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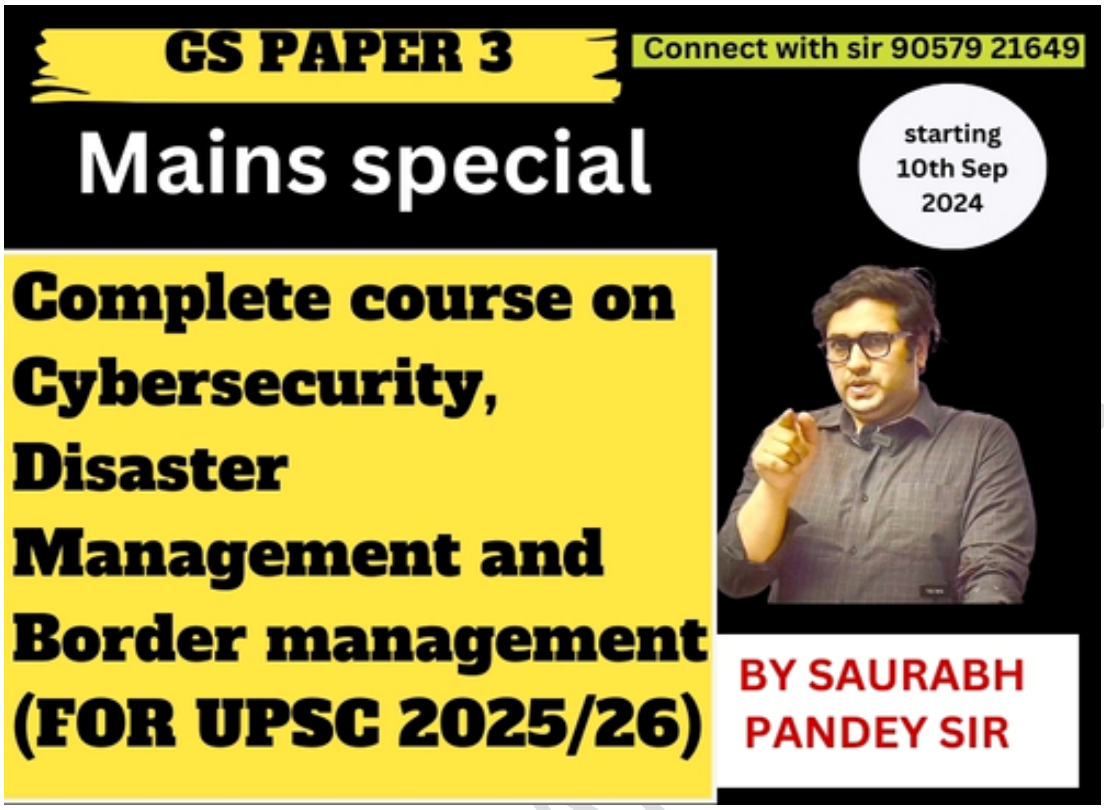
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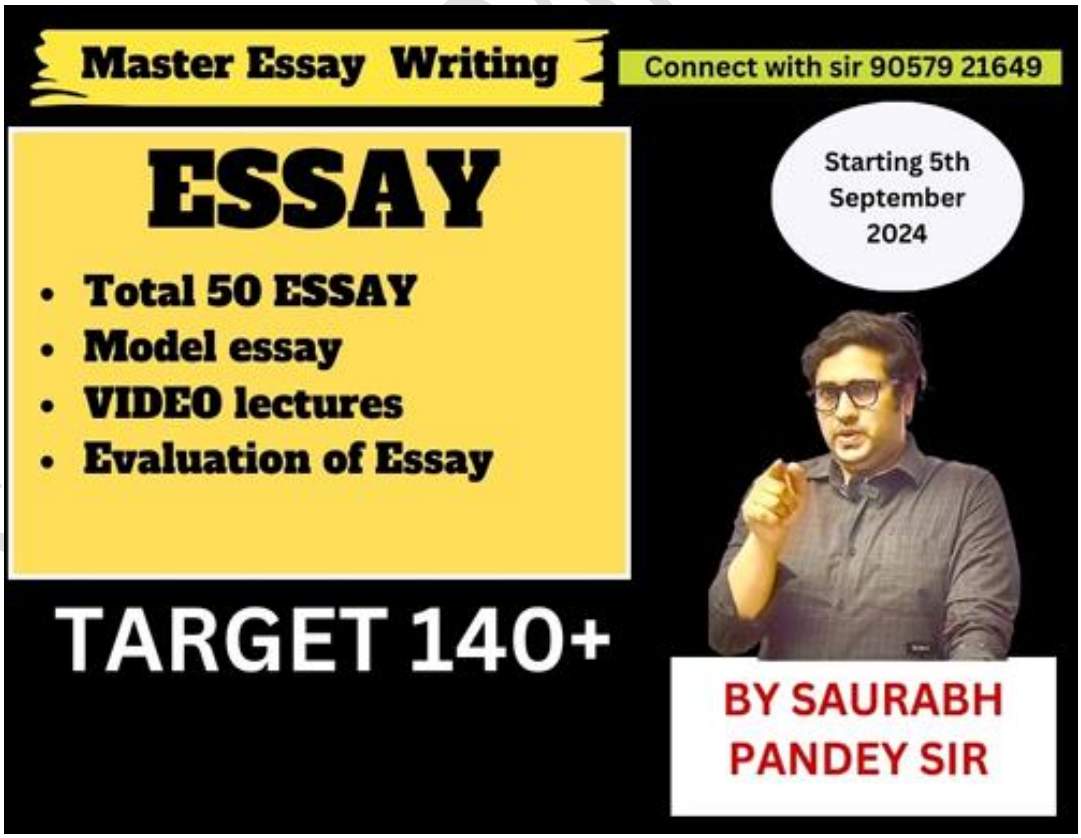
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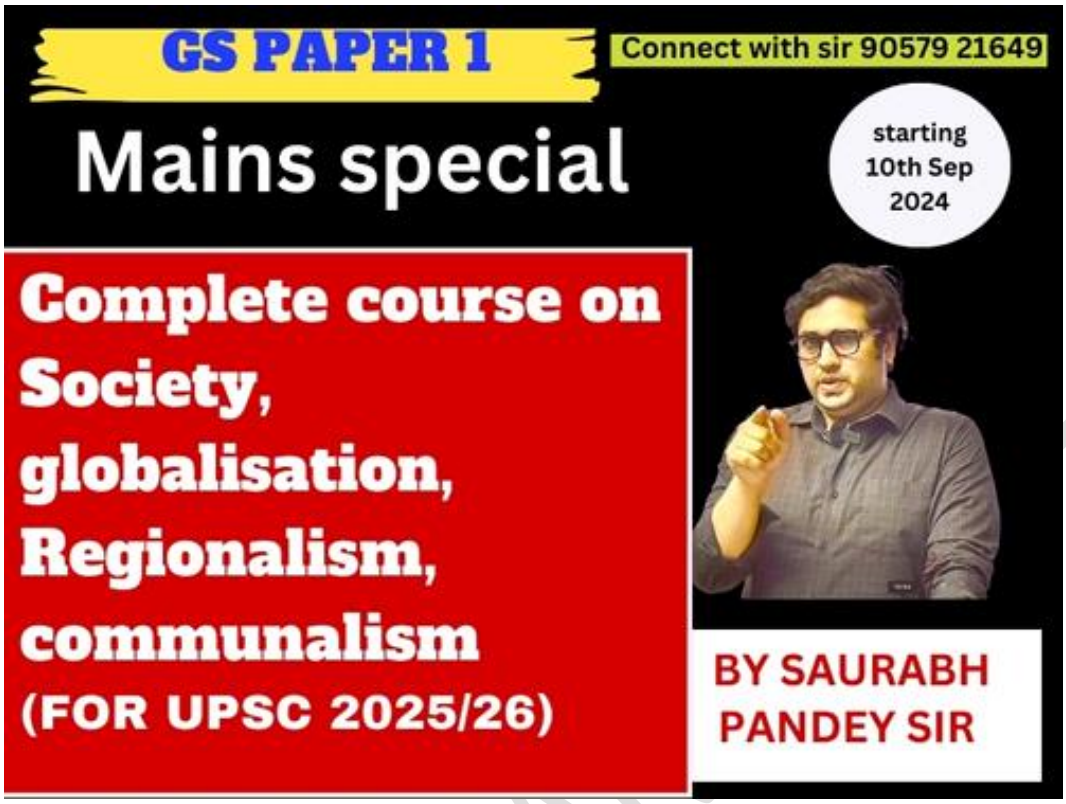
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CRISPR Fncas9

- **Indian scientists build breakthrough gene-editor, are aiming for patent**
- **A CRISPR system built to use the FnCas9 enzyme was found to edit genomes more efficiently and with less unintended damage than existing technologies, researchers at CSIR-IGIB and the L.V. Prasad Eye Institute have reported**
- **Scientists from the CSIR-Institute of Genomics and Integrative Biology, New Delhi, have developed an enhanced genome-editing system that can modify DNA more precisely and more efficiently than existing CRISPR-based technologies.**

CRISPR's off-target problem

- **Today, using CRISPR-Cas9, researchers can add, remove, or alter specific DNA sequences in the genomes of animals.**
- **This system has been used in various fields, including in agriculture to improve the nutritional value of plants and increase their yield and in healthcare to diagnose several diseases and treat genetic disorders.**
- **The CRISPR-Cas9 gene editing tool uses a guide RNA (gRNA) designed to find and bind to a specific part of the target genome.**
- **The gRNA directs an enzyme, Cas9, to the target site, which is followed by a short DNA sequence called the protospacer adjacent motif (PAM).**
- **Cas9 recognises and binds to the PAM sequence, and acts as a molecular scissor that snips some damaged DNA.**
- **This repair system triggers the cell's DNA automatically, which repairs the snipped part to insert the correct DNA sequence.**
- **But the CRISPR-Cas9 system can also recognise and cut parts of the genome other than the intended portion.**
- **Such "off-target" effects are more common when using the SpCas9 enzyme derived from Streptococcus pyogenes bacteria. Scientists have been able to engineer versions of SpCas9 with higher fidelity but only at the cost of editing efficiency.**
- **Switching SpCas9 with FnCas9**

- **To overcome these issues, researchers are exploring Cas9 enzymes from Francisella novicida bacteria. While it has low efficiency, is highly precise, this Cas9, called FnCas9 is well.**
- **To enhance it without compromising specificity, researchers at CSIR-IGIB in Delhi recently tested lab-modified and engineered new versions of FnCas9.**
- **The researchers tinkered with amino acids in FnCas9 that recognize and interact with the PAM sequence on the host genome. "By doing this, we increase the binding affinity of the Cas protein with the PAM sequence," Dr. Chakraborty said.**
- **"The Cas9 can then sit on the DNA in a stronger configuration, and you've got editing moments much more efficient."**
- **The researchers also engineered the end regions of FnCas9 to be more flexible and released the PAM on the genome at the otherwise harder-to-access. "This opens up more avenues for gene editing**

figures:
figure 1.1 mindmap:

Topic-2 Can States tax mining activities?

Why was an earlier judgment by a seven-judge Bench called into question?

What are the provisions of the Mines and Minerals (Development and Regulation) Act, of 1957?

Are royalties the same as tax?

What was the latest verdict on the issue?

The story so far:

- **In a landmark ruling on July 25, the Supreme Court affirmed that States have the legislative authority to impose taxes on minerals in addition to the royalty levied by the Centre.**
- **Upholding the principles of federalism, the verdict clarified that the power of State legislatures to tax mineral activities within their respective territories is not constrained by Parliament's Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act).**
- **The case which has been pending for more than a quarter century was decided by an 8:1 ruling with Chief Justice of India (CJI) N.V. Ramana authoring the majority opinion.**
- **Justice B.V. Nagarathna gave a dissenting opinion where she cautioned that allowing States to impose additional levies could hinder the development of the nation's mineral resources and disproportionately advantage mineral-rich States.**
- **The Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act) provides the framework for the regulation of mining activities in India.**
- **It requires those who obtain leases to conduct mining activities to pay "royalty" in respect of any mineral removed from the individual or corporation who leased the land to them.**

What was the case?

- **Section 9 of the MMDR Act requires those who obtain leases to conduct mining activities to pay "royalty" in respect of any mineral removed/ to the individual or corporation who leased the land to them.**
- **The key question for consideration was whether the royalties paid by mine leaseholders to State governments under the 1957 Act could be classified as "tax."**
- **Additionally, the court needed to determine whether or if the Centre could impose such charges the Centre States possessed the sole authority to levy them within their jurisdictions.**

- **The case has its genesis in a dispute between Central Cement Ltd and the Tamil Nadu government which arose after the company incurred a mining lease in Tamil Nadu.**
- **Although the government already pegs royalties, the Indian Tax was receiving an additional tax on the imposed payments, including royalties.**
- **The company challenged this in the Madras High Court contending that the taxes on royalties effectively constitute a tax on royalties, the imposition of which exceeded the State's legislative authority.**
- **In 1989, a seven-judge Bench of the Supreme Court in India Cement Ltd. vs. State of Tamil Nadu decided in favor of India Cement by restraining the States from imposing taxes on mining activities and pointed out the tax on royalty payments likely overstepped the outer government control over the authority over the development of minerals by mineral regulation, as specified under §54 of the "Union list" under Entry 54 (in this case, the 1957 Act).**
- **Thus, States are not empowered to levy additional taxes on this subject.**

What is the difference between royalty and tax?

- **The majority ruling clarified the distinction between royalty and tax. It deemed royalty as "the contractual consideration"**

Can States tax mining activities?

- **Entry 50 of the State List under the Seventh Schedule of the Constitution gives States the exclusive authority to make laws regarding “taxes on mineral rights”, but this power is limited by any laws Parliament may pass concerning mineral development.**
- **On the other hand, Entry 54 of the Union List gives the Centre the power to regulate “mines and mineral development,” especially when Parliament decides it is necessary in the public interest.**
- **During the proceedings, the Centre argued that Entry 50 in the State List had allowed Parliament to impose “any limitations” on taxes on mineral rights through the promulgation of laws relating to mineral development in this case, the 1957 Act.**

- **However, the majority reasoned that since royalties could not be classified as a tax, they do not fall within the category of "taxes on mineral rights" as defined in Entry 50 of the State List.**
- **As a result, it was held that the 1957 Act merely provided States with another source of revenue through royalties, without interfering with their authority to levy taxes on mineral rights under Entry 50**

figure 1.1 mindmap:

The Yazidi community

- **The Yazidi community is an ethnoreligious group indigenous to the Kurdish regions of Iraq, specifically the Nineveh Plain in the north of the country, with smaller communities in neighboring countries such as Syria, Turkey, and Armenia.**
- **The Yazidis are known for their unique religion, which is monotheistic but incorporates elements of angel worship and has a complex cosmology that includes several divine beings and spirits.**

The Mettur Dam (Geography)

- **The Mettur Dam, officially known as Stanley Reservoir, is a large reservoir located in the Salem district of the Indian state of Tamil Nadu.**
- **It is one of the most important dams in the state, serving multiple purposes including irrigation, hydroelectricity generation, and water supply.**
- **The dam is constructed across the Kaveri River, a major river in South India that is considered sacred and is an important source of water for irrigation and drinking in the region.**
- **Construction: The construction of the Mettur Dam began in 1924 and was completed in 1934 under the British Raj. It was named after Sir Arthur Hope, 1st Baronet, who was the Governor of Madras Presidency at the time.**
- **Purpose: The primary purpose of the dam is to provide irrigation water for the fertile delta regions of Thanjavur, Tiruvarur, Nagapattinam, and parts of Pudukkottai and Cuddalore districts. It also supports hydroelectric power generation and serves as a major source of drinking water for several towns and cities downstream.**

The Gadgil Committee, officially known as the Western Ghats Ecology Expert Panel (WGEEP (Environment)

- **The Gadgil Committee, officially known as the Western Ghats Ecology Expert Panel (WGEEP), was formed in 2010 by the Ministry of Environment and Forests (MoEF) of the Government of India.**

- **The committee was named after its chairman, Madhav Gadgil, a renowned ecologist and environmentalist.**
- **The primary objective of the committee was to recommend a strategy for the environmental conservation of the Western Ghats, a mountain range in the western part of India that is known for its rich biodiversity and is a UNESCO World Heritage Site.**

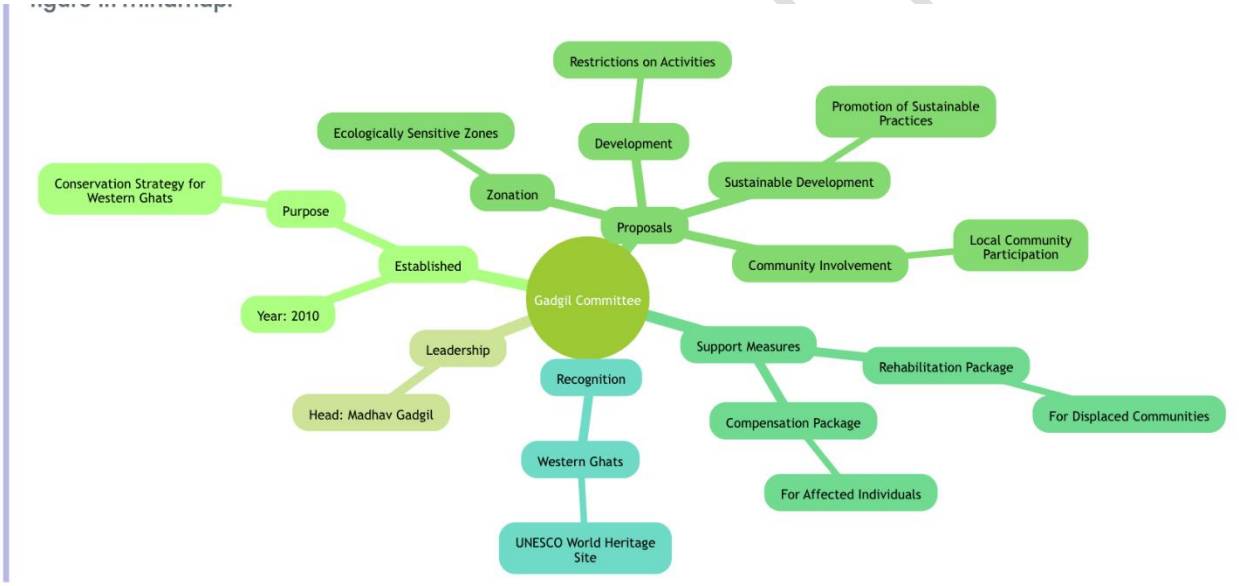
The Gadgil Committee submitted its report in 2011, making several recommendations aimed at conserving the ecological integrity of the Western Ghats. Some of the key recommendations include:

- **Zonation of the Western Ghats: The committee proposed dividing the Western Ghats into three ecological zones based on their ecological sensitivity: Ecologically Sensitive Zones (ESZ), Ecologically Sensitive Sub-Zones (ESSZ), and a zone where development activities are permissible.**
- **Restrictions on Development Activities: The committee suggested imposing restrictions on development activities in the ESZ and ESSZ to protect the ecology of the region. This included limitations on mining, quarrying, thermal power plants, and other potentially harmful activities**
- **Involvement of Local Communities: The committee emphasized the importance of involving local communities in the conservation efforts. It recommended the establishment of Community Conservation Committees and the recognition of the traditional rights of local people over forest resources.**
- **Sustainable Development: The committee advocated for the promotion of sustainable development practices that do not harm the environment. This included encouraging eco-friendly tourism and the development of sustainable agriculture.**
- **Compensation and Rehabilitation: The committee proposed a compensation and rehabilitation package for those displaced or affected by the conservation measures, ensuring their livelihoods are not adversely affected**
- **Pangong Lake, also known as Pangong Tso, is a long, narrow endorheic lake located in the Himalayas.**
- **It is situated at an altitude of approximately 4,350 meters (14,270 feet) and is renowned for its scenic beauty and crystal-clear waters.**

- **The lake is divided between India and China, with about two-thirds of its length in the Tibetan Autonomous Region of China and the remaining one-third in India. The Indian portion of the lake lies in the Ladakh region of Jammu and Kashmir.**

Key points about Pangong Lake include:

- **Geography: Pangong Lake is approximately 134 kilometers (83 miles) long and varies in width from 1 to 5 kilometers (0.6 to 3.1 miles). It is one of the highest lakes in the world.**
- **Biodiversity: The lake is known for its rich biodiversity, including a variety of fish species. However, the biodiversity of the lake is under threat due to factors such as climate change and human activities**



The Chabahar Port (IR)

The Chabahar Port is strategically important for several reasons, primarily due to its location in southeastern Iran, on the Gulf of Oman, which provides access to the Indian Ocean. Here are some of the key reasons for its importance:

- **Trade and Connectivity: Chabahar Port serves as a crucial transit point for trade between Iran, India, and Afghanistan, bypassing Pakistan.**
- **This is particularly important for India, as it provides a direct sea route to Afghanistan, facilitating the transport of goods and aid to landlocked**

Afghanistan without relying on Pakistani routes, which have been subject to political tensions.

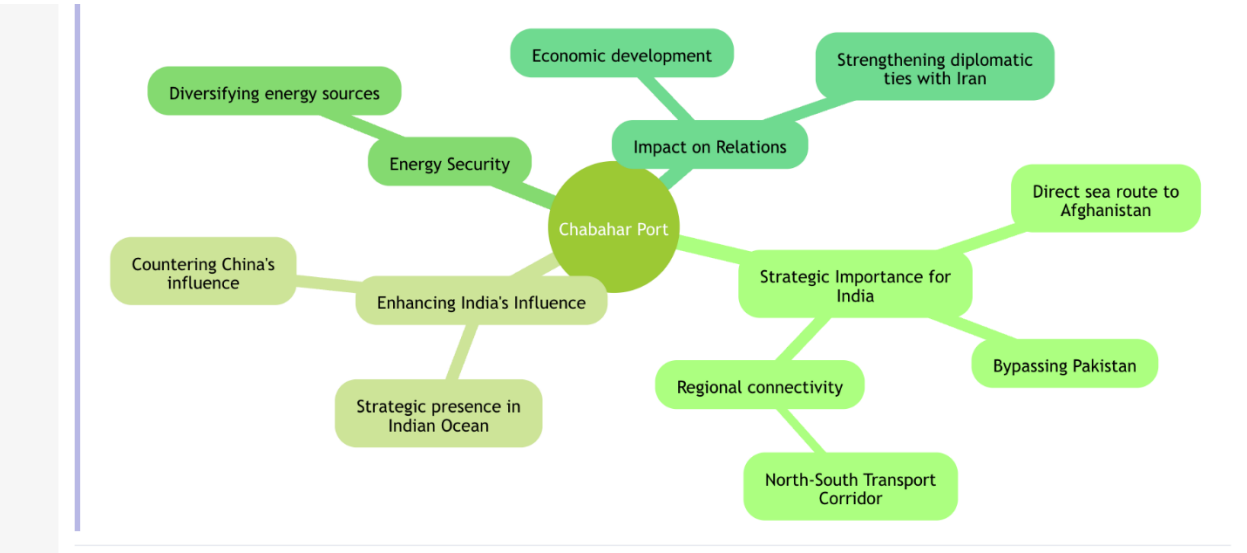
- **Regional Connectivity: The port is a key component of India's vision for regional connectivity, part of the North-South Transport Corridor, linking India to Russia through Iran. This route significantly reduces travel time and cost for cargo, making it an attractive alternative to the traditional route through the Suez Canal**

- **Strategic Importance: Chabahar Port has strategic significance for India, as it allows India to have a presence in the region and to counterbalance China's influence in Pakistan through the Gwadar Port. India's involvement in the development of Chabahar Port is seen as a way to enhance its strategic footprint in the Indian Ocean and to secure its energy and trade routes.**

- **Economic Development: The development of the port is expected to boost economic development in the region, providing opportunities for investment, trade, and job creation. It can also serve as a gateway for Indian companies to access markets in Central Asia and the Middle East.**

- **Energy Security: The port can play a role in India's energy security by facilitating the import of natural gas and oil from Iran and other Central Asian countries. This diversifies India's energy sources and can reduce its dependence on the Strait of Hormuz, a chokepoint for much of the world's oil trade.**

- **Diplomatic Relations: India's involvement in the development of Chabahar Port is a significant aspect of its diplomatic relations with Iran. It demonstrates India's commitment to enhancing ties with Iran and contributing to the development of the region.**



Wood encroachment in an open ecosystem

- **Grasslands and savannahs are biodiverse habitats in tropical and temperate regions throughout the world.**
- **They cover nearly 40% of the earth's total landmass and are home to many endemic and at-risk species of plants and animals.**
- **From rhinoceroses and elephants in Africa to grassland birds like the bustards, Asian grasslands are prime habitats open for grasslands, and because of the dry conditions that limit their expansion, rapidly losing it all. However, we are activists who have them.**
- **Ecosystems intervening in the function of grassland ecosystems, agriculture, deforestation, intensive conversion of lowland to erosion, large-scale loss due to projects, and overgrazing. But lurking among these usual suspects is also a highly unusual one: trees.**
- **The increase in tree and shrub cover is called woody encroachment and it is considered across most ecosystems. Woody encroachment entails that the dispersion of open habitats to habitats with greater tree cover and/or shrub density.**

- **The result is the homogenization of an ecosystem, meaning a diverse, multi-layered ecosystem turns into a uniform layer of woody plants.**
- **This is a dire prospect because open ecosystems are characterized by a grassy understory and a scattering of native tree species.**
- **They are generally maintained by certain natural as well as human activities like grazing and fire, which are called disturbance regimes because they work in tandem to limit the growth of tree species.**
- **But once these regimes are disrupted, trees have the calm they need to establish themselves and start woody encroachment.**

When trees have ill-effects

- **A higher concentration of carbon dioxide in the air due to ongoing climate change also encourages deep-rooted plants in grasslands to proliferate.**
- **"Increased atmospheric CO2 is likely to promote tree over grasses because the C3 photosynthesis pathway used by trees is preferred under high CO2 conditions,**

The human hand

- **Woody encroachment is a direct result of human-driven factors that are changing the disturbance regimes open ecosystems need to thrive.**
- **The suppression of the practices grasslands need to thrive stems from colonial conservation and management policies.**
- **Colonial officers in tropical countries were known to regard open ecosystems as "wastelands" because they took up space in which trees could grow instead and provide timber**
- **Woody encroachment in open ecosystems has altered biodiversity in myriad ways. There has been a big decline in grassland birds due to woody encroachment.**
- **"Succession of woody species changes the soil conditions, which changes the grass species and faunal association. Woody species invite increased predation, especially of the specialist birds' nests,"**

- **Woody encroachment brought down the population of grassland specialist rodents in the Banni grasslands of Kutch.**
- **In the Banni grasslands, studies have found that the spread of the invasive species Prosopis juliflora which the Gujarat Forest Department planted in 1961 to combat desertification and provide firewood to communities has since transformed swaths of the grasslands into a Prosopis woodland.**
- **In fact, most of India's open ecosystems have stories to tell of ruin led by artificially introduced plants. In the Shola grasslands, eucalyptus plantations have run amok, whereas the Malabar silk-cotton tree has been running riot in the wet Terai grasslands of the Himalayas.**

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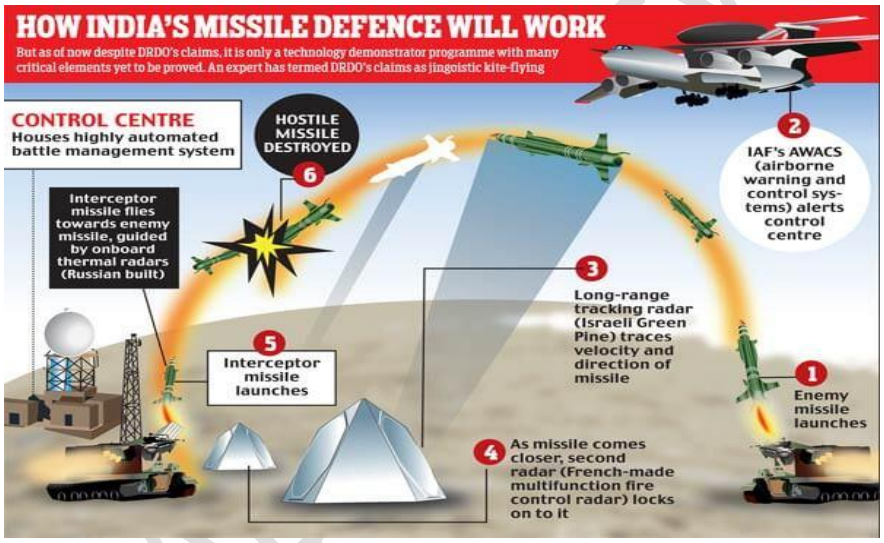
Ballistic Missile Defence (BMD) system

- **The DRDO successfully Flight-tested the Phase-II Ballistic Missile Defence (BMD) system demonstrating the indigenous capability to defend against ballistic missiles of the 5,000-km class.**
- **Phase 1 of the BMD, which can intercept ballistic missiles with a range of 2,000 km, has already been deployed**



Cheetah in Gujarat

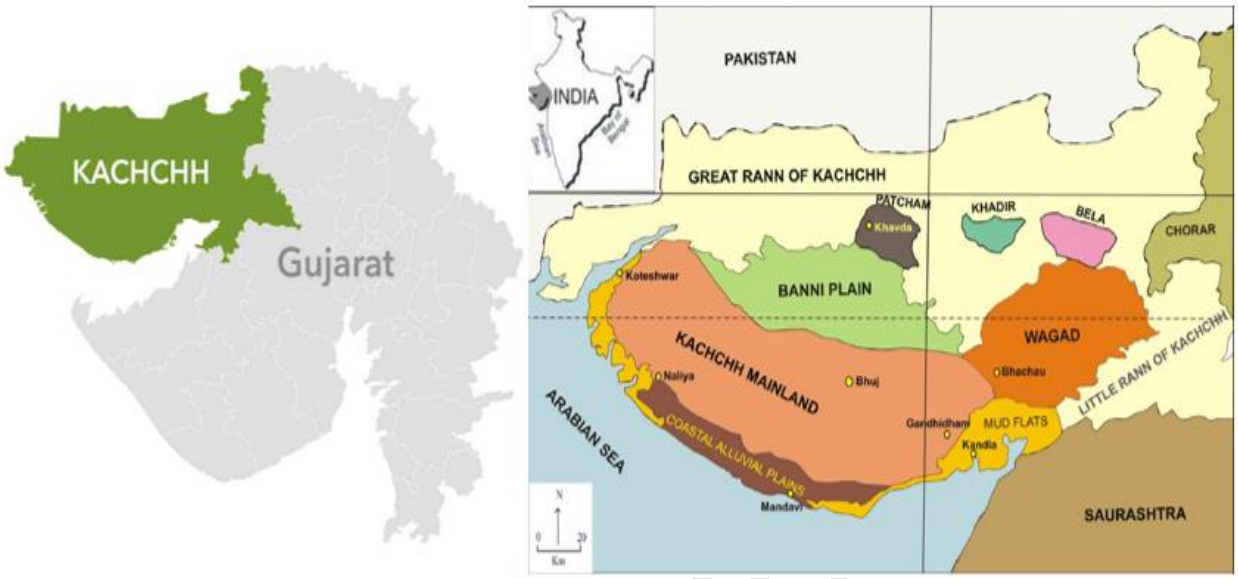
Some of the next batches of cheetahs being brought in from Africa, as part of the next phase of Project Cheetah, may be sent to a cheetah-breeding and conservation center being built in the sprawling grasslands of Banni in the Rann of Kutch in Gujarat,

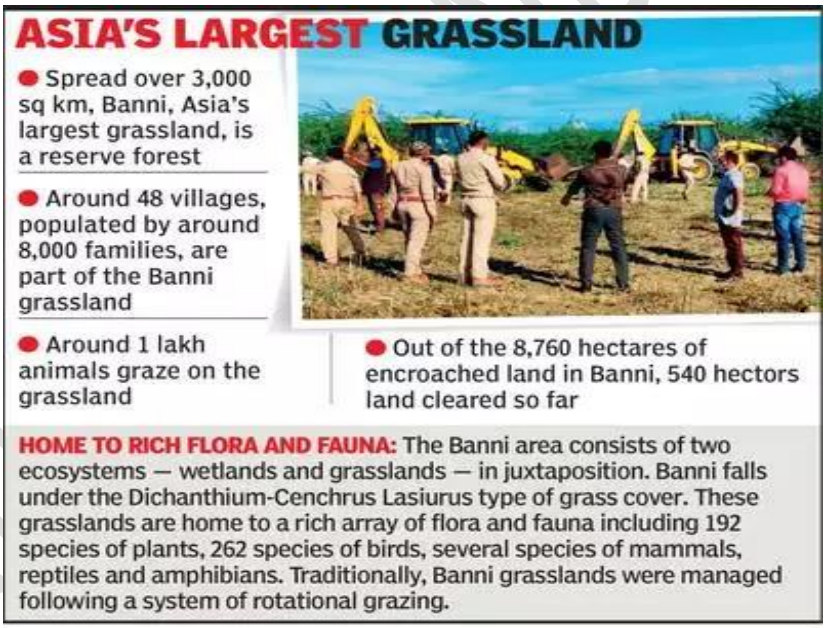
- **While the Gandhi Sagar sanctuary in Madhya Pradesh is the preferred location for the next lot of wild cats, Banni has been considered a potential habitat for over a decade.**

Banni grassland

- **Banni is a vast grassland in the southern part of Kutch and extends to nearly 3,500 square kilometers.**
- **While that is plenty of space, more than that available in Kuno and Gandhi Sagar, there is barely enough prey to sustain a viable population.**

- **Antelope species such as chinkara and blackbuck the prey for the cheetah are present in the Banni landscape but not enough for the big cat.**

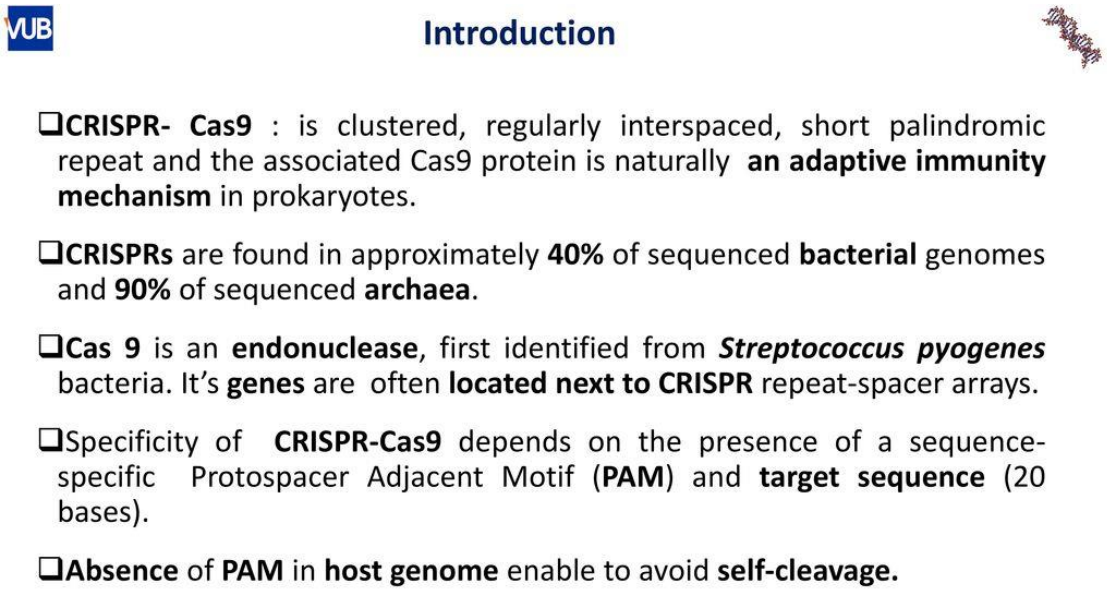




A CRISPR Cas-based TB detection system"

- **A CRISPR Cas-based TB detection system". Developed by the ICMR Regional Medical Research Centre, Dibrugarh, the technology is touted as the "world's cheapest TB testing system".**

