

- **But clouds are white because of Mie scattering, which is due to light scattered by larger particles like water droplets.**
- **Another form of interaction is fluorescence when an object absorbs some light of higher energy (like blue colour) and releases it at lower energy (like red colour).**
- **It usually happens when an electron absorbs a photon, or a particle of light, jumps to a higher energy level, before releasing that energy and jumping back down.**

TVD1

Mission Definition

"In-flight Abort Demonstration of Crew Escape System (CES)" at Mach number 1.2 with the newly developed Test Vehicle followed by Crew Module separation & safe recovery.

Mission Objectives:

- **Flight demonstration and evaluation of Test Vehicle sub systems.**
- **Flight demonstration and evaluation of Crew Escape System including various separation systems.**
- **Crew Module characteristics & deceleration systems demonstration at higher altitude & its recovery**

Mission Highlights

TV Mission Pillbox	• Mach 1.2 • Altitude 11.7 km • Flight path angle 60° • Dynamic Pressure 22.6 kPa
CM-CES separation	• Mach 0.5 • Altitude 17 km • Dynamic pressure 2-3 kPa
Drogue Parachute deployment	• Altitude 16.7 km
Main Parachute	• Altitude ‹ 2.5 km

TV-D1 Vehicle:

- The Liquid propelled single stage Test Vehicle uses a modified VIKAS engine with Crew Module (CM) and Crew Escape System (CES) mounted at its fore end.

Health of Himalaya

- **In technical terms, carrying capacity of a region is based on the maximum population size that an ecosystem or environment can sustainably support over a specific period without causing significant degradation or harm to its natural resources and overall health.**
- **It is crucial in understanding and managing the balance between human activities and the preservation of natural ecosystems to ensure long-term sustainability.**
- **There have been initiatives by the Union government regarding overall development in the IHR.**
- **Some of them are the National Mission for Sustaining the Himalayan Ecosystem (2010), the Indian Himalayas Climate Adaptation Programme, Secure Himalaya Project, and the recent guidelines on 'Carrying Capacity in the IHR' circulated on January 30, 2020.**

SIM Cards

What is a SIM card?

- **'SIM' stands for 'subscriber identification module'. Specifically, it is an integrated circuit, or a microchip, that identifies the subscriber on a given network.**

- **Imagine each cellular network is a city whose residents are identified by a number, called the international mobile subscriber identity (IMSI). The SIM card is a subscriber's ID card in this city.**

What is an eSIM?

- **Over the years, the SIM card has shrunk from the SIM to the mini SIM to the micro SIM to the nano SIM.**

- **The latest on this path is the eSIM, with specifications defined by the GSM Association.**

- **In the eSIM paradigm, the SIM software is loaded on to a UICC that is permanently installed in the mobile equipment in the factory itself, that it can't be removed. (This is called the eUICC.)**

- **Users using mobile equipment with this capability such as the Google Pixels 2, 3, and 4 or the iPhone 14 series don't have to bother with physically replacing their SIM cards when they join or switch networks. Instead, the network operator simply has to reprogram the eSIM, which can also be done remotely.**

An eSIM has two immediate advantages.

- **First, it is considered to be environmentally friendlier than a physical SIM:**

its reprogrammability means no need for more plastic and metal for a new SIM.

- Second, if a malicious person gains access to your phone, they won't be able to separately access the SIM application nor be able to duplicate it.

There are also at least two disadvantages.

- First, in some countries, including the U.S., eSIMs can be programmed by subscribers themselves. But this process might be difficult for those with low digital literacy, such as the elderly.
- Second, an eSIM can in theory allow network operators to track subscribers' data, including inside apps on the device, especially in the absence of data privacy laws.

Lyapunov time

- Deterministic chaos essentially means that the future can be predicted only if the present is known with a great degree of accuracy.
- However, if the present is known only approximately, the future can't be predicted.
- This is also what the term 'butterfly effect' stands for: that some system is highly sensitive to its starting conditions.
- Even a small change in these conditions can produce disproportionately large changes in the way the system evolves.
- The duration for which the system's evolution will be predictable depends on a few things, such as how accurately and precisely its present state is

known, the amount of uncertainty that it can tolerate, and a time factor determined by the dynamics of the system, called the Lyapunov time.

- For example, in a chaotic electrical circuit, the Lyapunov time is about 1 ms. For weather systems, it is a few days, and for the inner solar system, it can be 4-5 million years.
- The Lyapunov time mirrors the limits of the predictability of the system.
- By convention, it is defined as the time for the distance between nearby trajectories of the system to increase by a factor of *e*.
- Quantum mechanics is probabilistic, not chaotic, as far as we know.
- This is because there are no point like locations of subatomic particles in space, so it is meaningless to determine their exact locations at some time and then attempt to determine their locations at a later point.
- In atoms, electrons exist in a cloud that hovers around the nucleus. An atom by itself can't be chaotic but it can be disturbed by applying an electric or a magnetic field.
- Quantum physics takes care of such mild disturbances using perturbation theory.
- In mathematics and applied mathematics, perturbation theory comprises methods for finding an approximate solution to a problem, by starting from the exact solution of a related, simpler problem.
- A critical feature of the technique is a middle step that breaks the problem into "solvable" and "perturbative" parts.

The Rydberg atom

- If an electron is excited to a sufficiently high energy even when it is still a part of an atom, a group of energy levels could get close to each other in a continuous manner almost creating a continuous energy level.
- An atom excited in this way, to have a continuum of energies, is called a Rydberg atom, and we can apply the principles of classical mechanics to describe it.
- The Rydberg atom is like a link that connects the classical and the quantum domains.

Ball lightning

What is ball lightning?

- One of the most rare and mysterious forms of lightning is ball lightning. It is a ball of luminosity that usually occurs near the impact point of a flash and moves horizontally at a speed of a few centimeters per second. It can penetrate closed windows, is usually accompanied by a hissing sound, and has a lifetime of several seconds.

- The colour is quite variable and the ball often ends with an explosion. However, it is not usually destructive. Also called globe lightning, it occurs

at times of intense electrical activity in the atmosphere. These balls are said to be plasmas.

- Plasma is a completely ionized state of matter, at high temperature, in which positive and negative ions freely move, when the atoms in a gas become ionized.

GLOF in Himalaya region

- 

- The enormity of the challenge is seen in the National Remote Sensing Centre's (NRSC) Glacial Lake Atlas of 2023. Three major river basins, of the Indus, Ganga, and Brahmaputra, are host to 28,000 glacial lakes greater than 0.25 hectares in area, in five countries. Of these, 27% are in India, in six States and Union Territories.

- This region has witnessed catastrophic GLOF events in the past few decades.

- Many geo-technical solutions for mitigation of GLOFs have been tried globally, including excavating channels for regulated discharge, drainage using pipes and pumps, spillway construction, and setting up small

catchment dams to cut the speed of outflow.

- **But in practice, conditions above 5,000 metres above mean sea level create formidable challenges such as inaccessibility, impossibilities in transporting and retaining excavation equipment, strong winds, difficulties in sourcing power and connectivity, and vandalism.**
- **These measures are arduous and labour- intensive, yet need to be implemented across high- risk lakes.**
- **The most significant risk of such a disaster is to downstream hill communities and authorities who get a very short lead time to respond.**
- **They stand to suffer serious damage to life, property, and livelihood.**
- **Such events bring permanent changes in morphology, topography and stream hydrology.**
- **Interviews show that people downstream are mostly unaware of the risks posed by sudden glacier -melt and cascading hazards.**
- **Risks from glacial melting, slope shifting, landslides, intense precipitation, and heatwaves, among other hydro -meteorological and geo-physical hazards, are rising.**
- **While meeting the development needs of hill communities, disaster and climate resilience principles need to be assimilated into government policy and practice as well as private investment.**
- **The NDMA's national guidelines (2020) provide States with a technical overview of the hazard and risk- zonation and suggest strategies for monitoring, risk- reduction and mitigation.**

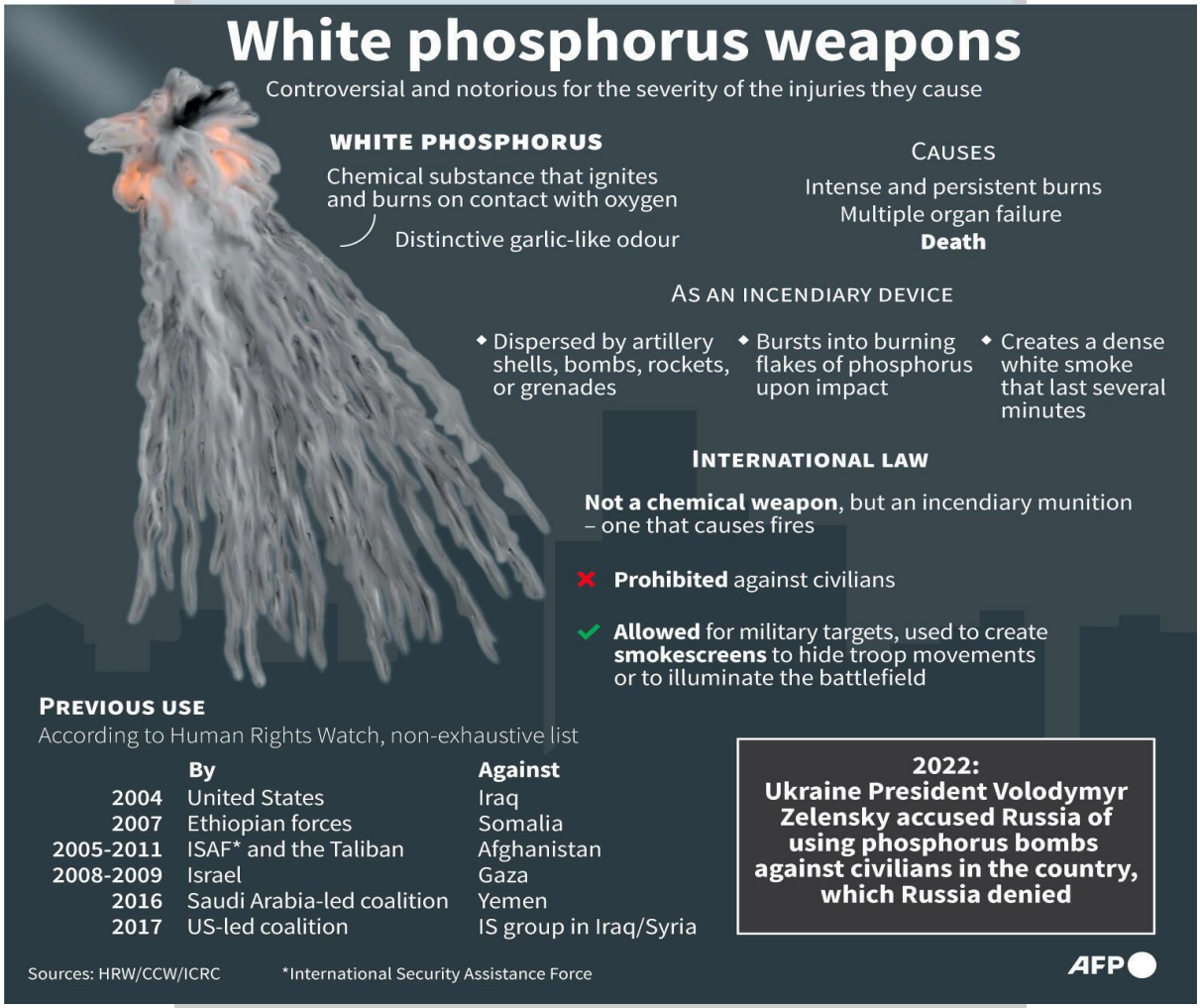
- **A comprehensive GLOF risk mitigation plan is in the final stages of approval and will include installation of monitoring and end- to -end early warning systems at high- risk glacial lakes.**
- **In this endeavour, all governments and scientific institutions need to come together to integrate resources and capacities in disaster risk reduction.**

International Solar Alliance (ISA)

- **The International Solar Alliance (ISA) is an action-oriented, member-driven, collaborative platform for increased deployment of solar energy technologies as a means for bringing energy access, ensuring energy security, and driving energy transition in its member countries.**
- **The ISA strives to develop and deploy cost-effective and transformational energy solutions powered by the sun to help member countries develop low-carbon growth trajectories, with particular focus on delivering impact in countries categorized as Least Developed Countries (LDCs) and the Small Island Developing States (SIDS).**
- **Being a global platform, ISA's partnerships with multilateral development banks (MDBs), development financial institutions (DFIs), private and public sector organizations, civil society and other international institutions is key to delivering the change its seeks to see in the world going ahead.**
- **The ISA was conceived as a joint effort by India and France to mobilize efforts against climate change through deployment of solar energy solutions.**

- **It was conceptualized on the sidelines of the 21st Conference of Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Paris in 2015. With the amendment of its Framework Agreement in 2020, all member states of the United Nations are now eligible to join the ISA.**

White Phosphorus and CWC



- **White phosphorus has a wide range of applications. It is useful in military operations. But it also poses environmental dangers.**

- White phosphorus can be employed to create dense smoke screens in the context of combat, hindering visibility and providing cover for military manoeuvres.
- Additionally, it can be used in incendiary devices such as grenades and artillery shells, which can result in persistent and intense fires, effective against people, equipment, and structures
- The Convention on Certain Conventional Weapons (CCW) imposes restrictions on the use of incendiary weapons, including white phosphorus, with the aim of safeguarding civilians.
- In addition, white phosphorus use is subject to the rules and principles of international humanitarian law, which aims to minimise harm to both civilians and combatants in armed conflicts.
- This includes the principles of distinction, which require differentiation between combatants and civilians, and proportionality, ensuring that military actions do not cause excessive harm to civilians compared to the military advantage sought.
- International humanitarian law also prohibits indiscriminate attacks that may disproportionately harm civilians and civilian objects.
- Protocol III under the CCW specifically deals with incendiary weapons.
- Article 1 of this protocol defines an “incendiary weapon” as a weapon or munition primarily designed to set fire to objects or to cause burn injury to persons through the action of flame, heat, or combination thereof, produced by a chemical reaction of a substance delivered on the target.

- **Article 1(b)(i) includes an exemption in this classification for munitions that may cause unintended incendiary effects, such as illuminants, tracers, smoke, or signalling systems.**

- **White phosphorus munitions are primarily intended to produce illuminating and smokescreen effects, with the incendiary aspects being secondary or unintentional. The Chemical Weapons Convention (CWC) is a treaty that establishes a comprehensive ban on the use of chemical weapons.**

- **White phosphorus, although a chemical agent and toxic, is not covered by the CWC. When employed as an incendiary weapon and not for chemical warfare, white phosphorus falls under the regulations of Protocol III of the CCW.**

Project tiger, NTCA, Anamalai tiger reserve

- **Many conservation areas were created to make sure that no human could enter the area and do any harm to the tiger or its habitat.**
- **Project Tiger was first initiated in the year April 1, 1973, and is still going on.**

- **This project was started to save tigers.**
- **The much-needed project was launched in Jim Corbett National Park, Uttrakhand under the leadership of Indira Gandhi.**
- **The objectives of the Project Tiger was clear- saving Royal Bengal Tigers from getting extinct.**
- **The major cause of their depletion is humans, and so all the conservation areas are made human free. They made sure that the place that tigers lived in was also safe and secure.**

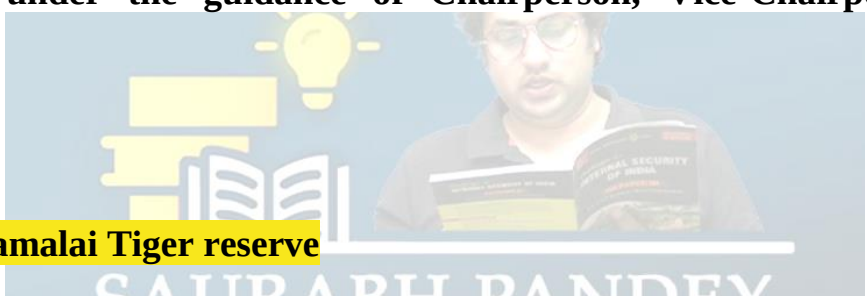
The main objectives behind Project Tiger are to reduce the factors which cause the diminishing of tigers and also to manage them and ensure a viable tiger population in the case of economic, scientific, ecological, and cultural values.