- **It can detect the TB bacterium using DNA from saliva at a very low cost. It can identify the bacterium with preliminary symptoms, and test over 1,500 samples within two hours**



Ketamine

- **A new tablet that slowly releases the drug ketamine can ease treatment-resistant depression, offering an alternative to cumbersome clinic-based treatments for people with the condition, researchers have found in a clinical trial.**
- **Ketamine, sometimes called a "party drug", blocks the receptor for an excitatory neurotransmitter those that cause neurons fire and send messages called glutamate.**
- **It was originally used as an anesthetic but researchers found that it had rapid antidepressant effects, acting within hours**

Urbanisation in India

- **Cities are home to about 50 crore people, accounting for about 36% of India's population. The urban population has been growing at a steady pace of 2% to 2.5% annually. The ever-growing pace of urbanization in India calls for sustained investments, with a vision and determination.**

- **The Pradhan Mantri Awas Yojana (Urban) has been under implementation since 2015 and has provided as many as 85 lakh housing units for the Economically Weaker Sections (EWS)-Middle-Income Groups (MIG) categories of population, with an investment of about ₹8 lakh crore.**
- **The migrant population working in industries has been surviving in general in slums and yearning for a roof over their heads and a functional housing unit close to their workplaces. The Budget has announced new rental housing with dormitory-type accommodation for industrial workers.**
- **This is envisaged to be developed in public-private partnership (PPP) mode with upfront financial support under the Viability Gap Funding (VGF) scheme.**
- **The core infrastructure requirement for cities includes water supply, sanitation, roads, and sewerage systems. Specific to the cities, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) provides ₹8,000 crores, which, by itself, may not appear to be very substantial.**
- **The Budget Speech also mentions a huge investment of ₹11.11 lakh crore for capex in infrastructure. The Smart Cities Mission, which was launched in 2015, was provided budgetary support of ₹8,000 crores in 2023-24, which has been scaled down to ₹2,400 crores in 2024-25, to take care of the remnant commitments.**
- **The Budget has declared the intention of focusing on the planned development of cities. Municipalities would get the normal 'Finance Commission Grant' of ₹25,653 crores.**
- **In addition, a provision of ₹500 crores has been made for the incubation of new cities. With the development of mass rapid transit systems, cities can embark on transit-oriented development, wherein transit hubs can be surrounded by denser development without creating a traffic overload on roads.**
- **Moreover, a well-designed mobility plan can conveniently connect cities with their peri-urban areas and 'new cities'.**
- **Accordingly, the Budget has announced an enhanced focus on economic and transit planning, with the orderly development of peri-urban areas utilizing town planning schemes.**

- **The Budget has also proposed encouraging electric bus systems for cities and has provided ₹1,300 crores for it. E-buses offer an economical and eco-friendly operating system, but the main challenge is their higher upfront cost**
- **Solid waste management (SWM) is perhaps the biggest challenge that most cities face today. The Budget has announced a special thrust to introduce bankable projects for SWM in collaboration with the State government and financial institutions.**
- **States and municipalities can also make use of the VGF for this purpose.**
- **Cities such as Indore, and Madhya Pradesh, have shown the way to making SWM a financially viable proposition. The Street Vendors Act, of 2014, was enacted by Parliament to regulate street vendors in public areas and protect their rights.**
- **It also envisaged the preparation of street-vending plans and the creation of street-vending zones, with a view to make street-vending a healthy and safe option for consumers and vendors.**
- **The Budget has proposed to develop 100 weekly 'haats' or street food hubs in select cities.**
- **Perhaps States need not feel constrained with the number and can facilitate all cities in preparing street-vending plans and developing street-vending 'haats' in various parts of the city, according to felt needs.**

Typhoon Gaemi

- **A powerful typhoon made landfall in northeastern Taiwan.**
- **Typhoons go by different names depending on where they occur: typhoons are over the Northwest Pacific Ocean; hurricanes are in the North Atlantic Ocean and Northeast Pacific; cyclones happen over the South Pacific and Indian Ocean.**
- **All of these are a type of giant tropical storm with winds of at least 119km/h,**

- **A number of factors contribute to the formation: the force brought by Earth's spin, warm and humid air above the sea surface and cold and unstable air in the atmosphere. Typhoons use warm and humid air as fuel, which is why they only occur near the equator.**
- **A typical typhoon forms due to high temperatures around the sea surface, as a result of which water evaporates and becomes warm and humid air.**
- **This air moves away from the surface, leaving an area of lower air pressure below. Air from surrounding areas with higher air pressure pushes into this lower-pressure area. The new air then becomes warm and rises as well.**
- **As this process repeats, clouds are formed when the moist air cools off, and when the rain falls, the wind increases, hence the thunderstorm.**
- **This is where the Coriolis force comes into play. The Coriolis force is caused by the Earth's rotation that deflects moving objects to the right in the Northern Hemisphere and the left in the Southern Hemisphere.**
- **When the wind speed reaches 63km/h, it is called a "tropical storm", and by the time it reaches 119km/h, it is officially a tropical cyclone or typhoon, according to Nasa.**
- **When a typhoon approaches land, it can also be tracked by buoys, radars, ships and even a special type of plane called the reconnaissance aircraft**

How does global warming affect typhoons?

- **Typhoons are formed over relatively warm sea surfaces. With temperatures rising due to global warming, it is widely believed that the number of typhoons will greatly increase as a result.**

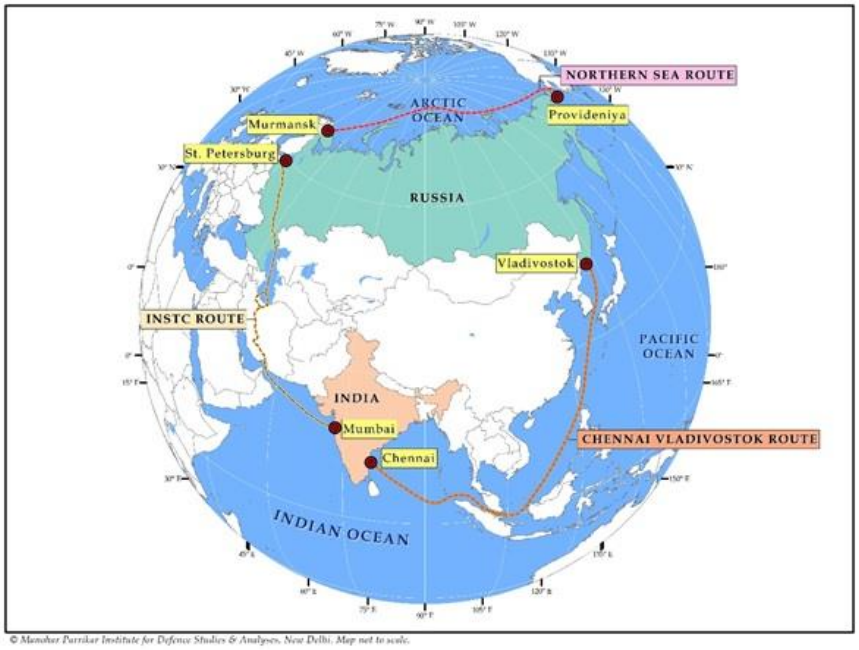
Krishna Raja Sagara

- **Krishna Raja Sagara, also popularly known as KRS, is a lake and the dam that creates it. They are close to the settlement of Krishna Raja Sagara in the Indian State of Karnataka.**
- **The gravity dam made of *surki* mortar is below the confluence of river Kaveri with its tributaries Hemavati and Lakshmana Tirtha, in the district of Mandya.**
- 

PM Visit to Russia

- **Finally, Mr. Modi's Russian journey must be considered in its 'geo-economic' rather than just its 'geopolitical' context.**
- **Regardless of the outcomes of the battle held in Ukraine, it is clear that Western sanctions against Russia will remain, and, consequently, so will India's supply of discounted Russian oil as well.**

- **These imports have meant that India-Russia trade ties, which have hovered in the $5 billion-$10 billion range for decades, grew by 66% to a whopping $65 billion last year; this has grown a further 20% in the first quarter of 2024.**
- **The spurt is unsustainable unless India develops payment mechanisms for oil imports. The Modi-Putin summit took many steps to address that issue, listing action items in nine specific areas in a Joint Vision statement on trade by 2030 that appeared to make circumventing Western sanctions a priority.**
- **In addition, the joint statement on furthering cooperation in Russia's Far East focuses on increasing energy (oil and LNG) supplies from Russia, as well as much-needed commodities exports from India, using the yet-to-be-operationalized Chennai-Vladivostok maritime corridor.**
- **While these will help rationalize the trade imbalance, both sides will also seek mutual investments, of the kind seen when Rosneft acquired a controlling stake in the Gujarat-based Vadinar refinery (Nayara Energy), the largest foreign direct investment of its kind in India, at more than $23 billion, according to Mr. Putin.**



- **In turn, Indian public sector units have bought stakes in Russian oil • fields to the tune of $15 billion.**
- **Despite the financial implications, the U.S. and Europe have steered clear of sanctioning any of these transactions, as they accept Vadinar-processed Russian oil products as "Indian products", and New Delhi is surmising that more such deals could be a safe proposition in the future as well.**
- **Russian access to the North Sea trade route around the Arctic region is invaluable as India seeks new connectivity possibilities to its east a Trump administration is likely to double down on strictures against Iran-led connectivity routes such as the International North-South Transport Corridor (INSTC) and the Chabahar project to India's west.**
- **At a time when military hardware imports, that have been the mainstay of India-Russia ties, are being reduced due to India's decade-long diversification and Russia's preoccupation with the Ukraine war, such geo-economic strategies give New Delhi new levers in the bilateral relationship.**

Why is illegal coal mining rampant in India?

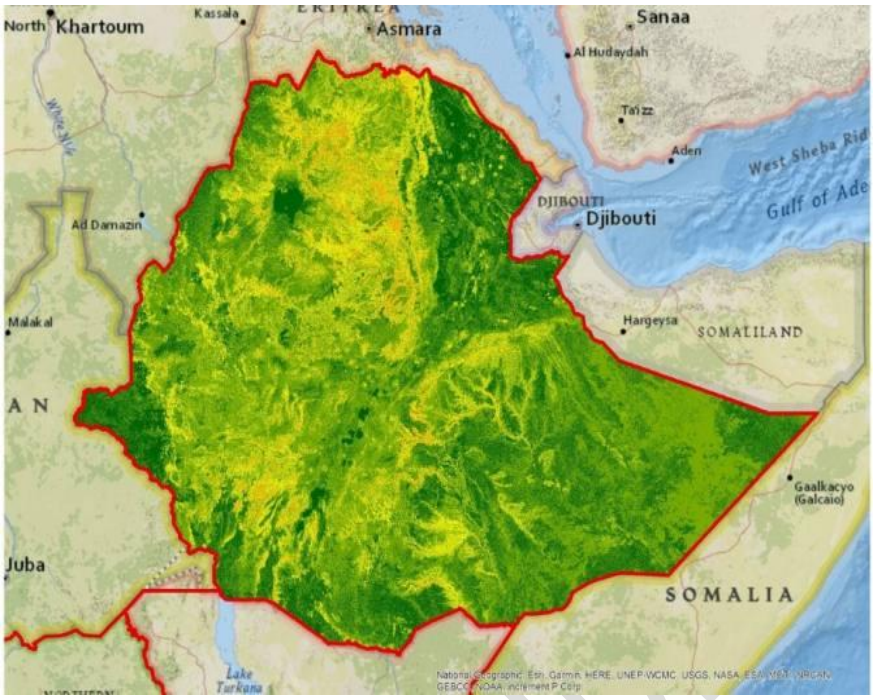
- **According to the Ministry of Coal, illegal mining in India is mostly carried out in abandoned mines or shallow coal seams in remote or isolated places. Several factors contribute to illegal coal mining in India. Coal is the most abundant fossil fuel in India, accounting for 55% of the country's energy needs.**
- **The high demand for power in India translates into a high demand for coal, which often outstrips the legal supply, prompting illegal supply. Many areas that are rich in coal are also situated close to homes for populations struggling with poverty and unemployment, which contributes to illegal mining in these areas.**

- **In remote areas, mining regulations can be weak due to inadequate monitoring and lack of resources, leading to weaker enforcement. This can result in the rise of "coal mafias," as has been alleged in multiple cases of illegal coal mining in India.**
- **For example, in 2018, activist Marshall Biam of the North East Indigenous People's Federation registered a complaint accusing a "police-backed" coal gang of threatening him.**
- **Mining tragedies are not uncommon in coal-rich Meghalaya.**
- **Illegal coal mining also allegedly receives tacit support from political leaders in areas where it is prevalent, making it difficult to curb.**
- **Illegal mining is often carried out using rudimentary techniques like surface mining and rat-hole mining, rather than the scientific methods required for legal operations on a larger scale.**
- **In areas where coal seams are closer to the surface, illegal miners access them with limited safety equipment.**
- **Minimal operational costs can also turn into significant profits, making illegal mining lucrative.**

Why Landslide in Ethiopia??

- **Landslides are particularly common in Ethiopia between July and September, which is the main wet season, as well as April and May when there is heavy seasonal rain.**
- **Millions of people in Ethiopia live in areas at risk from landslides.**
- **The soil in southern Ethiopia has been saturated by seasonal rains, making the area more prone to landslides.**
- **Rains from April to early May caused flooding and mass displacement,**

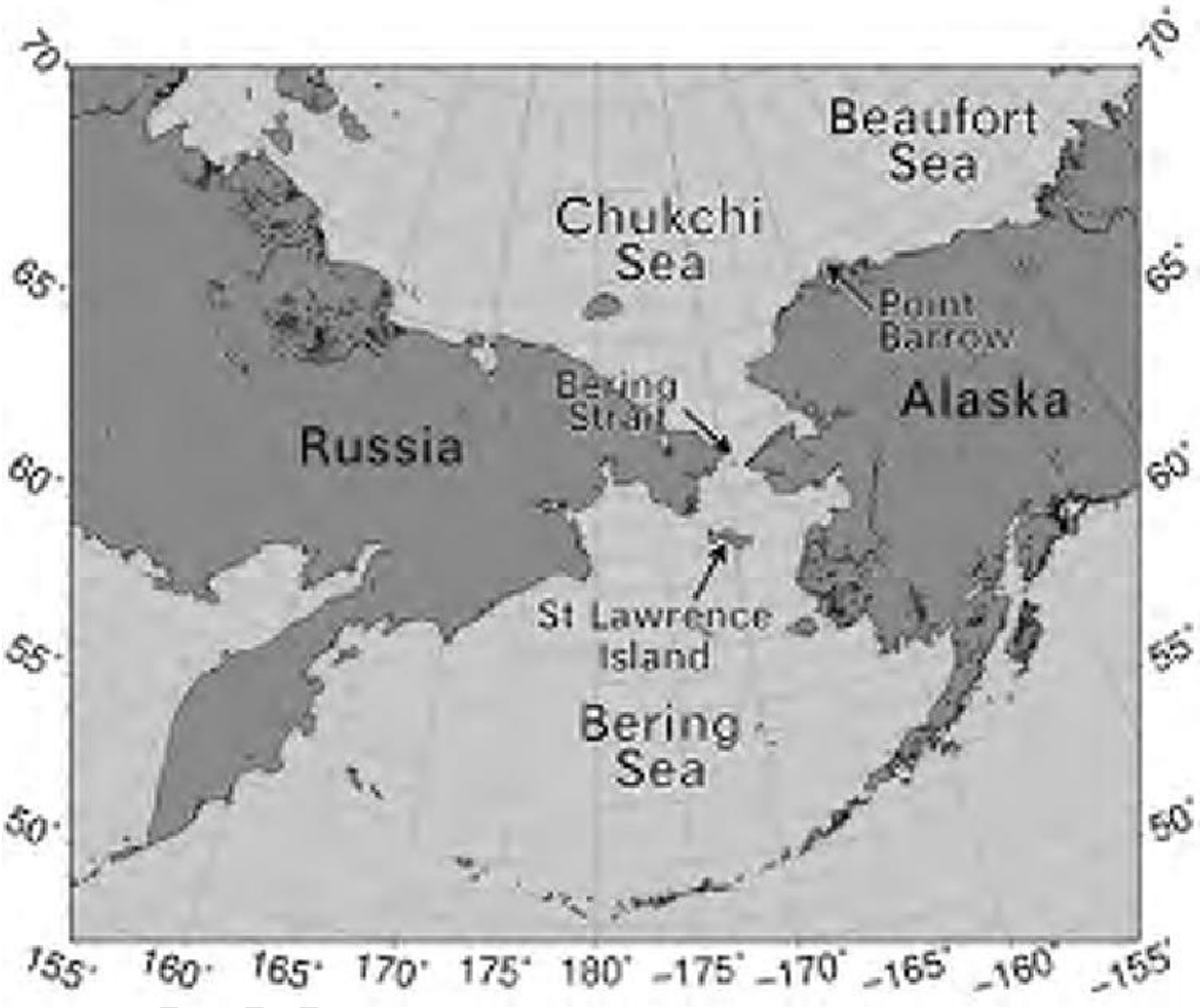
Recent Landslide in Kencho Shacha locality



Tu-95MS

- **"Tu-95MS strategic missile carriers and the Chinese air force's Xian H-6 strategic bombers carried out an aerial patrol over the Chukchi and Bering Seas and the north Pacific Ocean".**

- **The joint U.S.-Canadian North American Aerospace Defence Command earlier said American and Canadian warplanes had intercepted two Russian and two Chinese bombers in international airspace near Alaska**



- **The TU-95MS planes were developed in the Soviet era to carry long-range cruise missiles and are part of Russia's nuclear triad. The Xian H-6 planes are also nuclear-capable.**

'States have unlimited right to tax mineral-rich lands'

- **A nine-judge Constitution Bench, headed by Chief Justice of India D.Y. Chandrachud, held that Parliament cannot limit the power of State legislatures to tax mineral-bearing lands and quarries.**