The body administrating is National Tiger Conservation Authority and there are 8 Conservation units:

1. **Sundarbans Conservation Unit**
2. **Northeast Conservation Unit**
3. **Western Ghats Conservation Unit**
4. **Shivalik-Terai Conservation Unit**
5. **Eastern Ghats Conservation Unit**
6. **Sariska Conservation Unit**
7. **Central India Conservation Unit**
8. **Kaziranga Conservation Unit**

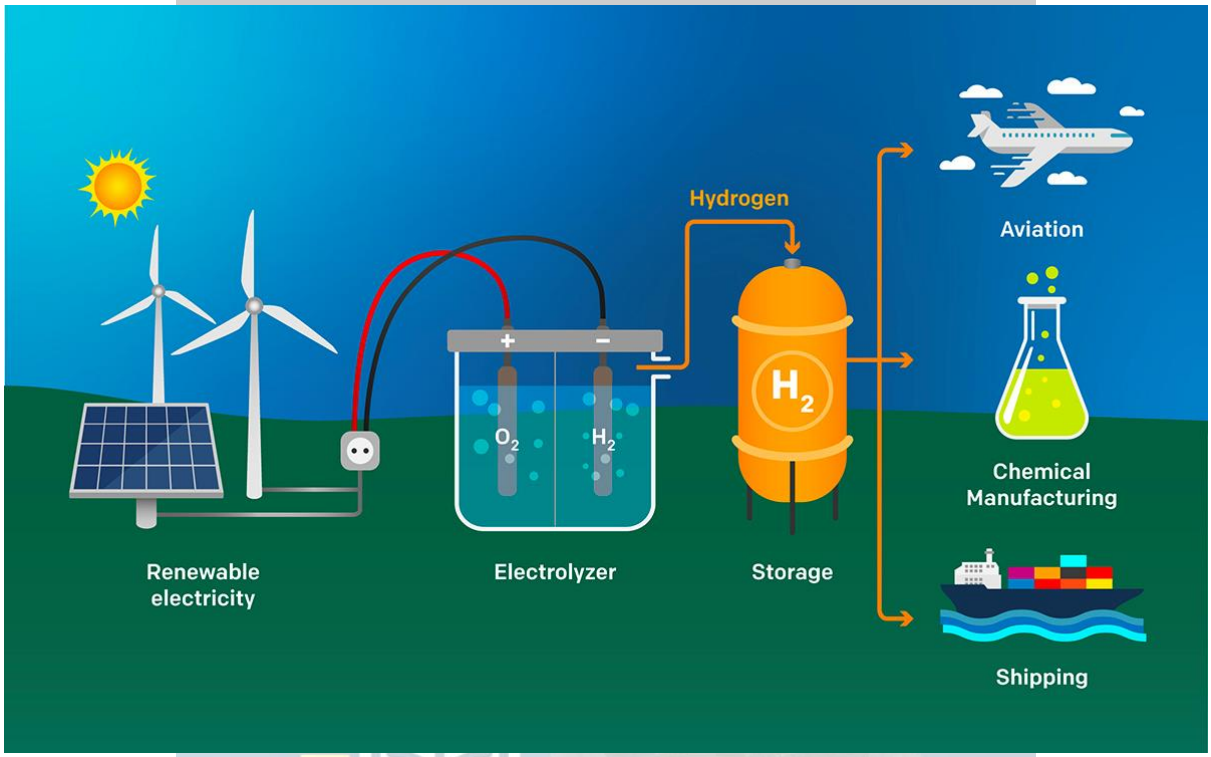
About NTCA

- **The National Tiger Conservation Authority (NTCA) has been constituted under section 38 L (1) of Wildlife (Protection) Act, 1972.**
- **Further, as per the section 38 L, sub section 2 of the said Act, the authority consists of the Minister in charge of the Ministry of Environment and Forests (as Chairperson), the Minister of State in the Ministry of Environment and Forests (as Vice-Chairperson), three members of Parliament, Secretary, Ministry of Environment and Forests and other members.**
- **The authority derives its power from section 38 O (1) of WLPA, 1972 and functions under the guidance of Chairperson, Vice-Chairperson and members.**



- **About Anamalai Tiger reserve**
- **Anamalai Tiger Reserve is carved out of the Tamil Nadu portion of the Anamalais.**
- **The Tamil Nadu part of the reserve is called as Anamalai Tiger Reserve (ATR).**
- **It lies South of the Palakkad gap in the Southern Western Ghats.**
- **The Anamalai Tiger Reserve falls within the Western Ghats mountain chain of South West India, a region designated as one of 25 Global Biodiversity Hotspots. The biogeographical classification of the country includes Western Ghats which are considered as one of eight "hottest hot spots".**

Green hydrogen and carbon emission



- **India's plans to produce so- called 'green hydrogen' where the gas is produced without resulting in fossil fuel emissions may end up worsening pollution if proper checks and balances are not in place, according to a study by environmental and energy think -tank, Climate Risk Horizons (CRH).**
- **The National Green Hydrogen Mission, piloted by the Ministry of New and Renewable Energy (MNRE), expects to manufacture five million tonnes by 2030.**
- **This would require the installation of renewable energy capacity worth 125 GW and the use of 250,000 giga watt -hour units of power, equivalent to about 13% of India's present electricity generation.**
- **As of August 2023, India's total renewable energy (RE) capacity stood at 131 GW.**

- **The 2030 green hydrogen plan thus envisages adding an equivalent RE capacity by 2030.**
- **This is over and above the 500 GW of RE capacity that India has committed to install by 2030 as part of the Paris Agreement.**
- **To put that in perspective, India installed only 15 GW of new solar and wind capacity in 2023, against the 45 GW per year needed to reach the 2030 target.**
- **The MNRE has defined green hydrogen as hydrogen produced in a way that emits no more than two kg of carbon dioxide per kg of such hydrogen.**
- **Currently, producing one kg of 'grey hydrogen', as it is known, ends up emitting nine kg of carbon dioxide**
- **The main concern is that if electrolysers were run 24x7, they would be expected to operate even at night when no solar power is available.**
- **"Where will the electricity come from?**
- **If it comes from India's coal -powered grid in general, it will in fact increase carbon emissions, since about 70% of the electricity on the grid is coal generated more in non-daylight hours when solar generation is nil,"**

Dark pattern

- **What is problematic is the tactics that compel users to pay without their knowledge or in ways that entice users to do something that they normally would not have done.**
- **Dark patterns are unethical tactics from companies to entice users to pay up**

for things, and services they would normally not have shelled out money for. Such tactics involve unethical user interface designs that may make your internet experience harder than it should be in order to even exploit you.

- Tech firms often use deceptive tactics to make users accept, for example, certain terms and conditions or products and services.
- For this, tech firms or other companies may flood your inbox with promotional emails or tweak their websites or apps in a way that users may think acceptance or certain conditions is the only way forward.
- Social media companies and tech giants like Facebook, Apple, Amazon, Skype, LinkedIn, Microsoft and Google have used dark patterns.
- Amazon faced heat in the European Union (EU) over its multi-step cancellation process for Amazon Prime subscriptions. It was reportedly noted by the EU that if a user wished to subscribe to Prime, the process was much simpler as opposed to if he wanted to unsubscribe.
- This year, Amazon made the cancellation process simpler for its customers in Europe.

Ejecta halo

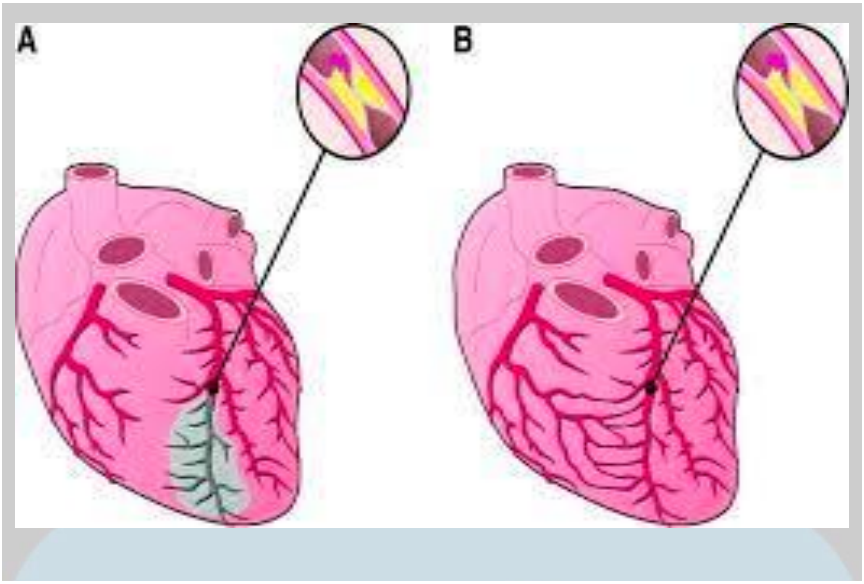
- Chandrayaan-3's lander module, Vikram, had generated an "ejecta halo" on the lunar surface while making the historic touchdown on the south pole of the moon.
- The Vikram lander of the Chandrayaan-3 mission landed near the south pole of the moon on August 23.

- **During the action of descent stage thrusters and the consequent landing, a significant amount of lunar surficial epi regolith material got ejected, resulting in a reflectance anomaly or ejecta halo,"**

Ischemia/reperfusion injury

- **Researchers has discovered a mechanism that contributes to ischemia/reperfusion injury (IRI) in the lung, one of the leading causes of poor outcomes, in transplant recipients.**

- **Their data show how the channel TRPV4 is activated in IRI in a mouse model, suggesting that TRPV4 of the pathway could offer targets for researchers seeking to boost the survivability of transplanted lungs.**



- **TRPV4 (Transient Receptor Potential Cation Channel Subfamily V Member 4) is a Protein Coding gene.**
- **Diseases associated with TRPV4 include Metatropic Dysplasia and Hereditary Motor and Sensory Neuropathy, Type Iic.**

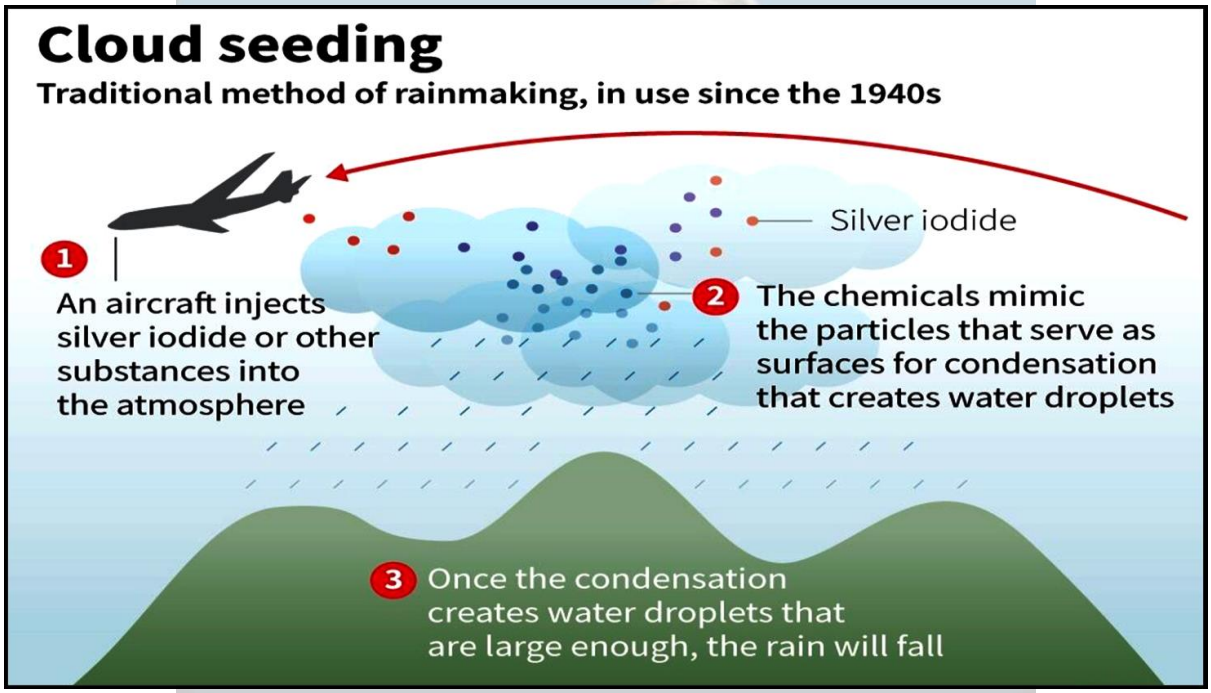
Microbiome

- **Parsing data from two clinical trials, researchers have mapped out how the gut microbiome can impact how people respond to teplizumab, a drug that can delay the onset of type 1 diabetes.**
- **Patients with stronger immune responses against three different gut microbes tend to benefit more from the drug's disease- delaying effects.**
- **The results show how the immune system's relationship with the microbiome can shape the progression of type 1 diabetes.**
- **The microbiome is the collection of all microbes, such as bacteria, fungi, viruses, and their genes, that naturally live on our bodies and inside us.**
- **Although microbes are so small that they require a microscope to see them,**

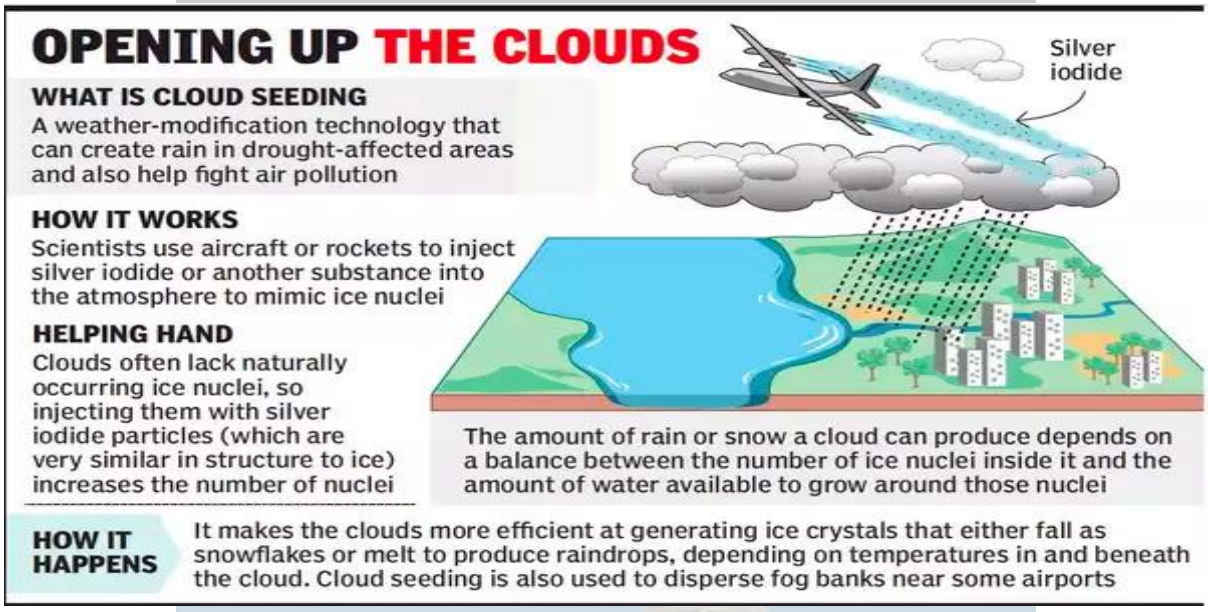
they contribute in big ways to human health and wellness.