- **The judgment, freeing States from the restrictions imposed by the Centre, is in tune with the federalist principles of governance. "Any dilution in the taxing powers of the State legislatures will necessarily impact their ability to raise revenues, which in turn will impede their ability to deliver welfare schemes and services to the people.**
- **The ability of the State governments to invest in physical infrastructure, health, education, human capacity, and research and development is directly correlated to the raising of government revenues.**
- **Fiscal federalism entails that the power of the States to levy taxes within the legislative domain carved out to them and subject to the limitations laid down by the Constitution must be secured from unconstitutional interference by Parliament,**
- **The judgment said Parliament, through the Mines and Minerals (Development and Regulation) Act of 1957 cannot restrict the States from legislating on the taxation of mining lands and quarries.**
- **The court further held that royalty paid to the States by mining lease holders is not a tax.**
- **State legislatures derive their power to tax mines and quarries under Article 246 read with Entry 49 (tax on lands and buildings) in the State List of the Seventh Schedule of the Constitution.**
- **The Centre had argued that Entry 50 in the State List had allowed the Parliament to impose "any limitations" on taxes on minerals rights through laws relating to mineral development, in this case, the MMDR Act.**
- **The Mines and Minerals Act is an Act of the Parliament of India enacted to regulate the mining sector in India. It was amended in 2015 and 2016.**
- **This act forms the basic framework of mining regulation in India.**
- **This act applies to all minerals except minor minerals and atomic minerals**

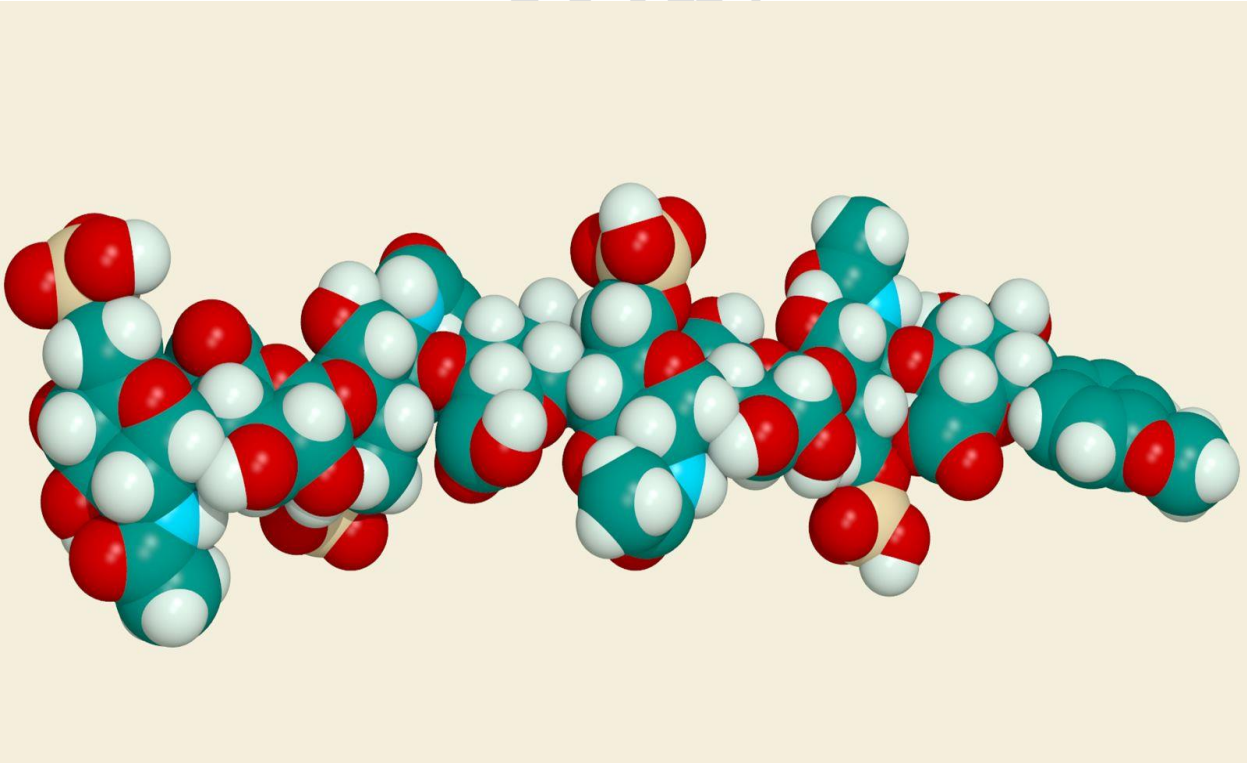
Tinzaparin

- **In a July 2024 study published in the journal Science Translational Medicine, a team of Australian, British, Canadian, and Costa Rican scientists reported that tinzaparin, a drug commonly used to prevent blood clots, significantly reduces damage to cells due to spitting cobra venom.**

- **The team also found the drug could reduce skin damage in mice injected with the venom.**

Heparan sulfate (HS)

- **Heparan sulfate (HS) is a linear polysaccharide found in all animal tissues. It occurs as a proteoglycan (HSPG, i.e. Heparan Sulfate ProteoGlycan) in which two or three HS chains are attached in close proximity to cell surface or extracellular matrix proteins.**
- **regulates a wide range of biological activities, including developmental processes, angiogenesis, blood coagulation, abolishing detachment activity by GrB (Granzyme B), and tumour metastasis.**
- **Angiogenesis is the physiological process through which new blood vessels form from pre-existing vessels**
- **Metastasis is a pathogenic agent's spread from an initial or primary site to a different or secondary site within the host's body; the term is typically used when referring to metastasis by a cancerous tumor.**



Barbiturates

- **Barbiturates, derivatives of barbituric acid, are mainly used in tablets to cause sedation and hypnotic activity. The list also includes benzodiazepines and alcohol.**
- **They decrease the total REM time and proportion of sleep spent in REM sleep with enhanced amounts of NREM sleep.**
- **REM, or 'rapid eye movement', sleep is characterized by loss of reflexes, intermittent jerky eyeball movements, brief body twitches, and irregular heartbeats and blood pressure**
- **During the three stages of non-REM sleep, a person falls asleep and then moves from a light sleep into a deep sleep. This is when a person's brain activity, breathing, and heart rate slow down, body temperature drops, muscles relax, and eye movements stop**

BIG SHOT

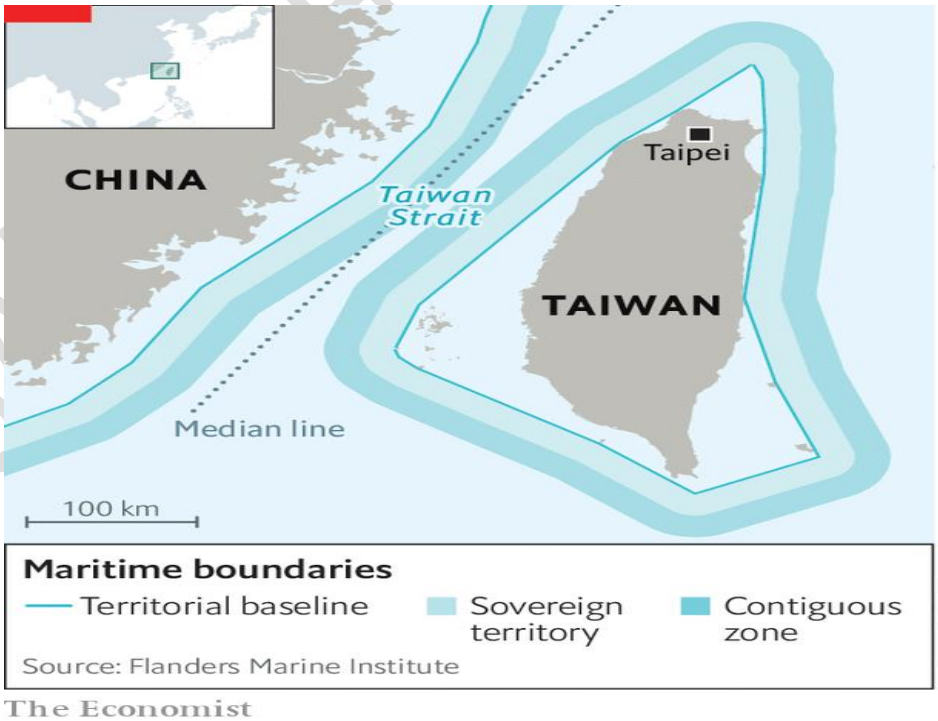
Palaeontologists from the Federal University of Santa Maria working on a dinosaur fossil discovered in Sao Joao do Polesine, Brazil. The image was released on July 18. Heavy rain that caused historic flooding in southern Brazil brought to the surface a "very well-preserved" dinosaur fossil about 230 million years old, scientists said. AFP

Flooding and fossils

- **Paleontologists from the Federal University of Santa Maria working on a dinosaur fossil discovered in Sao Joao do Polesine, Brazil.**

- **Heavy rain that caused historic flooding in southern Brazil brought to the surface a "very well-preserved" dinosaur fossil about 230 million years' old**
- **Santa Maria is a municipality in the central region of Rio Grande do Sul, the southernmost state of Brazil**

What is the history between China and Taiwan?



The Economist

- **Taiwan's first known settlers were Austronesian tribal people, believed to have come from modern day southern China.**
- **Chinese records appear to first mention the island in AD239, when an emperor dispatched an expeditionary force to it - a fact Beijing uses to back its territorial claim.**
- **After a relatively brief spell as a Dutch colony, Taiwan was administered by China's Qing dynasty, before it was ceded to Tokyo after Japan won the First Sino-Japanese War.**
- **After World War Two, Japan surrendered and relinquished control of territory it had taken from China. Afterwards, Taiwan was officially considered occupied by the Republic of China (ROC), which began ruling with the consent of its allies, the US and the UK.**
- **But in the next few years a civil war broke out in China, and then-leader Chiang Kai-shek's troops were defeated by Mao Zedong's Communist army**
- **Chiang, the remnants of his Kuomintang (KMT) government and their supporters about 1.5m people - fled to Taiwan in 1949.**
- **Chiang established a dictatorship that ruled Taiwan until the 1980s.**
- **Following his death, Taiwan began a transition to democracy and held its first elections in 1996**

Taung Kalat

- **Taung Kalat is a Buddhist monastery and temple complex located on Mount Popa in Mandalay Region, Myanmar.**
- **The site is built on a tall volcanic plug and is one of several prominent *nat* spiritual sites in the vicinity of nearby Mount Popa.**
- **The nats are god-like spirits venerated in Myanmar and neighboring countries in conjunction with Buddhism.**

Russia and China Cooperation in the Arctic

- **Russia and China pushed back against a U.S. warning over their increasing military and economic cooperation in the Arctic, where climate change is opening up greater competition.**
- **Russia has in recent years beefed up its military presence in the Arctic by reopening and modernizing several bases and airfields abandoned since the end of the Soviet era, while China has poured money into polar exploration and research growing military cooperation, "with Russia and China conducting joint exercises on the coast of Alaska.**
- **The rapid melting of polar ice has sent activity in the inhospitable region into overdrive as nations eye newly viable oil, gas, and mineral deposits as well as shipping routes in an area with a complex web of competing territorial claims.**
- **Moscow is heavily promoting its Northern Sea Route, an alternative cargo route for vessels traveling between Europe and Asia**

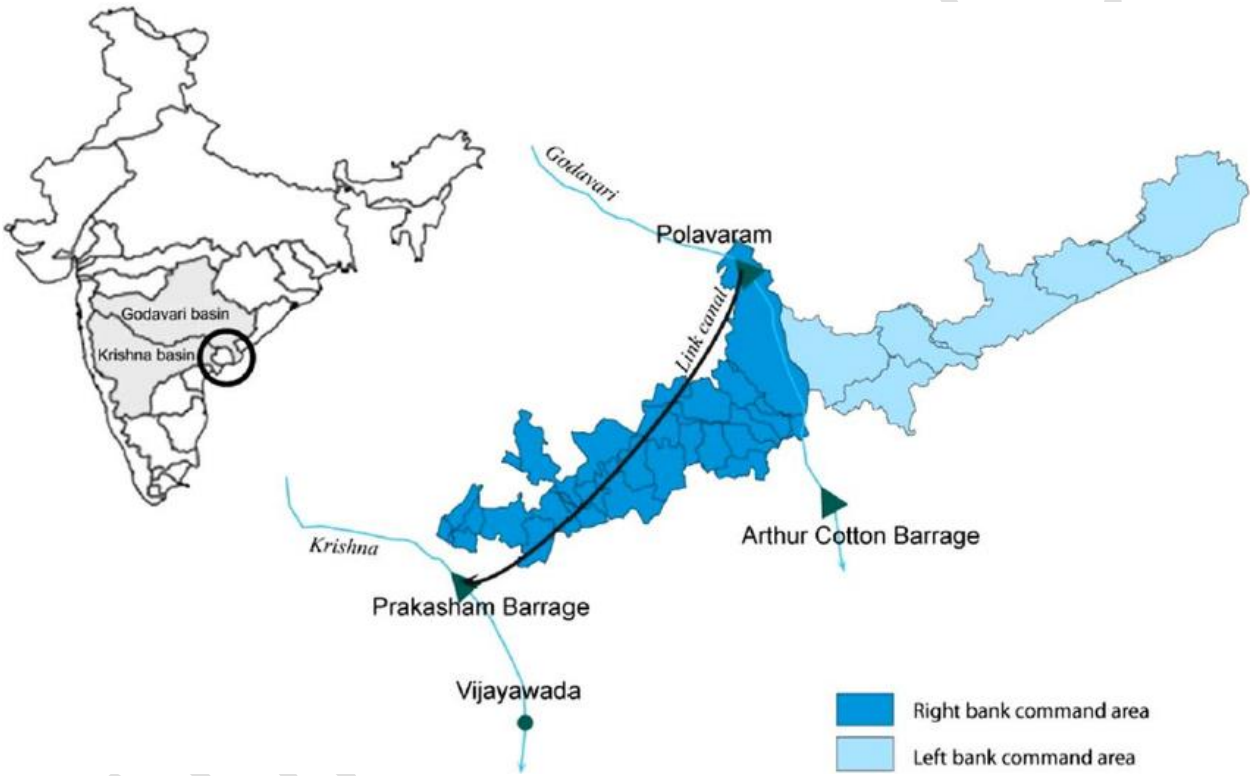
US Approach

- **Washington's Arctic strategy describes the area as "a strategically important region" for the United States that includes "the northern approaches to the homeland" and "significant U.S. defense infrastructure."**
- **It says climate change could result in the Arctic experiencing its first "practically ice-free summer by 2030."**

- **"Increases in human activity will elevate the risk of accidents, miscalculation, and environmental degradation,**

The Polavaram Project

- **The Polavaram Project is an under construction multi-purpose irrigation project on the Godavari River in the Eluru District and East Godavari District in Andhra Pradesh.**
- **The project has been accorded National project status by the Central Government of India.**



Future and options

- **Increase in both long-term and short-term capital gains (STCG) tax budget 2024-25. As per definition, any profit or gain that arises from the sale of a 'capital asset' is a capital gain.**
- **Any profit and gains arising from the transfer of capital assets such as property, shares, bonds, vehicles, etc., shall be chargeable to tax under the head "Income from Capital Gains." Capital assets are classified into short-term and long-term assets.**

- **Short-term capital gain/loss arises if a short-term capital asset is transferred. A short-term capital asset is an asset which is held for a period of less than or equal to 36 months, except for certain exceptions where the period is shorter: listed shares and equity-oriented funds qualify if held for less than or equal to 12 months, while immovable property and unlisted shares require a holding period of less than or equal to 24 months to be considered short-term capital assets.**

- **Future and options**

- Futures and options (F&O) are derivative products in the stock market. Since they derive their values from an underlying asset, like shares or commodities, they are called derivatives.

  Two parties enter a derivative contract where they agree to buy or sell the underlying asset at an agreed price on a fixed date. This fixed date is termed the expiry date in the stock market. The reason for entering such a contract is to hedge market risks by locking the price of an asset for a future date.

  One party expects the prices to rise, while the other expects the opposite. As a result, one counterpart stands to profit, and the other party bears the loss.

  A future is a contract to buy or sell an underlying stock or other assets at a pre-determined price on a specific date. On the other hand, options contract gives an opportunity to the investor the right but not the obligation to buy or sell the assets at a specific price on a specific date, known as the expiry date.