Cloud seeding

- **Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX phase-4) was a scientific investigation conducted in Solapur city during the summer monsoon period of 2018 and 2019.**
- **The primary objective was to investigate the efficacy of hygroscopic seeding in deep convective clouds and to develop a cloud seeding protocol.**

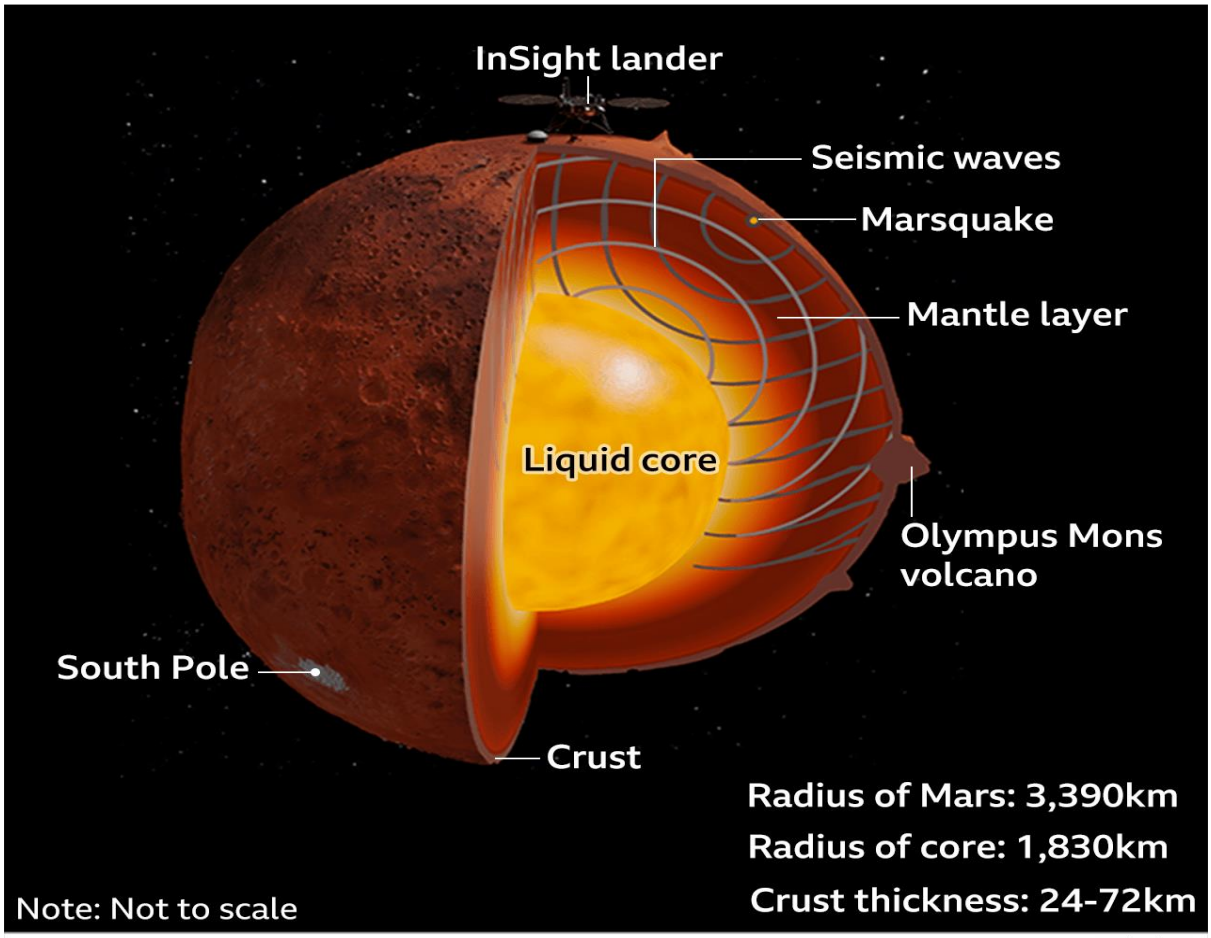


- **Calcium chloride flare was used for seeding the clouds.**
- **A cloud seeding flare releases these particles when triggered.**
- **The seeding was done at the base of the warm convective clouds and at a time when the clouds were in their growing stage so that the seed particles could enter the clouds with minimum dispersion.**

- 

Internal structure of mars

- **Mars's liquid iron core is likely to be surrounded by a fully molten silicate layer, according to a pair of studies published in Nature.**
- **These results offer a new interpretation of the interior of Mars, suggesting its core is smaller and denser than previously proposed.**
- **Seismological study of Mars to understand the interior of the red plant was carried out in 2019.**
- **The InSight Mars Lander used an instrument called the Seismic Experiment for Interior Structure (SEIS) to record seismic waves passing through Mars's interior**

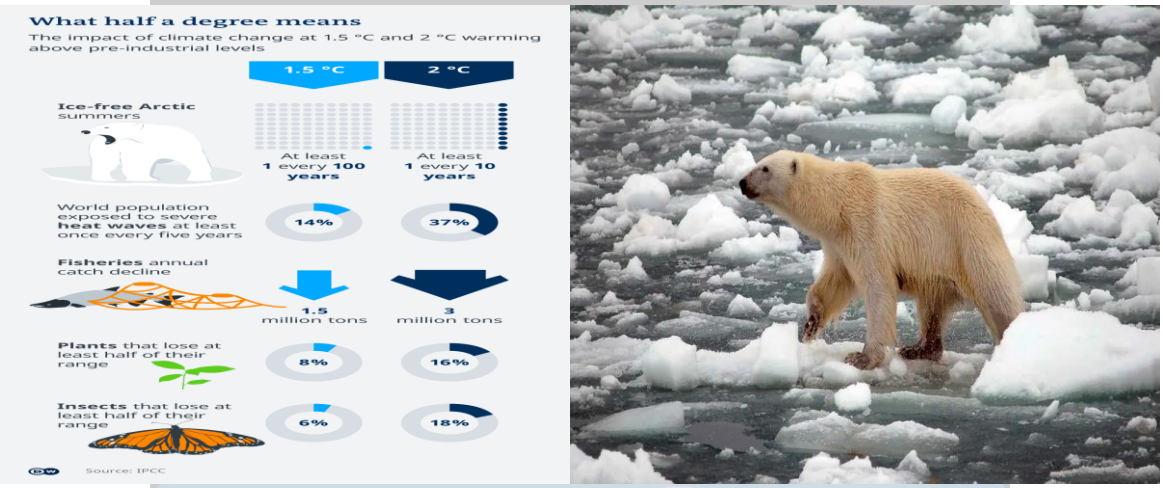


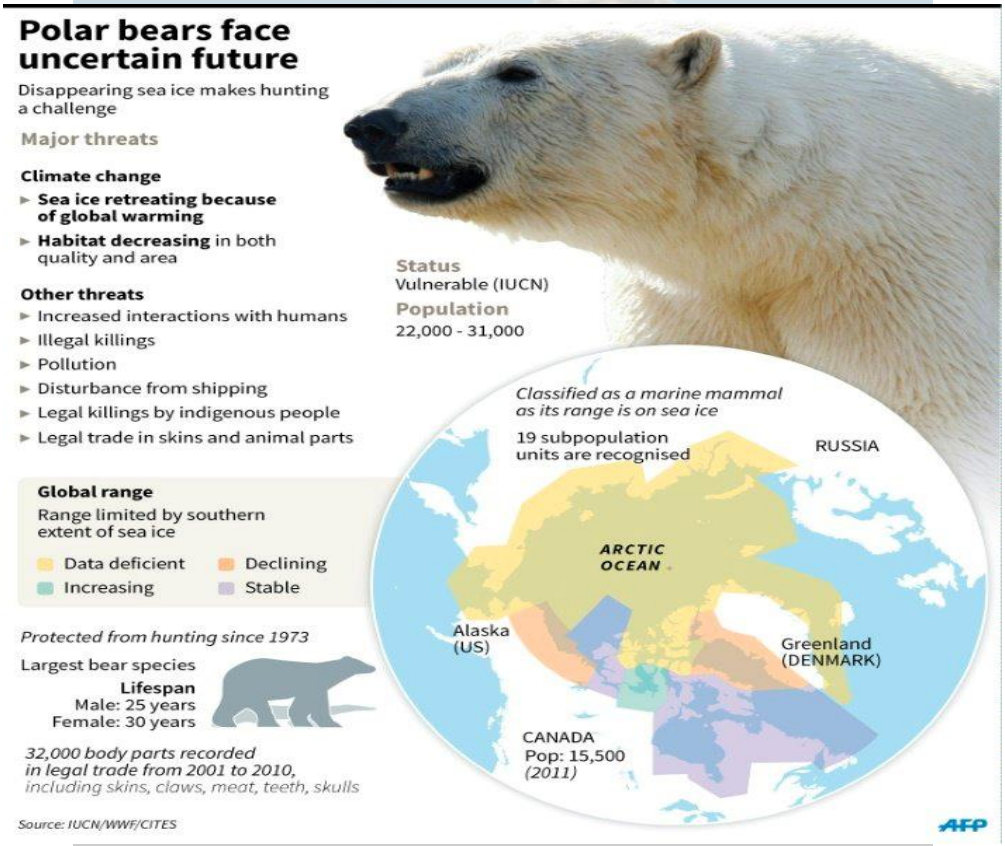
- **The analysis of measurements from the NASA InSight lander's Seismic Experiment for Interior Structure (SEIS) project in 2021 suggested the presence of a large but low density core, composed of liquid iron and lighter elements such as Sulphur, carbon, oxygen and hydrogen**