Neutrinos

- **Neutrinos are a type of subatomic particle.**
- **They don't have an electric charge, have a small mass, and are left-handed (a physics term meaning the direction of its spin is opposite to the direction of its motion). And they are flooding the universe.**
- **They are the second-most abundant particles after photons (particles of light) and the most abundant among particles that make up matter. These particles are produced when particles called leptons interact with matter.**
- **For example, when a type of lepton called a muon interacts with matter, the interaction produces a muon-neutrino.**
- **The same goes for electrons (electron-neutrino) and tauons (tau-neutrino). However, the neutrinos themselves interact with matter very, very rarely to produce a corresponding muon, electron, or tauon.**
- **This small interaction rate makes studying neutrinos difficult.**
- **For example, a muon-neutrino will scatter an atom's nucleus only once out of a million times or so, producing a muon and a proton.**
- **So to study them, physicists have built detectors with very new tracking capabilities**
- **New data from Nova One such experiment is NovA, an acronym for 'NuMI Off-axis νe Appearance', in Minnesota in the U.S.**

- **It creates a beam of neutrinos that fly towards a 14,000-tonne detector located 800 km away.**
- **NOvA is managed by the Fermi National Accelerator Laboratory. NOvA was designed to determine the role of neutrinos in the evolution of the cosmos.**
- **It does this by trying to understand which neutrino type has the most mass and which type has the least. Because neutrinos pass through most matter untouched, they can carry information across large distances.**
- **Humans currently use electromagnetic waves to do this job because they are easier to transmit and detect.**
- **But in some situations, they don't work well.**
- **For example, seawater is opaque to electromagnetic radiation of shorter wavelengths, which impedes the transmission of waves of certain frequencies to submarines.**
- **Neutrinos on the other hand can easily pass through 1,000 light-years (9,400 million million km) of lead, so an ocean will hardly be a barrier.**

Ordering the neutrinos

- **This is why physicists study how neutrinos (and their antimatter counterparts, antineutrinos) change their type as they travel large distances. This quantum mechanical phenomenon is called neutrino oscillation.**
- **For example, all neutrinos from the Sun are electron-neutrinos, yet we receive a big chunk of them on the earth as muon-neutrinos. Theoretical models predict two possible solutions for the neutrino mass hierarchy problem, called normal and inverted.**
- **The normal order proposes that one of the three types is much heavier and that the other two have comparable lower masses.**
- **In the inverted order, one of the neutrino types is lighter and the other two have comparable heavier masses.**
- **The new NOvA data favors the normal order, but not conclusively.Cracking the hierarchy problem is closely related to the universe's evolution.**

- **Their low interaction rate means neutrinos are excellent carriers of information from the universe's past, from sources like exploding stars and black holes.**

Impact of heat waves

- **In recent periods, climate change and environmental degradation have significantly affected the safety and the health of workers worldwide.**
- **Heat stress is anticipated to affect labour efficiency and productivity, in turn reducing work hours and hindering the International Labour Organization's (ILO) objective of promoting fair and decent employment.**
- **Workers, who are particularly vulnerable to climate change hazards, sometimes cannot cease working despite hazardous conditions because of financial constraints.**
- **The main health effects of heat stress on workers include heat stroke, heat cramps, cardiovascular disease, acute kidney injury, and physical injury.**
- **The Intergovernmental Panel on Climate Change (IPCC) states that to retain normal physiological activities, it is necessary to maintain a core body temperature of roughly 37°C.**
- **Temperature elevations over 38°C have a deleterious effect on one's cognitive and physical capabilities.**
- **During various life stages, women who are employed in heat-exposed sectors, such as subsistence agriculture, may be at risk for pregnancy-related complications, including hypertension, miscarriages, and premature births.**
- **An increase in temperature can diminish work productivity due to excessive heat that makes it difficult to work**

Impact in India

- **India is undergoing a consistent increase in temperatures annually.**
- **By 2030, an estimated 160 million-200 million individuals around the nation may face the risk of experiencing deadly heat waves every year.**
- **Approximately 34 million people in India will experience job losses due to reduced productivity caused by heat stress.**

- **India is expected to experience a significant decline in full-time employment by 2030 as a result of heat stress, which can be attributed to its large population.**
- **Further, migrant workers often work in hazardous and physically demanding jobs, primarily in the informal economy. They are particularly vulnerable to the risks posed by climate change, as they usually lack occupational safety and health protections, essential services, and infrastructure**

Steps

- **There are national guidelines under the title, 'Preparation of Action Plan – Prevention and Management of Heat Wave', by the National Disaster Management Authority in collaboration with the Ministry of Home Affairs.**
- **These guidelines are designed to protect the Indian workforce from the negative impacts of extreme heat.**
- **They are designed to help public officials create heatwave action plans for both urban and rural areas, with a focus on the general population.**
- **The importance of the following factors is highlighted: providing education to workers; ensuring proper hydration; managing work schedules, and offering necessary medical facilities, there should be a focus on improving the implementation of international labor standards that are related to occupational safety and health.**
- **This will ensure that those affected by heat stress are provided with suitable working conditions.**
- **Considering the current climate change scenario, decent and green employment emerges as a promising solution for the future of work.**
- **Green jobs are employment opportunities that help protect or restore the environment while also supporting economic and social well-being.**

Hodeidah

- **Hodeidah, city, western Yemen.**
- **It is situated on the Tihāmah coastal plain that borders the Red Sea.**
- **It is one of the country's chief ports and has modern facilities.**

- **The Hudaydah Port is a key Yemeni port on the Red Sea coast.**
- **It is the second largest port in the country, located in Al Hudaydah, the fourth largest city in Yemen.**
- **The port handles up to 80% of the humanitarian supplies, fuel, and commercial goods in northern Yemen.**

The Piracicaba River

- **Tons of dead fish are rotting in the Piracicaba River in Sao Paulo state downstream from where local authorities say a sugar and ethanol plant dumped industrial waste this month.**
- **The Piracicaba River is a river of São Paulo state in southeastern Brazil. It is a tributary of the Tietê River, which joins in the reservoir created by Barra Bonita Dam.**

Dyson spheres

- **Dyson spheres are hypothetical artificial megastructures built around a star to collect all of its radiant energy. In theory, detecting a Dyson sphere could be a way to find a technologically advanced alien civilization that did not wish to communicate.**
- **However, many challenges exist for both building and finding such Dyson spheres, also called Dyson swarms. The idea behind a Dyson sphere is to collect as much energy from a star as possible.**

- **On Earth, the total amount of energy we receive from the sun a value known as the total solar irradiance is 1,361 watts per square meter, as measured by NASA's Solar Radiation and Climate Experiment.**
- **Yet that is just a tiny proportion of the sun's total energy output radiated in all directions, which is 380 billion quadrillion (3.86×10^{26}) watts every second, according to the Australian Space Weather Forecasting Centre. Because Earth is so small by comparison, we receive only a tiny proportion of this energy.**
- **Suppose, though, that an enterprising technological civilization wanted to make use of all their star's energy that would otherwise move off into space at the speed of light.**
- **If they had sufficiently advanced technology, they might build themselves a Dyson sphere a spherical swarm of solar-energy collectors that would fully encapsulate their star and collect all of its energy.**
- **In 1960, physicist Freeman Dyson suggested that technological extraterrestrial civilizations might build a cloud of solar energy collectors that would completely surround their star and that would be detectable from its waste heat.**

India and geo strategic divide

- **India is a member of many plurilateral groups on both sides of the geo-strategic "divide", its engagement in Quad and with BRICS present the country with interesting, and sometimes contrasting, dilemmas.**
- **India has enthusiastically embraced Quad and its strategic objectives**
- **With Quad now working on reorientation of global supply chains of critical technologies and on a range of areas of direct strategic relevance to the region, including digital, telecom, health, power, and semiconductors, it has underlined that development too has a security perspective which cannot be ignored.**
- **India, in its turn, has benefited through enhanced bilateral relations with Quad partners, especially the U.S.**
- **On the other hand, the formation of AUKUS with the U.S., Australia, and the U.K., to enhance their military capabilities, especially Australia's with nuclear submarines, has put securitization of the Indo-Pacific region and deterrence of China at the center.**

- **The Ukraine war and enhanced focus on NATO has made the West look at Asia too through a military lens.**
- **AUKUS may well suit India's geo-strategic interests, but India's reluctance to go the whole nine yards in embracing a purely security vision for Quad is seen as a dampener, in spite of the Indian External Affairs Minister clarifying that Quad is not an Asian NATO and India is not a treaty ally unlike the other three**
- **India's independent policy of close relations with Russia and calling for a diplomatic solution to the Ukraine war, both of which are frowned upon by the West, do not distract India from strengthening the Quad.**
- **Some Quad members and European countries are themselves enhancing their bilateral engagement with China, underlining their differing bilateral and regional compulsions.**
- **In fact, at the 10th annual summit of the BRICS in 2018 in Johannesburg, South Africa, it was Mr. Modi who reminded the leaders that BRICS was founded to reform the multilateral system and proposed for the first time his vision of "reformed multilateralism."**
- **After Quad and the situation in Ukraine, Russia too realized the potential of BRICS, which includes pushing back the West and lining up behind China.**
- **The change of guard in Brazil leaves India as the lone member to push back China.**
- **A reluctant India decided to accept BRICS expansion rather than oppose it and now many more countries are reportedly waiting to join**

What is an emulator in a PC?

- **An emulator, as the name suggests, is software that allows a computer device to emulate another software.**
- **The difference in how a device operates allows it to run and use software designed for other, previously, incompatible devices.**
- **For example, software designed for a Windows PC will have to be redesigned to run on macOS.**
- **This redesign will have to be done by developers, who may choose to not include all the functionalities available on Windows to Mac users.**

- **An emulator can be used in this scenario to run software designed for Windows on macOS by emulating the design architecture of Windows.**
- **Emulators are commonly used to run applications designed for different operating systems, play video games from older consoles, and test software across different platforms.**

Show of strength

Majestic cruise: Warships sail along the Neva river during a naval parade rehearsal in St. Petersburg on Sunday. Russia will celebrate Navy Day on July 28, the last Sunday of July by tradition. AP

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Neva river

- **The Neva is a river in northwestern Russia flowing from Lake Ladoga through the western part of Leningrad Oblast to the Neva Bay of the Gulf of Finland.**
- **Despite its modest length of 74 kilometres, it is the fourth-largest river in Europe in terms of average discharge**

Turkish delight

Turkish fighter jets fly over a warship off the city of Kyrinia, in the self-proclaimed Turkish Republic of Northern Cyprus, as part of the 50th anniversary celebrations of July 20 Peace and Freedom Day, marking the Turkish invasion of the Mediterranean island. AFP

City of Kyrenia

- **Kyrenia is a city on the northern coast of Cyprus, noted for its historic harbor and castle. It is under the *de facto* control of Northern Cyprus.**
- **While there is evidence showing that the wider region of Kyrenia has been populated before, the city was built by the Greeks named Achaeans from the Peloponnese after the Trojan War (1300 BC).**

Bdelloid rotifers

- **A group of small, freshwater animals protect themselves from infections using antibiotic recipes "stolen" from bacteria, according to a new study.**

- **The tiny creatures are called bdelloid rotifers, which means 'crawling wheel-animals'. They have a head, mouth, gut, muscles and nerves like other animals, though they are smaller than a hair's breadth**
- **When these rotifers are exposed to fungal infection, the study found, they switch on hundreds of genes that they acquired from bacteria and other microbes. Some of these genes produce resistance weapons, such as antibiotics and other antimicrobial agents, in the rotifers**

ipRGC

- **Our vision is enabled by the rods and cones, which are photoreceptor cells in the outer retina. The rods are very sensitive to light but are not color sensitive and so are most useful in dim light; the cones work best in bright light, giving us color vision.**
- **Rods and cones convert photons of light into electrical signals, which are passed on to retinal ganglion cells.**
- **These cells process information from the retina and pass it on to the brain. Photosensitive cells About 20 years ago, a new class of cells that could perceive light was found in the inner retina.**
- **Called the intrinsically photosensitive retinal ganglion cells (ipRGC), these cells contain a photopigment, melanopsin, that allows them to directly respond to light. These cells have very important roles in our body's interaction with light that are not related to seeing.**
- **Electrical impulses from the ipRGC travel to areas of the brain that are involved in sleep, alertness, and mood regulation. ipRGC cells are most responsive to blue light (480 nm).**
- **The morning light has a low ratio of blue to yellow light, just enough to send a message to the hypothalamus marking the start of another circadian cycle.**

Artemisinin-based combination therapies (ACTs)

- **Artemisinin-based combination therapies (ACTs) have become the cornerstone of malaria treatment and control.**
- **However, the emergence and spread of artemisinin-resistance (ART-R) in malaria-causing Plasmodium falciparum parasites in eastern Africa has compromised the efficacy of these crucial treatments.**

- **To counter ART-R in Africa, researchers recommend using triple ACTs (TACTs), combining an artemisinin derivative with two partner drugs, which have proven effective in Asia.**

Heparinoids

- **By studying the molecular characteristics of venom from spitting cobras, scientists have discovered that approved drugs called heparinoids can shield against the venom's destructive effects on local tissue.**
- **The study in cells and mice suggests that heparinoids could potentially be developed into antidotes for cobra bites.**
- **These compounds also don't require refrigeration like most antibody-based antivenoms, making heparinoids useful in remote regions that lack medical infrastructure.**
- **India carbon crediting mechanism with Japan. India is looking to enter into a carbon trading and carbon credit adjustment mechanism with Japan.**
- **The two countries plan to sign a Memorandum of Cooperation for setting up a Joint Crediting Mechanism (JCM) with emission reduction credits being shared**

What is carbon credit??

- **Carbon credits are permits that allow the owner to emit a certain amount of carbon dioxide or other greenhouse gases (GHGs).**
- **One credit permits the emission of one ton of carbon dioxide or the equivalent of other greenhouse gases. Carbon credits are also known as carbon offsets**

What is the Paris Agreement Crediting Mechanism?

Article 6 of the Paris Agreement sets out how countries can pursue voluntary cooperation to reach their climate targets.

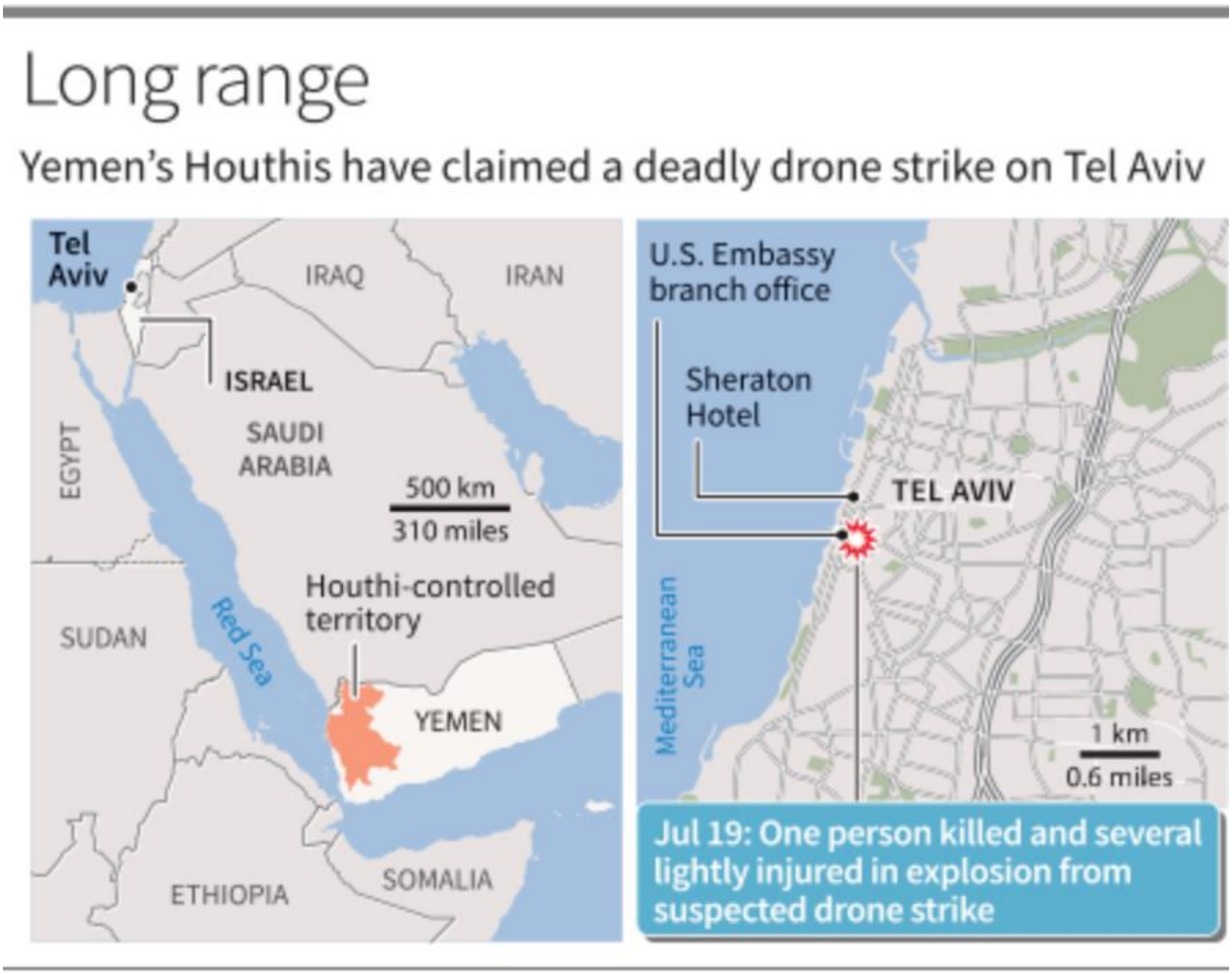
- **It enables international cooperation to tackle climate change and unlock financial support for developing countries.**

- **This means that, under Article 6, countries are able to transfer carbon credits earned from the reduction of greenhouse gas emissions to help one or more countries meet their climate targets.**
- **There are three tools which countries can draw upon under Article 6, one of which is the Paris Agreement Crediting Mechanism (PACM) - the UN's new high-integrity carbon crediting mechanism.**
- **India and global electronics revolution. India's electronics production has reached an impressive milestone of about $115 billion in FY24, growing by almost four times in the past decade.**
- **Projections for the next five years are even more promising, with expectations to multiply this figure by five times.**
- **Globally, the electronics market, currently valued at $4.5 trillion, is anticipated to soar to $6.1 trillion by 2030**
- **Central to this vision is the role of capital goods machinery, tools, and equipment that drive production.**
- **Advanced capital goods enable us to produce high-quality electronics efficiently and at scale. Our focus should be on developing unique, cutting-edge solutions that serve domestic and global markets.**
- **This demands a significant investment in research and development, supported by policies that encourage innovation and protect intellectual property rights (IPR).**

Steps needed

- **Demand supply gap Meeting domestic demand and targeting the export market are both essential.**
- **At home, there is an urgent need to close the gap between the demand and supply of capital goods.**
- **By bolstering our manufacturing infrastructure, we can reduce dependency on imports and ensure a steady supply of high-quality equipment for local consumption**

- **To spearhead this initiative, there is a need for a dedicated centre with a substantive corpus of minimum ₹1,000 crore focused on innovation in capital goods.**
- **India's robust IPR protection can create a secure environment where new ideas can thrive. By promoting strong R&D ecosystem, we can develop indigenous technologies that not only meet international standards but also set new benchmarks in quality and efficiency**
- **Prioritizing the development and acquisition of advanced manufacturing technologies is crucial, supported by dedicated funds for acquiring and enhancing capital goods, including second-hand equipment.**
- **Investing in education and training programmes to equip workforce with technical and soft skills is equally vital.**
- **Strong collaboration between industry and academia can foster innovation and ensure that research aligns with industry needs, leading to breakthrough technologies and processes.**
- **Additionally, government policies must support the growth of the capital-goods industry by providing incentives for R&D, facilitating ease of doing business, and ensuring a stable regulatory environment.**
- **As the world moves towards sustainable manufacturing practices, India must adopt eco-friendly technologies and processes, enhancing our global competitiveness and positioning India as a responsible manufacturing hub.**
- **Embracing digital technologies such as AI, IoT, and big data can revolutionise manufacturing processes, making them more efficient and cost-effective.**
- **Addressing technology and skill gaps is also critical for India's ambitions in the electronics sector. Joint ventures with global leading firms can facilitate skills and technology transfer, while government programme to attract skilled diaspora and foreign experts can build domestic capabilities**