- **The core has a higher proportion of lighter elements than is feasible according to estimates of the abundances of these elements early in Mars's formation history**

- **The two studies found that the liquid iron- nickel core of Mars is surrounded by an approximately 150 km thick layer of near- molten silicate rock, the top of which was previously misinterpreted as the surface of the core.**

Impact of high temperature

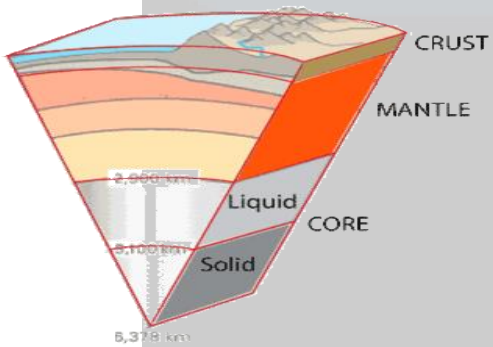


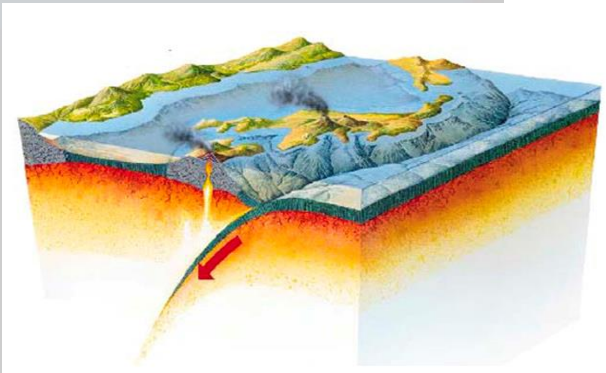


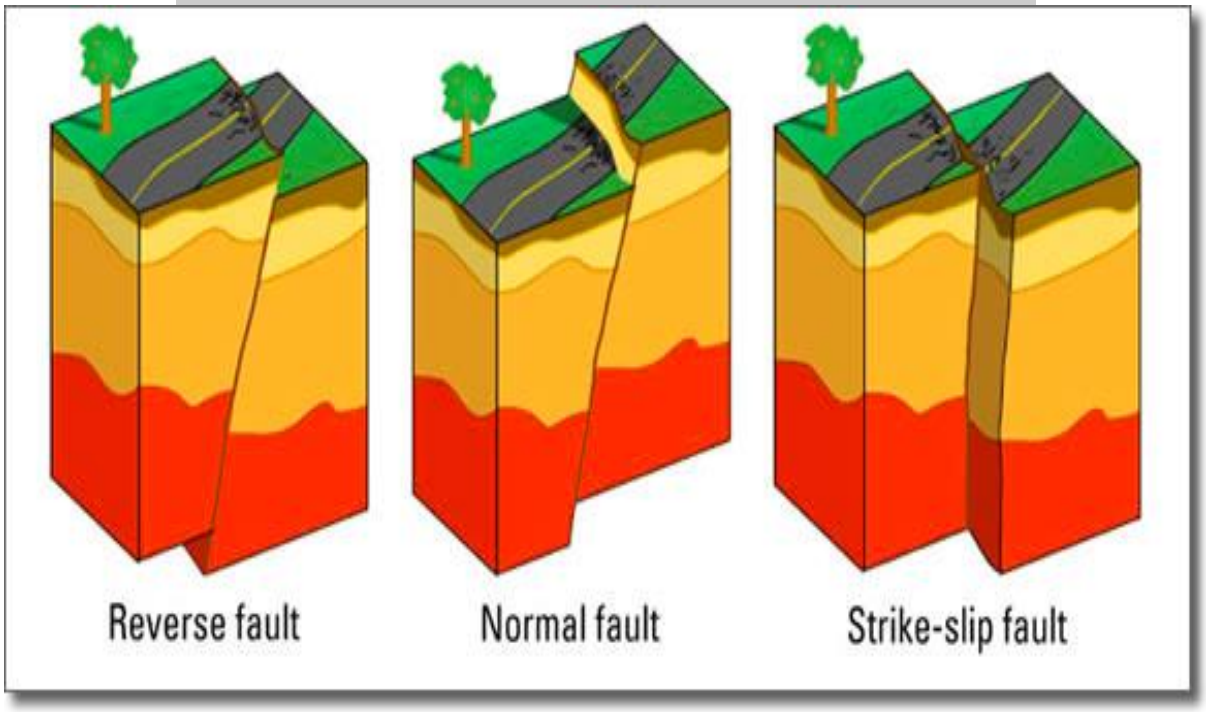
- **Developed countries responsible for three fourths of existing carbon emissions will end up emitting 38% more carbon in 2030 than they have committed to, going by current trajectories, shows a study published last week by the Delhi -based think tank Council for Energy Environment and Water (CEEW).**

- **The CEEW study noted that the NDCs of developed countries already fall short of the global average reduction of emissions to 43% below 2019 levels that is needed to keep temperatures from rising above 1.5 degrees Celsius.**
- **Instead, developed countries' collective NDCs only amount to a 36% cut.**
- **For a fighting chance at keeping warming below critical tipping points, decades of negotiations have obliged developed countries to lead global efforts to reduce greenhouse gas emissions with legally binding targets.**
- **To keep temperatures below 1.5 degrees Celsius, developed countries need to cut emissions to 43% below their 2019 level.**
- **However, the CEEW study found that based on their current emissions trajectories, their cuts would likely amount to only 11% by 2030.**
- **Except for two countries Belarus and Norway none of the developed countries seem to be on the path to meet their 2030 targets, though Japan and Kazakhastan are close, and are expected to miss their targets by only a single percentage point.**

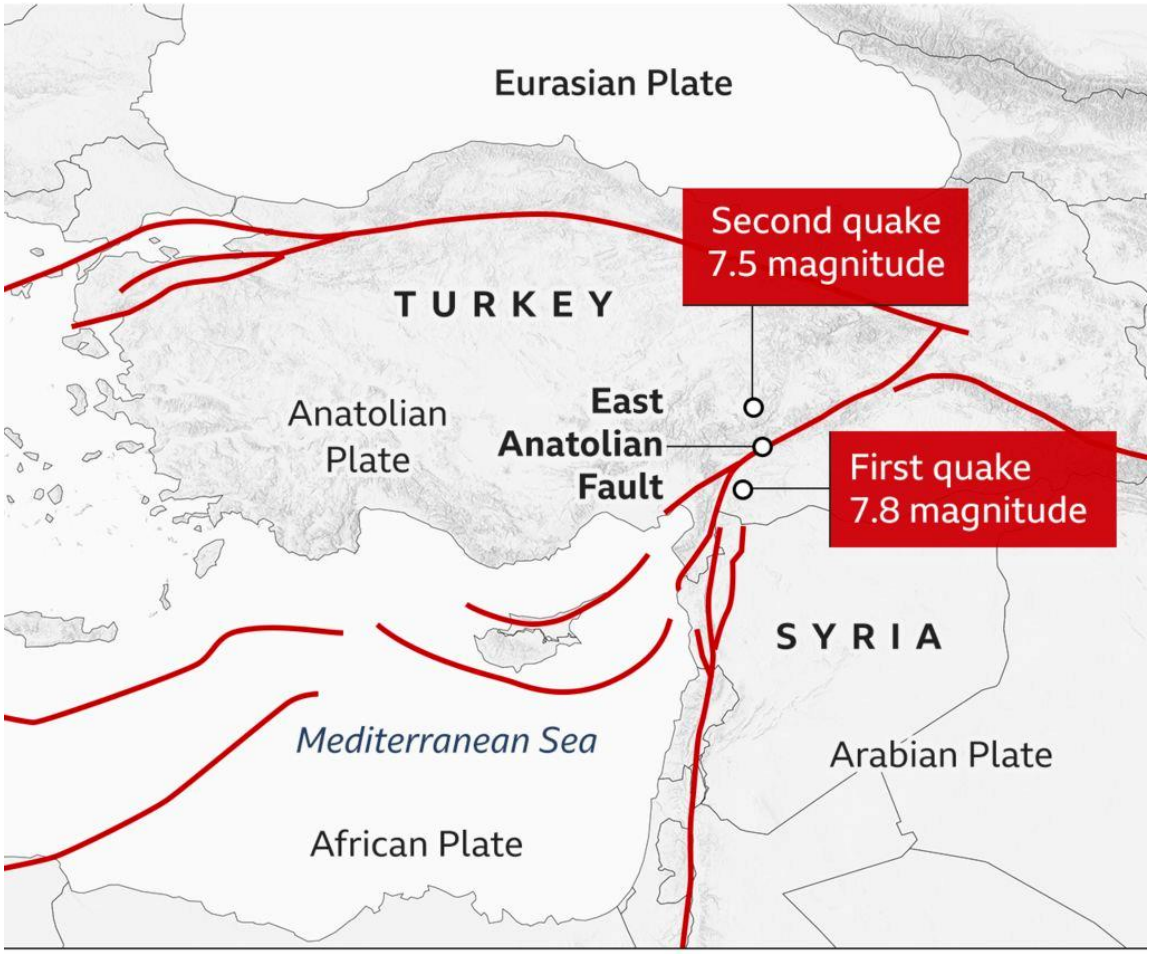
Why earthquake in Turkey?