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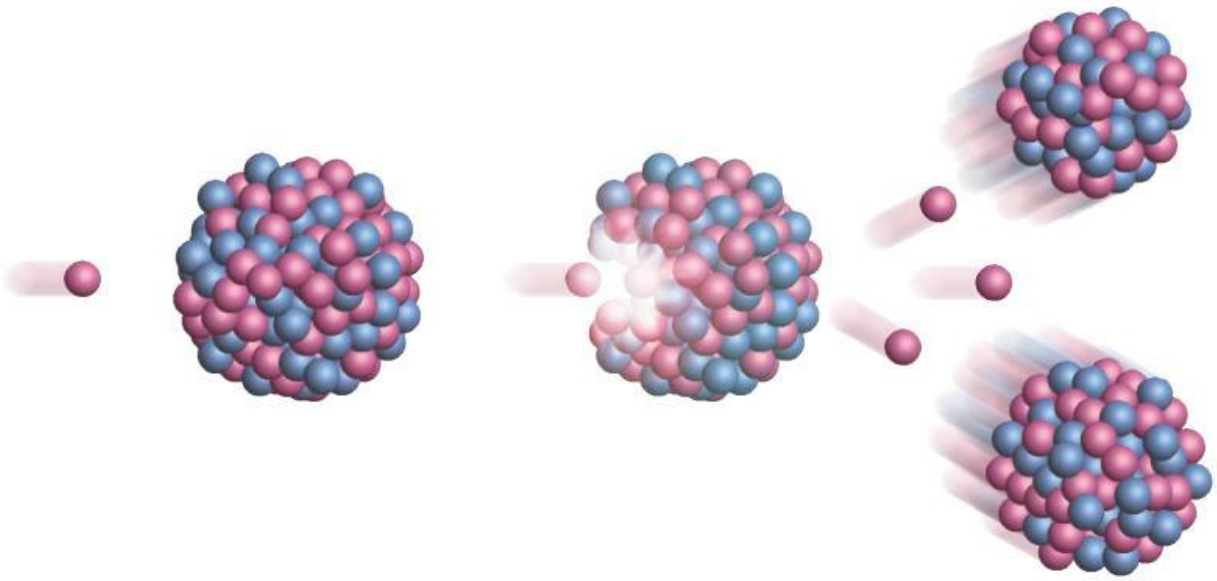
- **What is fissile material??**

- **A nuclide that is capable of undergoing fission after capturing low-energy thermal (slow) neutrons.**
- **Although sometimes used as a synonym for fissionable material, this term has acquired its more restrictive interpretation with the limitation that the nuclide must be fissionable by *thermal neutrons*.**
- **With that interpretation, the three primary fissile materials are uranium-233, uranium-235, and plutonium-239.**
- **This definition excludes natural uranium and depleted uranium that have not been irradiated, or have only been irradiated in thermal reactors.**



JCPOA

- **The JCPOA resulted from prolonged negotiations from 2013 and 2015 between Iran and P5+1 (China, France, Germany, Russia, the United Kingdom, the United States and the European Union, or the EU).**
- **The JCPOA obliged Iran to accept constraints on its enrichment program verified by an intrusive inspection regime in return for a partial lifting of economic sanction**
- **On the nuclear front, beginning in May 2019, Iran began to move away from JCPOA's constraints incrementally:**
- **exceeding the ceilings of 300kg on low-enriched uranium and 130 MT on heavy water; raising enrichment levels from 3.67% to 4.5%; stepping up research and development on advanced centrifuges; resuming enrichment at Fordow; and violating limits on the number of centrifuges in use**
- **Finally, in January 2020, following the drone strike on Islamic Revolutionary Guard Corps commander Gen. Qasem Soleiman, Tehran announced that it would no longer observe the JCPOA's restraints.**
- **Tensions rose as the U.S. pushed ahead with its unilateral sanctions, widening their scope to cover nearly all Iranian banks connected to the global financial system industries related to metallurgy, energy, and shipping, individuals related to the defense, intelligence, and nuclear establishment.**

- **For the first year after the U.S. withdrawal, Iran's response was muted as the E-3 (France, Germany, the U.K.) and the EU promised to find ways to mitigate the U.S. decision.**

Safe harbour

A view of Mavavgat coastline in Antalya, Turkey, where sea turtles lay eggs. The coastline is a major breeding area for the endangered loggerheads also known as Caretta carettas, on the International Union for Conservation of Nature's red list of threatened species. AFP

Mavavgat coastline

- **Mavavgat coastline in Antalya, Turkey, where sea turtles lay eggs.**
- **The coastline is a major breeding area for the endangered loggerheads also known as Caretta carettas, on the International Union for Conservation of Nature's red list of threatened species.**

- 

Caretta caretta / Loggerhead sea turtle

- ***Caretta caretta* is found in nearly all the world's temperate and tropical oceans: the Atlantic Ocean from Newfoundland to Argentina, the Indian Ocean from southern Africa to the Arabian Gulf to western Australia, the Mediterranean Sea, and the Pacific Ocean from Alaska to Chile and Australia to Japan. During winter months loggerhead sea turtles migrate to tropical and subtropical waters.**
- 
- **The preferred habitat of *Caretta caretta* individuals changes throughout the life cycle. Adult females go ashore to lay eggs and seem to prefer steeply sloped, high-energy beaches.**
- **When hatchlings emerge from the nest, they head for the ocean.**
- **Young juveniles are typically found among drifting *Sargassum* mats in warm ocean currents.**
- **Older juveniles and adults are most often found in coastal waters and tend to prefer a rocky or muddy substrate over a sandy one**

- **Health and economics the law is quite clear. Article 21 of the Indian Constitution guarantees the right to life and personal liberty, including the right to health, as an integral part of this fundamental right.**
- **Furthermore, the Directive Principles of State Policy (DPSP) under Articles 39(e), 39(f), 41, 42, and 47 mandate the state to work towards improving public health, ensuring social justice, and raising the standard of living.**
- **These provisions compel the state to prioritize the health and well-being of its citizens over the economic benefits of tobacco farming**

WHO FCTC

CRISPR AND TOBACCO

- **In scientific innovation, the gene editing technique CRISPR (clustered regularly interspaced short palindromic repeats) presents a potential solution to the tobacco epidemic.**
- **Researchers are using CRISPR to develop genetically modified tobacco plants that are less harmful or harmless.**
- **This technology could potentially alter the nicotine content and other harmful substances in tobacco leaves, providing a safer alternative for consumer**
- **For example, targeting the transcription factor genes ERF199 and ERF189 resulted in an ultra-low-nicotine phenotype,**
- **Knocking out the QPT2 gene drastically reduced nicotine production but caused severe growth inhibition, making it unsuitable for agricultural use. The WHO Framework Convention on Tobacco Control (WHO FCTC) is the first international treaty negotiated under the auspices of WHO.**
- **It was adopted by the World Health Assembly on 21 May 2003 and entered into force on 27 February 2005. It has since become one of the most rapidly and widely embraced treaties in United Nations history.**
- **The WHO FCTC was developed in response to the globalization of the tobacco epidemic and is an evidence-based treaty that reaffirms the right of all people to the highest standard of health.**

- **The Convention represents a milestone for the promotion of public health and provides new legal dimensions for international health cooperation**

Human Auditory system

- **At the heart of our auditory system are intricate hair cells nestled within the human cochlea. Each cochlea houses around 16,000 of these flask-shaped sensory cells, each with a cluster of hair-like projections called stereocilia. These stereocilia, arranged like a staircase from the shortest to the tallest, are the key to our hearing.**
- **Two adjacent stereocilia are connected by a filamentous extracellular tether called a tip link. These tip links, functioning like a complex network of connections, are pivotal in our hearing process, converting sound waves into electrical signals our brain can interpret.**
- **When sound waves reach the ear, they create vibrations in the inner ear fluid. These vibrations cause the stereocilia to bend, stretching the tip links that connect them.**
- **This stretching opens ion channels in the stereocilia that allow potassium ions to enter the hair cell and create an electrical signal.**
- **Nerve cells attached to the hair cells pick up this signal and send it to the brain, where it is interpreted as sound. This mechanism is similar to a microphone converting sound waves into electrical signals.**
- **Humans can perceive sound in the range of 20 Hz to 20 kHz in frequency and 5-120 decibels (dB) in intensity.**
- **These sounds produce a force of 10–100 piconewtons (pN) on tip links.**
- **We must apply roughly one newton (N) of force to hold an apple or orange in our hands. One newton is equal to one thousand billion piconewtons.**
- **The auditory system relies on tip links. Each tip link consists of two proteins, cadherin-23 (CDH23) and protocadherin-15 (PCDH15). These proteins are at risk of breaking when exposed to loud noises**

THE SCIENCE QUIZ

The odoriferous life of agarwood

Vasudevan Mukunth

QUESTION 1
Agarwood is a fragrant wood produced naturally by trees belonging to a few genera. The principal among them is _____, trees of which are distributed around South and Southeast Asia. The genus name in Latin roughly means "eagle." Fill in the blank.

QUESTION 2
The process by which these trees produce agarwood, a.k.a. agalloch, begins when they are infected by a particular fungus. Name the fungal species.

QUESTION 3
Name the tree that provides most of the world's agarwood, which is used to make perfumes, incense sticks, and other aromatic products. The first half of its binomial nomenclature is the answer to Q1. It is also the state tree of Tripura. What is the scientific (species) name of this tree?

QUESTION 4
Due to unchecked demand for agarwood, trade in the tree that produces it (in Q3) and its products is protected by a multilateral treaty called _____. This treaty also requires countries that ratify it to ensure agarwood isn't harvested in a way that affects its survival. Name the treaty.

QUESTION 5
Researchers have found several compounds in the oil extracted from agarwood using steam distillation. Many of them belong to the class called Z. These compounds are derived from another compound that's the main component of natural rubber. A Z compound is also responsible for eucalyptus's unique fragrance. Name Z.

Answers to July 16 quiz:
1. Mathematicians who first developed a reasoned answer to the problem of points – **Ans: Blaise Pascal and Pierre de Fermat**
2. The mathematical foundation for statistics – **Ans: Probability**
3. Aristotle's hypothesis that Pascal overturned in 1647 – **Ans: Horror vacui**
4. Theorem that Andrew Wiles solved in 1994 – **Ans: Fermat's Last Theorem**
5. Subject of Fermat's principle that takes the shortest path – **Ans: Ray of light**

Visual: **Voltaire**

First contact: Irfan Ali | Pratyush Shukla | Seema Das

Please send in your answers to science@thehindu.co.in

Visual: Over time, the resin saturates a part of the tree called X (a.k.a. Y), shown above. This X (or Y) is called agarwood. Name X and Y. This woody part of the tree derives one of its names from its location rather than its function. RBREIDBROWN

- **Agarwood, aloeswood, eaglewood, gharuwood, or the Wood of Gods, most commonly referred to as oud or Oudh is a fragrant, dark, and resinous wood used in incense, perfume, and small hand carvings.**
- **It forms in the heartwood of *Aquilaria* trees after they become infected with a type of *Phaeoacremonium* mold, *P. parasitica*. The tree defensively secretes a resin to combat the fungal infestation.**
- **Before becoming infected, the heartwood mostly lacks scent and is relatively light and pale in coloration.**
- **However, as the infection advances and the tree produces its fragrant resin as a final option of defense, the heartwood becomes very dense, dark, and saturated with resin.**
- **This product is harvested, and most famously referred to in cosmetics under the scent.**
- **Since 1995, the Convention on International Trade in Endangered Species of Wild Fauna and Flora has listed *Aquilaria malaccensis* (the primary source) in its Appendix II (potentially threatened species).**
- **Agriculture and post-harvest losses. India ranks second in global agriculture production, but its share in global agricultural exports is only 2.4%, placing it eighth in the world.**

- **This is attributed to several factors that include low productivity, an inability to meet desired quality standards and inefficiencies in the supply chain such as an inadequate transportation network and infrastructure, which also leads to significant post-harvest losses.**
- **India's post-harvest losses amount to approximately ₹1,52,790 crore annually, according to a Ministry of Food Processing Industries 2022 study. The biggest loss is from perishable commodities, which include livestock produce such as eggs, fish, and meat (22%), fruits (19%) and vegetables (18%).**
- **During the export of perishables, approximately 19% of food is lost, particularly at the import-country (trade partner) stage. Storage, transportation, and marketing play a critical role in ensuring that perishable products reach the consumer in time.**
- **The strengthening of agri-logistics is recognized as a priority by the Committee on Doubling Farmer's Income (DFI).**
- **There are multiple logistical requirements in a single supply chain. Starting with first-mile transport from farmgate to mandi (wholesale/retail), long haul or wholesale transportation by rail, road, water, or air, and last-mile transportation to the consumer.**
- **The trade of perishables faces a time shortage once the crop is harvested. The latest agriculture Census shows that 86% of farmers in India are small and marginal (SMF).**
- **The Food Corporation of India is heavily dependent on the Indian Railways to move approximately 90% of its food grains. In contrast, about 97% of fruits and vegetables are transported by road. To support SMFs, the Kisan Rail was initiated to connect perishables (inclusive of milk, meat, and fish) production surplus regions to consumption regions more efficiently.**
- **A recent study highlighted the impact of the Kisan Rail scheme on reducing post-harvest losses and enhancing farmer incomes in India investment in specialized wagons for temperature-controlled transport and the establishment of rail-side facilities for safe cargo handling are essential.**
- **This would also present a significant opportunity to enhance food safety in the agriculture sector, by minimising spoilage and contamination risks, thereby supporting both domestic and export markets.**

- **The Railways offers a tremendous opportunity to reduce post-harvest losses and positively impact not just livelihoods but also the environment. Findings from the Logistics Division, Ministry of Commerce, state that the Indian Railways generates up to 80% less carbon dioxide for freight traffic than road transport.**

- **There is a need to adopt a systems-based approach, cutting across modes of transport and geographies. The private sector can play a crucial role in enhancing operational efficiency and strengthening the rail infrastructure through public-private partnerships.**

Indo Pacific

Battir – Land of Olives and Vines

- **Battir is a Palestinian village in the Bethlehem Governorate of the State of Palestine, in the West Bank, 6.4 km west of Bethlehem, and southwest of Jerusalem.**

- **Battir has a long history that dates back to ancient times. Within its area is an archaeological site containing the remains of Beitar, the last stronghold of the Bar Kokhba revolt against the Roman Empire.**

- **The village is particularly known for its ancient terraces and an irrigation system that dates back to the Roman period.**

- **Due to this, In 2014, Battir was inscribed in the List of World Heritage Sites as a World Heritage Site in the State of Palestine, under the name *Battir Land of Olives and Vines Cultural Landscape of Southern Jerusalem***

LUCA

- **In 1924 and 1929, Oparin and Haldane, respectively, suggested the first molecules making up the earliest life forms gradually self-organized from a "primordial soup" in a young earth's tempestuous, prebiotic environment.**

- **This idea is today called the Oparin-Haldane hypothesis. Researchers believe all three branches of life bacteria, archaea, and eukarya originated from a single cell, called the last universal common ancestor (LUCA).**

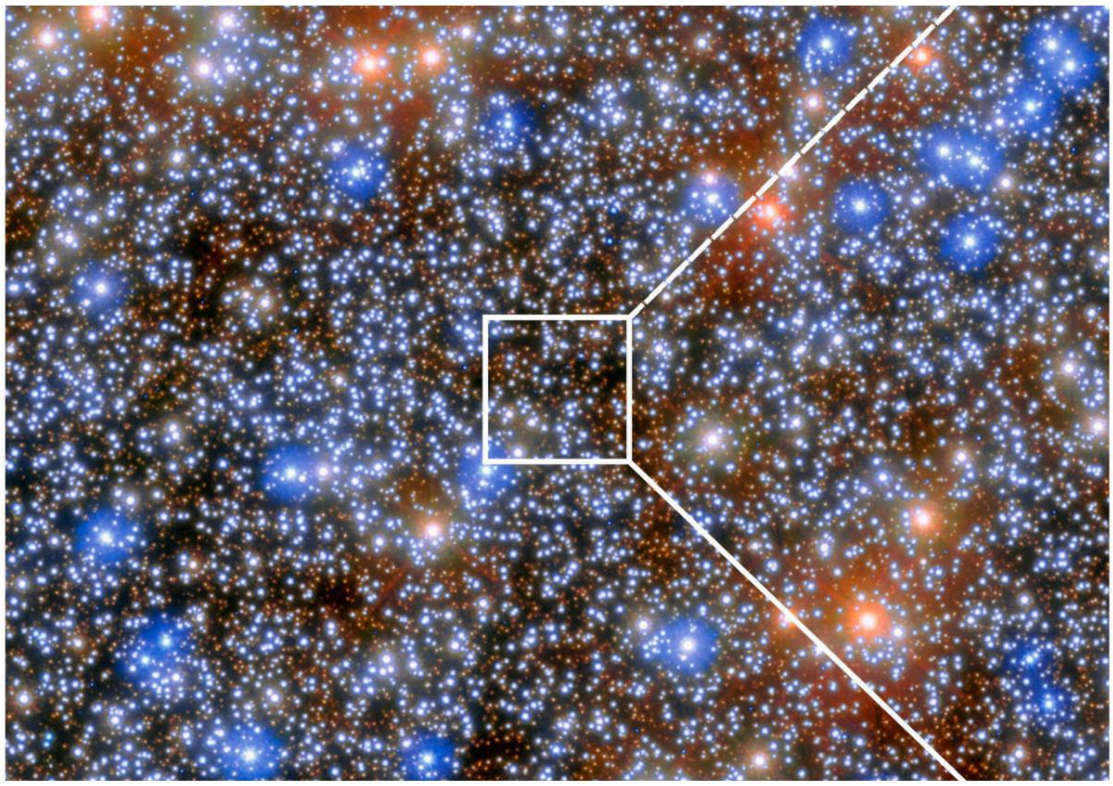
- **There is no fossil evidence to support the existence of LUCA, but the fact that modern genomes share so many features provides some insights.**