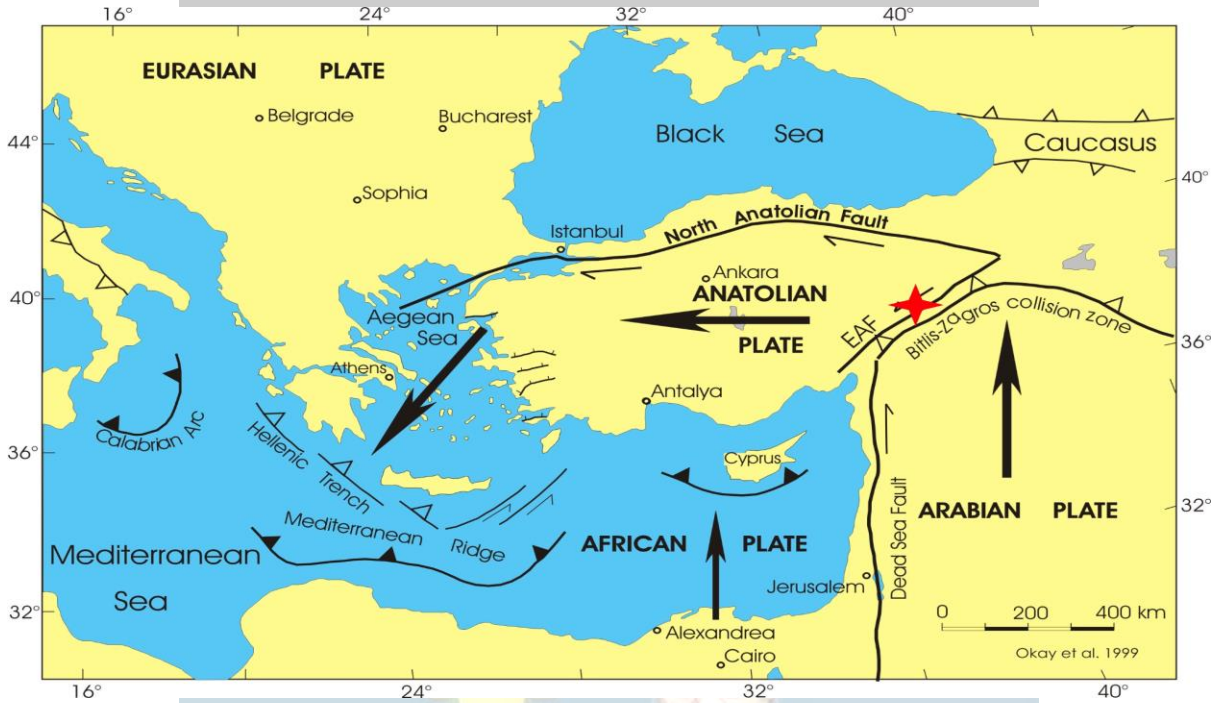


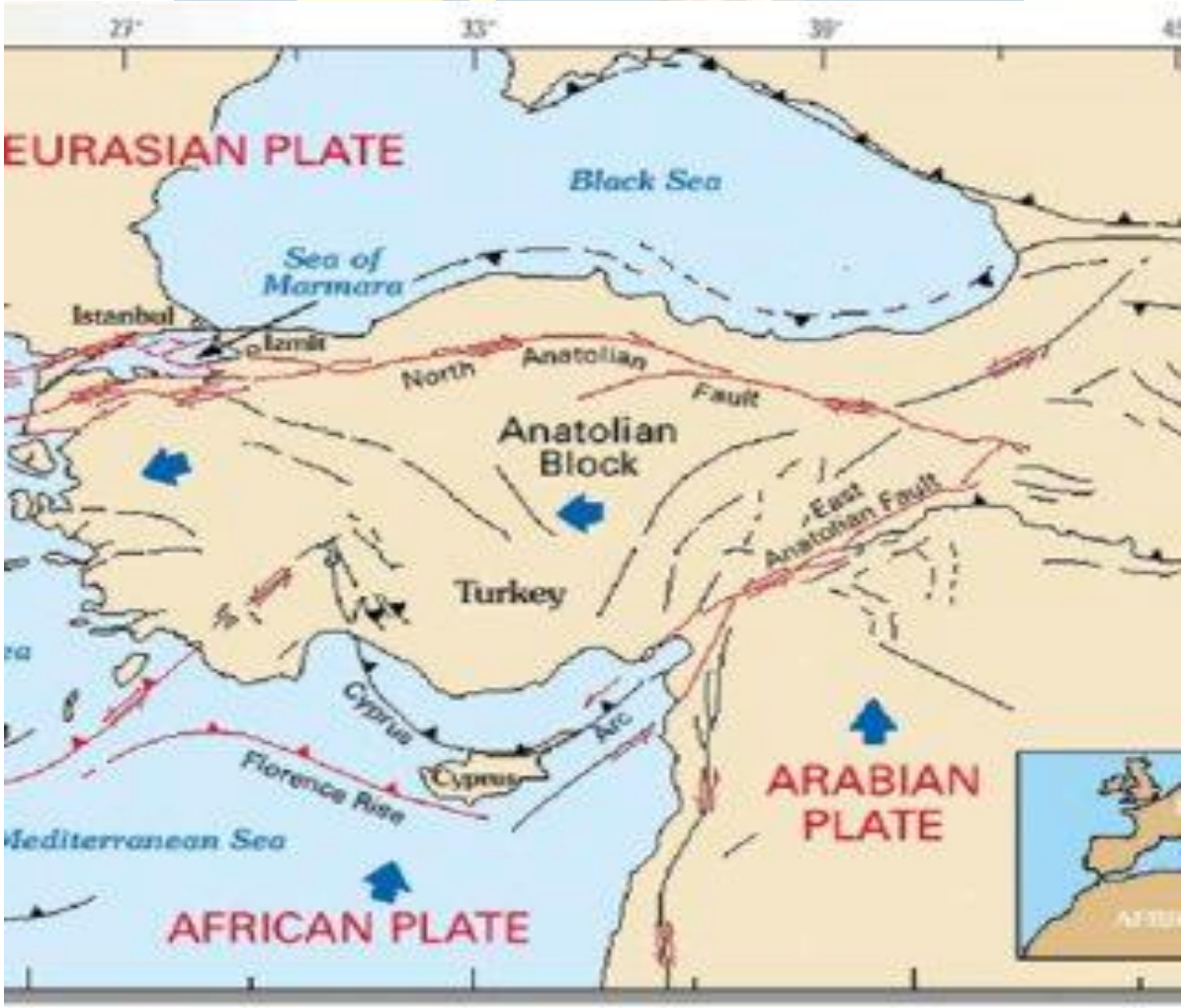
Fault lines around Turkey and Syria



Source: British Geological Survey

BBC





- **A Chinese communist party delegation has visited the Solomon Islands, calling the "flourishing" cooperation between China and the Pacific nation a show of how diplomatic ties were in their peoples' interest.**
- **China had signed a policing pact with the Solomon Islands in July, as both countries upgraded their ties to a "comprehensive strategic partnership"**
- **The earth's crust consists of tectonic plates. Fault lines form where these plates interact, as they collide, pull apart or slide past each other.**
- **When these plates abruptly grind and slip past each other, they release pent-up pressure, leading to earthquakes.**
- **The earthquakes in Turkey occurred along the East and North Anatolian Fault Lines, which run 700 km and 1,500 km long, respectively**
- **The unusual interaction initiated a cascade of ruptures, resulting in a larger-than-usual total rupture length and a more tremendous potential for destruction.**
- **The Narlı Fault and Çardak–Sürgü Fault Zone are also primarily located in eastern Turkiye.**
- **They extend from the southern part of Turkiye to the northeastern part, roughly parallel to the border with Armenia.**
- **They both experienced separate earthquakes. The ground near the coast some 200 km to the southwest began to move like a liquid work in Science was distinguished by two methods: kinematic slip inversion and fault-property modelling.**

- **Kinematic slip inversion is like rewinding an earthquake video to understand how fault surfaces moved, indicating what might have occurred underground.**
- **In fault -property modelling, researchers estimate the characteristics of the fault, like friction and material properties, to predict how an earthquake is likely to spread along it. These predictions are then compared to real earthquake data to gain insights.**

Gravitational constant

- **Any mass warps the fabric of space-time around itself. The more the mass, the more the warping.**
- **The force that an object feels when travelling along this warped path is called gravity. It tends to move the object towards the mass.**
- **The strength of this force depends on the gravitational constant. Denoted by a 'G', it is a fundamental physical constant.**
- **It was first accurately determined by Henry Cavendish in 1797.**
- **G is an essential component of both Isaac Newton's law of universal gravitation and Albert Einstein's theory of general relativity.**
- **In Newton's theory, the gravitational force between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. G is the proportionality constant.**
- **In Einstein's theory of general relativity, G appears in the equations that describe the curvature (or the 'warping') of spacetime in the presence of**

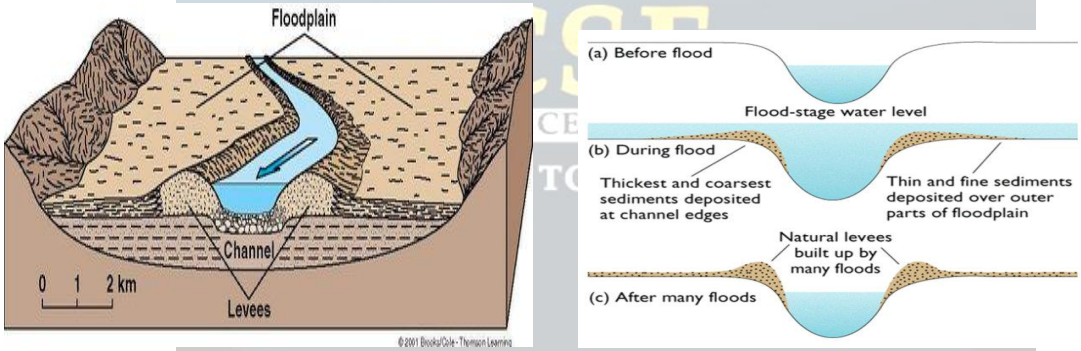
mass and energy.

- This theory provides a more accurate description of gravitation, particularly in extreme conditions, such as near massive celestial objects.
- The precise value of G is crucial to understanding celestial mechanics and to determine the mass of celestial bodies.

Mapping in news

- Rock paintings at the Ponta das Lajes archaeological site, in a rural area of Manaus, Brazil,
- The archaeological site was exposed following a drought in the Negro River, unveiling rock paintings.

Flood plain

- 

- **India's urban areas have been flooding more and more often, destroying lives and livelihoods.**

- **Yet, according to a study led by the World Bank and published in Nature on October 4, flood risk in many cities is rising because they are expanding into flood-prone areas.**

- **According to the paper, since 1985, human settlements in flood- prone areas have more than doubled. Experts say the findings spotlight the risk of unsustainable urbanisation in India.**