- **Using a molecular clock, the team estimated when LUCA could have originated: around 4.2 billion years ago, just 300 million years after the earth itself formed.**

ABO Blood group

- **Human blood consists of red blood corpuscles as a constituent, which give it its red colour. On the surfaces of these red cells are present one or both of two types of antigens (proteins), designated A and B.**
- **Other than these, two antibodies, designated as antibody-A and antibody-B, present in the serum are also involved in the classification of human blood.**
- **(Serum, a constituent of blood, is a straw-colored liquid that can be seen after removing all the other blood cells from a sample.)**
- **Antibodies have the property of clumping red cells. When Antigen-A is present on the red cells, the serum contains only Antibody-B, which will clump red cells with Antigen-B on their surface.**
- **Then the blood is classified as group A. When Antigen-B is present on the red cells, the serum contains only antibody-A, which clumps red cells with antigen-A. As a result, the blood is classified as group B.**
- **In some people, both antigens A and B are present in all the red cells, so their serum does not contain any of the antibodies.**
- **They belong to the AB group. Their blood cells don't clump whether they receive A-group or B-group blood. That is, A and B are compatible with the AB group. The fourth type, O, has neither of the antigens on its red cells but has both antibodies in the serum.**
- **To keep red cells from clumping, those with A group blood can receive only A and O group blood, and those with B group blood can only receive B and O group blood. But the AB group can receive blood from any of the groups.**
- **Thus, it is called the universal recipient. Similarly, those with O-group blood are universal donors. This system of classification is called the ABO system.**
- **Blood groups are also classified by the Rhesus system (Rh). The Rh factor leads to one type in which the Rh factor is present (Rhesus positive) and another in which it is not (Rhesus negative).**

BIG SHOT



This image captured by the Hubble Telescope, and released last week, shows the star cluster Omega Centauri. One of the enduring mysteries of the cosmos has been the strange absence of medium-sized black holes between the very small and very big extremes. On July 10, astronomers said they had found the best evidence yet of the existence of one of these "missing link" black holes, located within the square in this image. THE HINDU

Omega Centauri

- **Omega Centauri is a globular cluster in the constellation of Centaurus that was first identified as a non-stellar object by Edmond Halley in 1677.**
- **Located at a distance of 17,090 light-years (5,240 parsecs), it is the largest-known globular cluster in the Milky Way at a diameter of roughly 150 light-years.**
- **It is estimated to contain approximately 10 million stars, with a total mass of 4 million solar masses, making it the most massive known globular cluster in the Milky Way.**
- **Omega Centauri is very different from most other galactic globular clusters to the extent that it is thought to have originated as the core remnant of a disrupted dwarf galaxy. As thoughts become digitized, who will protect our neurorights?**

- **Neurotechnology have come a long way since the development of electroencephalography (EEG). Invented a hundred years ago, the EEG has had a significant impact on our knowledge of the human brain and various treatments of brain disorders.Many researchers expect that soon there will be wearable EEGs that could directly assist human cognitive functions.**
- **Elon Musk's Neuralink has also kindled hope about using brain-computer links to help physically impaired people restore some lost function.**

What are your neurorights?

- **Internationally accepted human rights principles and the Universal Declaration of Human Rights provide some inkling as to individuals' neuro rights.**
- **But the extent to which they are enforceable depends on the laws in each jurisdiction. In 2021, Chile became the first country to legally recognize its citizens' rights when its Senate agreed to amend the constitution.**
- **As a result, according to a 2022 article in the journal AI & Society, technological developments in the country must "respect people's physical and mental integrity" and its laws should "protect brain activity and information related to it".**
- **In the U.S., Colorado enacted a law in April 2024 to protect individuals' neurological privacy while California is deliberating a similar instrument.An important challenge to developing suitable neuroethical standards is that the underlying technologies are evolving rapidly. The contexts in which people use these technologies are also diverse, beset by disparate expectations and cultural norms.**
- **For now, UNESCO has appointed an expert group to develop the "first global framework on the ethics of neurotechnology", expected to be adopted by the end of 2025**

Vantage point

- A person watches a cloud and lava erupting over the Mount Etna volcano in Sicily on Monday. Sicily's Catania airport began gradually reopening for flights on July 5, after they were temporarily suspended following an eruption from Europe's largest active volcano. AFP

Mount Etna

- **Mount Etna, the active volcano on the east coast of Sicily.Like other active volcanoes, it varies in height, increasing from deposition during eruptions and decreasing from the periodic collapse of the crater's rim.**
- **Mount Etna is the highest active volcano in Europe, its topmost elevation being about 10,900 feet**

ISRO and space economy

- **India currently has four launch vehicles: The Small Satellite Launch Vehicle (SSLV), the Polar Satellite Launch Vehicle (PSLV), the Geosynchronous Satellite Launch Vehicle (GSLV), and the Launch Vehicle Mark-III (LVM-3).**
- **These rockets can launch satellites weighing up to four tonnes to the geosynchronous orbit. India also relies on foreign launch vehicles, like Europe's Ariane V and SpaceX's Falcon 9, when a satellite weighs more than four tonnes.**
- **At present, the country operates a fleet of satellites with applications in communications, remote sensing, positioning, navigation and timing (PNT), meteorology, disaster management, space-based internet, scientific missions, and experimental missions.**
- **It also needs launch vehicles for space missions like Chandrayaan 3 and Aditya L1. All this makes it look like there are more applications and satellites than there are launch vehicles**

Demand-driven model

- **The Indian space programme used to follow a supply-driven model: ISRO would build and launch satellites and then look for customers who needed the services provided by the satellites.**
- **When the Indian government reformed the space sector in 2019-2020, it changed this to a demand-driven model. Here, a satellite needs to be built and launched only if there is already demand for it. The customer of the services provided by the satellite needs to be educated about the need for the service.**
- **The customer will then create a demand for a service that will need a satellite to be launched. The other area from which demand is likely to arise is human spaceflight.**
- **This includes human-rated launch vehicles that carry humans and supplies into orbit and to destinations like an orbiting space station or the moon. There could in future be demand for space tourism as well.**
- **Launch capability limitations India's launch vehicles are also not powerful enough to undertake certain missions, like Chandrayaan 4. China used its Long March 5 launch vehicle to launch its Chang'e 4 and Chang'e 5 missions in a single launch.**
- **India's LVM-3 has less than one-third of Long March 5's capability (28% to be more precise) and will need two LVM-3 launches to launch all the components of Chandrayaan 4.**
- **ISRO will be upgrading the LVM-3 with a semi-cryogenic engine to boost its payload capacity to six tonnes to the geostationary transfer orbit (GTO).**
- **The organisation will also need a new launch vehicle already dubbed the Next Generation Launch Vehicle (NGLV), a.k.a. Project Soorya to carry 10 tonnes to GTO. But it has only submitted a funding proposal thus far for this project**

Launch vehicle economics

- **All these launch vehicles will need satellites to launch. The heavier vehicles can fulfill some national goals like lunar exploration and a space station while ISRO can use the smaller satellites for technology and capability demonstration.**
- **However, the latter will constitute only a small number of launches. Satellites have a defined mission life.**

- **As they get old, they will need to be replaced with newer satellites. This will also create a demand for launch vehicles. However, mission operators like their satellites to live longer and have been improving their lifetimes with software and hardware upgrades. Launch vehicles are improving as well. In a single launch, the PSLV can deliver multiple satellites in multiple orbits.**
- **Rocket stages are becoming reusable, which reduces the cost of building the rocket and increases profitability. ISRO has been building its Reusable Launch Vehicle and vertical landing technologies to make reusable landing stages.**
- **The Indian government wants the private sector to create demand among customers and to build and launch satellites. It wants them to look for services to offer customers in India and abroad. It also wants revenue by providing launch services of its own.**
- **Finally, the government wants to upskill workers and give them jobs**

Spade-toothed whales

- **The spade-toothed whales are the world's rarest, with no live sightings ever recorded. The spade-toothed whale (*Mesoplodon traversii*) is a very little-known species, the rarest species of beaked whale.**
- **No one knows how many there are, what they eat, or even where they live in the vast expanse of the southern Pacific Ocean. New Zealand's Indigenous people consider whales a taonga a sacred treasure of cultural significance.**
- **In April, Pacific Indigenous leaders signed a treaty recognizing whales as "legal persons," although such a declaration is not reflected in the laws of participating nations.Nothing is currently known about the whales' habitat.**
- **The creatures deep-dive for food and likely surface so rarely that it has been impossible to narrow their location further than the southern Pacific Ocean, home to some of the world's deepest ocean trenches,**
- **The spade-toothed whale is covered by the Memorandum of Understanding for the Conservation of Cetaceans and Their Habitats in the Pacific Islands Region (Pacific Cetaceans MOU).**
- **The species' IUCN Red List conservation status is "Data Deficient (DD)" due to lack of information and uncertain data.**

Heat waves impact women

Women are disproportionately harmed by extreme heat, largely because of unequal power dynamics, gender norms, and unequal access to resources, as reflected in the Global Gender Gap Index that places. Women living in informal settlements in cities (also at the margins and in slums) face multiple challenges due to rising temperatures.

- **Their homes could turn into heat chambers since the materials used in informal, urban neighborhoods, such as tin, asbestos, and plastic, trap heat.**
- **Women also toil in poorly ventilated kitchens, experiencing scorching temperatures while cooking. Rising temperatures are compounded by extreme time poverty and care burden for them.**
- **Due to lower productivity stemming from heat stress, women work considerably longer hours to complete their share of unpaid work at home.**
- **According to Arsht-Rock's 'Scorching Divide' report, the productivity loss due to heat waves translates to 90 more minutes of care work per day in India. This adds to the pre-existing gender differences in time-use pattern; in doing unpaid work like cooking, cleaning, and fetching water and fuel, women spend two and a half times minutes more per day than men**
- **Urban female informal laborers face harsh weather, whether working in marketplaces, streets, construction sites, landfills, or even their employers' homes.**
- **Due to their occupational settings, these casual-wage worker's street vendors, paid domestic helpers, construction workers, and sanitation workers are vulnerable to climatic extremes, reports the International Labour Organization ('Work in a Changing Climate').**
- **The situation worsens with energy poverty living without cooling facilities such as ventilated spaces, fans, air conditioners, or coolers. Greenery and other natural forms of cooling are also becoming increasingly unavailable for public consumption in dense urban areas.**
- **Furthermore, water scarcity and power fluctuations raise the challenge of being hydrated and staying comfortable. Women's days also involve longer working hours under heat stress.**

- **If she does home-based work inside the living area with asbestos or tin roofing, temperatures could become unbearable, making labour increasingly unsafe. Also, if she faces restrictive gender norms on mobility and clothing, she could be forced to stay indoors and follow dressing styles that are not heat-friendly**

Unequal health strain

- **The incidence of heat-related diseases is also on the rise with increasing temperature. Heat stress puts the body under a great deal of strain, making it harder for it to regulate its temperature, leading to several illnesses, including heat cramps, severe heat stroke, and hyperthermia.**
- **Women are at greater risk because of their physiological makeup their body fat percentage and water content levels affect heat tolerance and hydration, while hormonal changes associated with menstrual cycles and pregnancy affect body temperature regulation.**
- **Women have a dual burden from heat-related health issues since they are more susceptible to its effects and also shoulder the majority of the caregiving responsibility that follows. Additionally, heat stress has a pronounced impact on maternal and child health.**

What is an EEG?

- **EEG stands for electroencephalography. 'Electro' pertains to electricity; 'encephalo' refers to the brain; and 'graphy' is a suffix meaning to show or to represent.**
- **Neurons in the brain perform various functions by moving electrically charged particles such as ions. The movement of these particles gives rise to electrical activity that a health worker can use an EEG test to visualize.**
- **Researchers have also been able to relate data obtained from an EEG with different levels and modes of brain activity and used it to distinguish reliably between normal and abnormal states. EEG is not an uncommon diagnostic test in clinical settings.**
- **Among other applications, it is the reference standard that is, the best test available to diagnose epilepsy. An EEG test can also reveal the effects of anaesthesia, sleeping patterns, neurological activity during a coma, and availability of oxygen.**

- **EEG can also confirm brain death, one of the two legally recognised forms of death in India. In 1912, Vladimir Pravdich-Neminsky produced the first mammalian EEG, of a dog's brain.**
- **Berger succeeded him in 1924 with the human counterpart. He is also credited with inventing the EEG, naming it, and introducing its utility in clinical settings.**

Almatti Dam

- **The Lal Bahadur Shastri Dam is also known as Almatti Dam is a hydroelectric project on the Krishna River in North Karnataka, India which was completed in July 2005.**

Wolbachia bacteria

- **American researchers named Marshall Hertig and Simeon Burt Wolbach discovered that mosquitoes harbored bacteria within their cells. Other researchers later found similar bacteria in the cells of most insects and many other arthropods.**
- **The genus to which the bacteria belonged was named Wolbachia. Wolbachia bacteria are also present in insect eggs, but they are absent in the sperm.**

- **This means females can transmit Wolbachia to their offspring, whereas males can't from the bacteria's point of view, an evolutionary dead end. As a result, Wolbachia have evolved ways to manipulate their insect hosts to produce more female than male progeny.**
- **A paper in the journal Current Biology showed that Wolbachia bacteria had manipulated the wasp Encarsia formosa to entirely get rid of its males, Wolbachia bacteria can induce unfertilized eggs to somehow double the chromosome number and enable the development of female wasps.**
- **It is not known how the bacteria do this, but this renders males superfluous Wolbachia bacteria were shown to be smart enough to double the chromosome number in their host's unfertilised eggs and to supply them with tra**

E. formosa

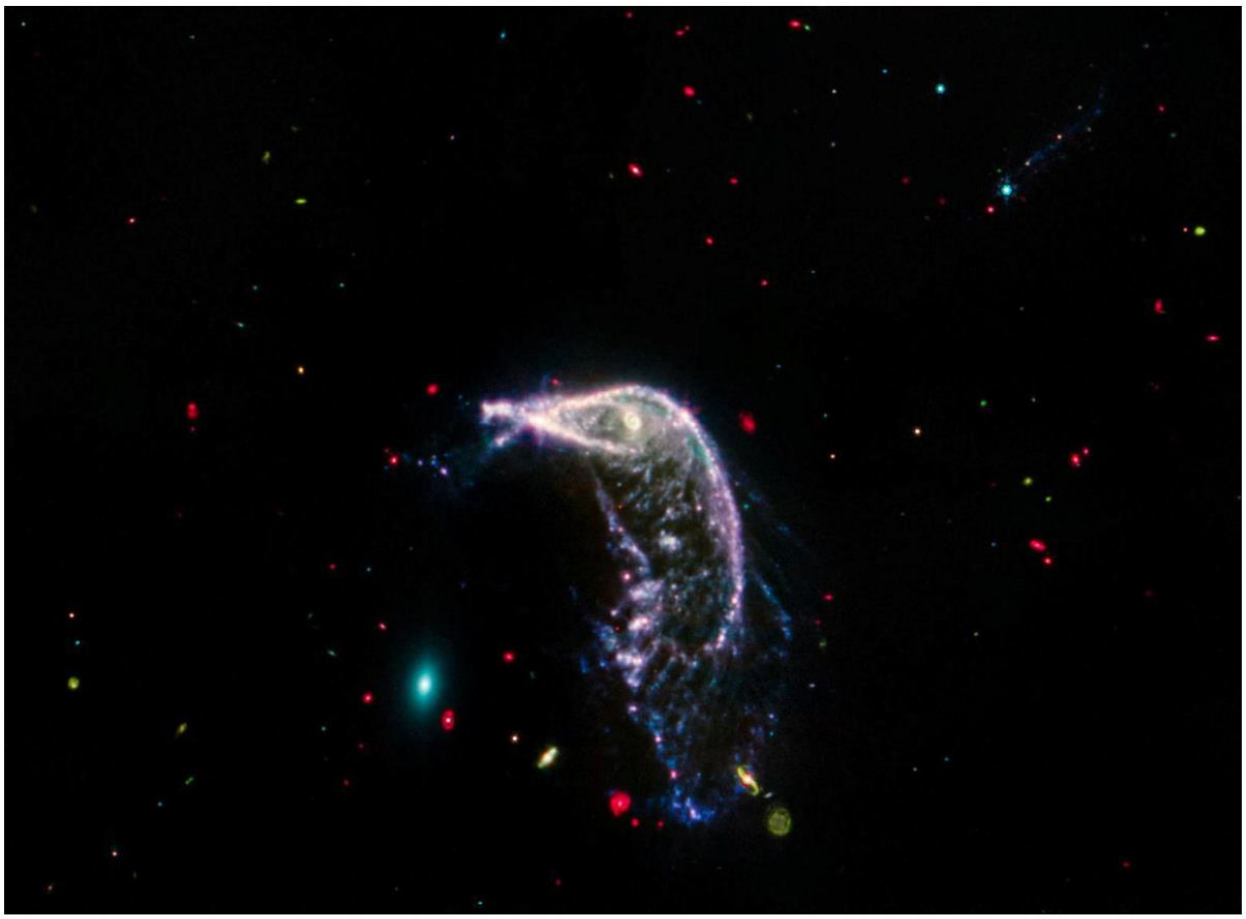
- **E. formosa wasps are of interest to agricultural scientists because they provide an efficient way to control whiteflies. Whiteflies feed on the sap of plant leaves, causing productivity losses, and are thus a major agricultural pest.**
- **Whiteflies belong to the insect order Hemiptera, whereas wasps belong to the insect order Hymenoptera. The wasp seeks out the nymphs (or larvae) of whiteflies and lays its eggs on them. When the eggs hatch, the larvae that emerge penetrate the nymph, feed on its tissues, grow to adulthood, and in the process kill the nymph.**
- **The progeny wasps emerge from the nymph's carcass. As a parasitoid of whiteflies, the female wasp is in effect a search-and-destroy weapon. The male wasps are superfluous in this role.**

About 'Tra'

- **A gene named tra has an evolutionarily conserved role in promoting female development in insects. ('Evolutionarily conserved' means all insects have it.)**
- **That is, if the tra gene mutates, cells won't be able to make a functional Tra protein, and progeny development proceeds along the default mode towards male production.**
- **Having lost its own tra gene, the E. formosa wasps had to rely on their Wolbachia's tra gene to allow their eggs to develop into females.**