- **The study also found that middle- income countries like India have more urban settlements in flood- prone zones than low- and high- income countries.**

How is India at risk?

- **India isn't among the 20 countries whose settlements are most exposed to flood hazards, but it was the third highest contributor to global settlements, after China and the U.S., and also third after China and Vietnam among countries with new settlements expanding into flood- prone areas, all from 1985 to 2015**

- **When environmental regulations are applied to new constructions, they are**

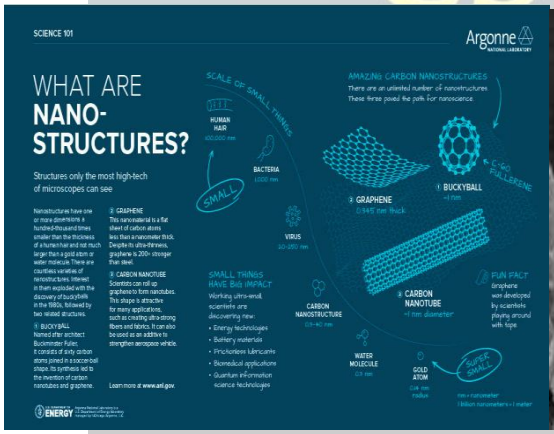
often applied only to big infrastructure projects and not to medium- and small- scale modifications of localities.

- **This contradicts the notion that certain localities are more flood- prone and that flooding and flood- risk are locality -level issues**

What is to be done?

- **Market forces tend to push expansion into flood -prone areas,"**
- **Sustainable urban planning**
- **Urban governments need to make housing in such areas more flood resilient and protect low -income housing.**
- **Example of riverside settlements that use stilt houses, like those used by the Mishing and the Miyah communities along the Brahmaputra.**

NANO forests



- **Carbon nanostructure that was "blacker than black". The structure of the silicon particles 50-1,200 nanometers in size resembled spikes arranged around a sphere.**

- **The carbon nanoflorets' high efficiency comes from three properties. First: the nanoflorets absorb three frequencies in sunlight – infrared, visible light, and ultraviolet.**
- **Other common materials for solar-thermal conversion, like photovoltaic materials used in solar panels, absorb only visible and ultraviolet light. More than half of the energy in sunlight arrives to the earth as infrared radiation.**
- **So the nanoflorets can absorb much more energy from the sun.**
- **The other two properties responsible for the material's high light- heat conversion efficiency are a result of its shape.**
- **As light falls on the material, the carbon cones ensure that very little is reflected back. Instead, most light is reflected internally.**
- **Second, one risk with a material that can convert sunlight into heat is that it can also lose it to its environment.**
- **The carbon nanoflorets don't, however, thanks to long-range disorder: parts of the structure at some distance from each other possess different physical properties. The researchers reported that a 1 m sq. coating of carbon nanoflorets on a surface could vaporise 5 litres of water in an hour**
- **"India is a country that is blessed with a lot of light, but also has areas that have low temperatures," In such regions, the nanofloret coatings can help heat up housing and sterilize surfaces in hospitals**
- **Given that the material can be coated on a vast variety of surfaces, it can heat up those using sunlight. If one were to use a coating of this material to heat up their homes, they would be doing so in an ecologically sound way while reducing the carbon footprint.**
- **The nanoflorets pose no risk of inhalation: "once coated, the adhesion is**

nearly as good as paint on a wall.

World thrift

- **World Thrift Day is observed on October 31 to promote saving money and developing a sense of financial prudence. Physicists generally attribute this to the principle of least action.**
- **Action in physics is defined by the change in energy of a system over time. The conservation laws in physics follow from the principle of least action.**
- **They imply that all energy is conserved, as is the total momentum. Nothing is deleted or destroyed, only conserved. All the phenomena that happen, from the subatomic world to the galaxies, follow the path of least action.**
- **The word 'least' here doesn't mean minimality. Instead, it means that a physical system between any two points in space -time evolves along a path that minimizes or maximizes the action depending on the outcome of the process.**