- **This is the first example of a bacterium using a horizontally transferred gene to manipulate female production in an insect**
- **Palimpsest For a major part of history, people used parchment to write. Parchment was a writing material made from the untanned skins of animals, especially goats.**
- **Since it was expensive in many parts of the world, people often scraped or washed of any existing text on parchment and reused it to write. Any page that has been reused in this manner is called a palimpsest.**

BIG SHOT



- Two galaxies interact in an image taken by the James Webb Space Telescope using its Mid-Infrared Instrument (MIRI). It was released by NASA on Friday. At left is NGC 2937, an elliptical galaxy that looks like a tiny teal oval and is nicknamed the Egg. At right is NGC 2936, a distorted spiral galaxy nicknamed the Penguin, which is larger. NASA, ESA, CSA, STSCI

Two galaxies merging

- **Two galaxies interact in an image taken by the James Webb Space Telescope using its Mid-Infrared Instrument (MIRI).**

- **NGC 2937, an elliptical galaxy that looks like a tiny teal oval and is nicknamed the Egg. NGC 2936, a distorted spiral galaxy nicknamed the Penguin, which is larger.**

Squalushima

- **Scientists from the Zoological Survey of India have discovered a new species of deep-water dog Fish shark, Squalus hima, from the Sakthikulangara fishing harbour in Kerala.**
- **Squalus is a genus of dog fish sharks in the family Squalidae, commonly known as spurdogs, and are characterised by smooth dorsal fin spines.**
- **The discovery, made by a team of scientists led by scientist Bineesh K. K, was published in the journal Records of the Zoological Survey of India.**
- **The shark species from the genus Squalus and Centrophorus are often exploited for their liver oil which is in high demand in pharmaceutical industry,**

Fox nuts

- **Makhanas are also known as fox nuts, Euryale ferox, lotus seeds, gorgon nuts and phool makhana. *Makhana* are a part of the lotus flower.**
- **Makhanas are derived from lotus seeds. Lotus develops seed pods, and each pod contains approximately 20 seeds that mature within 40 days. The flower that's known for its beauty has a lot to offer, including lotus seeds or *makhana.***
- ***Makhana* is highly produced in the state of Bihar in India, Korea and Japan along with a few parts of eastern Russia. Makhanas are rich in nutrients and are a highly potent source of manganese, potassium, magnesium, thiamine, protein, and phosphorus.**

Marine Protected zone

- **Canada had designated the country's largest marine protected zone of the coast of Vancouver, as it moves to shield a third of its oceans by the end of the decade.Canada is moving closer to meeting a historic commitment made by the world's nations at the Montreal Biodiversity Summit in December 2022.**
- **The zone is the result of an agreement signed in January 2023 by Ottawa and the Nuu-chah-nulth, Haida, Quatsino and Pacheedaht nations.**

- **The area is home to more than dozens species of fish, seabirds, invertebrates and marine mammals, including killer whales, sea otters and dolphin. India' population dynamics.**
- **India's population dynamics Three components, namely fertility, mortality, and migration, play a pivotal role in shaping India's demographic landscape. India has made significant strides in reducing its fertility.**
- **According to the National Family Health Survey (NFHS)-5, India's total fertility rate (TFR) decreased from 3.4 to 2 between 1992 and 2021, dropping below the replacement level of 2.1.**
- **There has been a significant drop in the mortality rate as well. The average life expectancy of Indians has also increased over time. With this, India is experiencing a demographic shift, towards an ageing population.**
- **According to the 2011 Census, individuals aged 60 years and above constituted 8.6% of the total population.**
- **The figure India's population dynamics is intertwined with its 'development' scenario. The reduction in fertility signifies a transition toward smaller family norms.**
- **This can reduce the proportion of the dependent population and result in a demographic dividend a period where the working-age population is larger than the dependent population. India can harness the potential of its young workforce by creating employment.**
- **The decline in mortality and increase in life expectancy are reflections of a robust health-care system and increased living standards. The issue of population ageing, however, requires a long-term plan focusing on geriatric care and providing social security benefits.**
- **Migration and urbanisation are also critical issues. Rapid rural to urban migration is posing a threat to the existing urban infrastructure. Among all these, gender equality also finds an important place.**
- **Women labour force participation, which is straggling, their notable absence from political representation and their unending plight within society are the silent issues that can sabotage India's path to 2030.**

- **'Development' in the simplest way means ensuring the basic requirements of food, shelter, and health for all. 'No Poverty, Zero Hunger, and Good Health' are the three most important SDGs which form the core of 'development'.**
- **India's journey from the brink of a demographic disaster to striving towards the 2030 goal of 'leaving no one behind' has seen a couple of hits and misses.**
- **India made great leaps towards the goal of eradicating poverty. The proportion of the population living below the poverty line reduced from 48% to 10% between 1990 and 2019.**
- **The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) that came into effect in 2006 played a critical role in addressing rural poverty.**
- **The Janani Suraksha Yojana of 2005 it provides cash benefits to pregnant women not only accentuated institutional deliveries but also saved poor families from hefty health expenditures,**
- **Health is one sector in India where progress made has been remarkable. All the critical mortality indicators have seen steady declines. The Maternal Mortality Rate (MMR) decreased from 384.4 in 2000 to 102.7 in 2020.**
- **The mortality rate for children under five reduced significantly post 2000s.**
- **The infant mortality rate also reduced from 66.7 deaths per 1,000 live births in 2000 to 25.5 deaths per 1,000 live births in 2021.**
- **Although India is still not near reaching the targets, it seems to be on the right track. These achievements show that there has been a significant improvement in the quality and coverage of health care**
- **According to Oxfam, the top 10% of India's population holds 77% of the national wealth. If the fruits of development are not equitably distributed and if development does not percolate to the poorest of the poor and the wealth scenario remains so skewed as it is now, 'sustainable development' can never be achieved in its truest sense.**
- **Absolute growth in GDP numbers has limited importance for a country where the top 1% holds 40% of the total wealth. Hunger and nutrition is another sector in crisis.**
- **In the Global Hunger Index (2023), India's rank was 111 out of 125 countries.**

- **In terms of nutrition, stunting, wasting and underweight among children below five years and anaemia among women pose serious challenges.**
- **India's epidemiological trajectory shows that the country has a double burden of communicable and non-communicable diseases (NCD**

Population changes

- **First, the population has grown 44% from 100 crores to 144 crores, but the annual growth rate of the population has fallen sharply from nearly 2% to below 1%.**
- **This is because the number of births per woman (total fertility rate or TFR) has fallen from 3.4 to 2, just below the "replacement level" of 2.1. Second, the per capita GDP of Indians grew six times, from $400 to $2,400.**
- **The average lifespan of an Indian has increased from 61 years to 70 years. Third, Indians living below the multi-dimensional poverty line decreased from 43% to 11%.**
- **However, 11% of 144 crore is still a very large number of 16 crore people. The 16 crore people below the poverty line are not distributed evenly across the country**

Impact of climate change

The Organisation for Economic Co-operation and Development (OECD) countries with a per capita income of $40,000 and a total population of 1.39 billion, together produce and consume $55.6 trillion worth of natural resources and manufactured goods.

In comparison, India, with a per capita GDP of $2,400 and a population of 1.44 billion, produces and consumes just $3.5 trillion worth of natural resources and manufactured goods.

- **In other words, the OECD countries with a population slightly less than that of India consume nearly 16 times of what the whole of India consumes.**
- **This has been the major cause of global warming over the past few decades, resulting in unpredictable weather changes.**
- **In turn this has adversely affected the poor in developing nations more severely than people in developed nations with much better housing and civic**

infrastructure. With 11% of its people still below the poverty line, India will continue to accord priority to economic growth over climate change mitigation measures, and rightly so

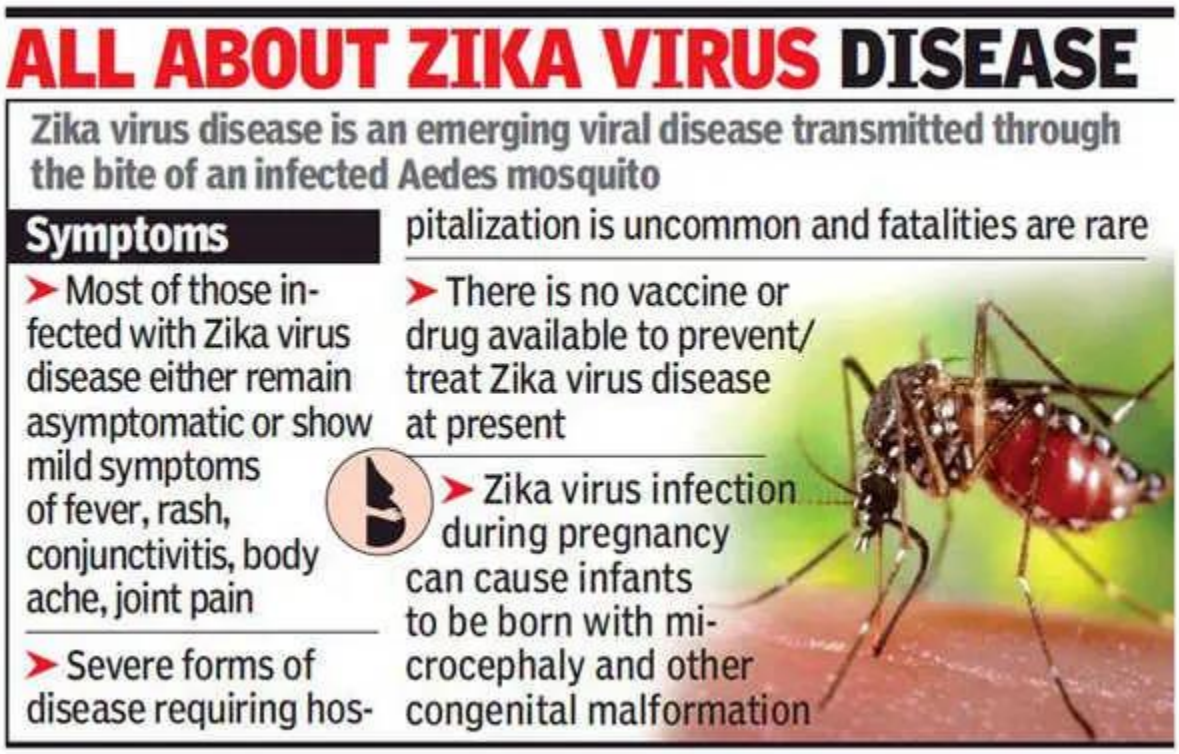
- **India is looked upon by the nations of the Global South in their efforts to maintain economic growth in their respective nations as the first priority, followed by measures to achieve net zero.**
- **India has fixed the year 2070 to achieve this, compared to the European Union's target of reaching net zero by 2050. But India would strive for zero poverty within the next decade.**
- **The next few decades will see developing nations focusing on eradicating persistent poverty among their people rather than responding to population growth doomsday**
- **The population today is more centered in urban areas. By 2030, it is estimated that two-thirds of the people will inhabit urban spaces, which will put a strain on infrastructure and amenities. This, in turn, could compromise the quality of life of urban citizens.**
- **Women's health and rights The theme of this World Population Day is 'women's sexual and reproductive health and reproductive rights', marking the 30th anniversary of the International Conference on Population and Development (ICPD).**
- **This allows us to accelerate efforts to realize the ICPD's program of action**
- **World Population Day has obvious significance for India. The most populated country in the world with a median age of 28 years could help balance the population-deficit regions.**
- **Lowering fertility levels and rising longevity also transform the size and composition of households. There will soon be an uneven distribution of children and the elderly within households, which will have implications for inequality, an important concern for India.**

Zika virus

- **As per the World Health Organization (WHO), Zika virus is a mosquito-borne virus first identified in Uganda in 1947 in a Rhesus macaque monkey, followed**

by evidence of infection and disease in humans in other African countries in the 1950s.

- **Zika virus occurs through the bite of infected Aedes mosquitoes, mainly Aedes aegypti, which also transmit dengue and chikungunya. The Aedes mosquitoes usually bite during the day.**
- **Sexual transmission, transmission from mother to foetus and transfusions of blood and blood products are other routes of transmission**
- **No vaccine is as yet available for the prevention or treatment of Zika virus infection, the WHO says. The development of a Zika vaccine remains an active area of research.**



What is scientific deep drilling?

What is scientific deep drilling?

- **Scientific deep-drilling is the enterprise of strategically digging boreholes to analyse deeper parts of the earth's crust.**
- **It offers opportunities and access to study earthquakes and expands our understanding of the planet's history, rock types, energy resources, life forms, climate change patterns, and more.**

The Borehole Geophysics Research Laboratory (BGRL) in Karad, Maharashtra, is a specialized institute under the Ministry of Earth Sciences mandated to execute India's sole scientific deep-drilling program.

- **Under BGRL, the aim is to drill the earth's crust to a depth of 6 km and conduct studies to help expand the understanding of reservoir-triggered earthquakes in the Koyna-Warna region of Maharashtra. This region has been experiencing frequent earthquakes since the Shivaji Sagar Lake, or the Koyna Dam, was impounded in 1962.**
- **BGRL's 3-km-deep pilot borehole in Koyna is complete; the Ministry of Earth Sciences is committed to reaching a depth of 6 km. The benefits of a deep-drilling mission Earthquakes are challenging to study. Surface-level observations can't make complete sense of them.**
- **The recurrent earthquakes in Koyna are synchronous with the dam's loading and unloading during the monsoon and post-monsoon periods, offering an opportunity to widen our understanding of earthquakes.**
- **However, making observations inside the earth is a different ball game. Scientifically drilled boreholes can be a hub of direct, unique in situ experiments and observations and monitor a region's fault lines and seismic behavior.**
- **They also provide exact and fundamental knowledge of the composition of the earth's crust, structure, and processes, and help validate models based on surface studies. Thus, it can inform a range of societal problems related to geohazards and geo-resources.**

Scientific deep drilling refers to the process of drilling deep into the Earth's crust for scientific research purposes rather than for the extraction of oil, gas, or minerals. This type of drilling is used to gather detailed information about the composition, structure, and properties of the Earth's subsurface, which can help scientists understand geological processes, the history of the Earth, and the behavior of its materials under extreme conditions.

Objectives of Scientific Deep Drilling:

1. **Geological Research**: To study rock formations, faults, and the processes that lead to earthquakes, volcanic activity, and mountain building.

2. **Climate Studies**: By extracting cores from deep below the Earth's surface, scientists can analyze trapped gases and isotopes to reconstruct past climate conditions and changes over millions of years.
3. **Biosphere Exploration**: Investigating the extent and forms of microbial life that exist deep within the Earth, which can offer insights into the limits of life and conditions for its sustainability.
4. **Geophysical Research**: To understand the physical properties of Earth's materials under high pressure and temperature conditions.
5. **Energy Studies**: Exploring geothermal gradients and potential geothermal energy sources.

Examples of Scientific Deep Drilling Projects:

- **The Kola Superdeep Borehole**: Located in Russia, this is one of the deepest boreholes ever drilled, reaching depths of about 12 kilometers (7.5 miles). The project aimed to explore the Earth's crust and provided valuable data on geothermal conditions and crustal composition.
- **The German Continental Deep Drilling Program (KTB)**: Aimed at exploring the crust's composition and properties to a depth of about 9 kilometers (5.6 miles).

Techniques and Technologies Used:

- **Rotary Drilling**: Commonly used technique where a drill bit attached to a drill string is rotated to cut through the rock.
- **Wireline Logging**: After the drilling, instruments are lowered into the borehole to measure physical, chemical, and structural properties of the rocks.
- **Core Sampling**: Extracting long cylindrical samples of rock allows for detailed laboratory analysis of the subsurface materials.

Challenges:

- **High Cost**: Deep drilling operations are expensive, requiring sophisticated equipment and technology.
- **Technical Difficulties**: Drilling to great depths involves dealing with high temperatures and pressures, which can complicate the operation and maintenance of equipment.

- **Data Interpretation**: The data obtained can be complex and require sophisticated models for accurate interpretation.

Scientific deep drilling is crucial for advancing our understanding of Earth sciences and can provide insights that are not possible through other means of investigation. Its interdisciplinary nature often brings together researchers from various fields, including geology, biology, physics, and engineering.

Scientific deep drilling, while highly valuable for understanding Earth's subsurface and broader geological phenomena, presents a range of technical, financial, and scientific challenges. Here are some of the primary difficulties associated with such endeavors:

1. Technical Challenges

- **High Temperatures and Pressures**: As the depth of drilling increases, the conditions become harsher with higher temperatures and pressures. This can lead to equipment failures and the need for more specialized, robust, and expensive technology.
- **Drill Bit Wear and Tear**: The extreme conditions and the hardness of the materials being drilled can cause rapid wear and tear on drill bits, requiring frequent replacement which interrupts the drilling process and adds to the costs.
- **Hole Stability**: Maintaining the stability of the borehole at great depths can be challenging. The hole may collapse due to the stresses in the Earth's crust or become clogged with debris.

2. Financial Challenges

- **High Costs**: The equipment, technology, and manpower required for deep drilling are extremely costly. Funding such projects often requires substantial investment from government bodies, research institutions, or partnerships with industrial entities, which are not always easy to secure.
- **Cost Overruns**: Due to the unpredictable nature of the subsurface conditions, projects can encounter unforeseen problems that may lead to significant cost overruns.

3. Logistical Challenges

- **Remote Locations**: Many drilling sites are located in remote or extreme environments (e.g., offshore, deserts, Arctic regions). Establishing and maintaining operations in such locations incurs additional logistical challenges and costs.
- **Supply Chain and Maintenance**: Ensuring a steady supply of necessary materials and the maintenance of equipment in remote areas can be difficult and costly.

4. Environmental and Regulatory Challenges

- **Environmental Impact**: Drilling operations, even for scientific purposes, can have significant environmental impacts, including disruption of local ecosystems, potential for spills or leaks, and other forms of contamination.
- **Regulatory Compliance**: Meeting environmental regulations and obtaining necessary permits can be complex, time-consuming, and restrictive, especially in environmentally sensitive areas.

5. Scientific and Data Challenges

- **Data Collection and Analysis**: The extreme conditions can compromise data collection tools and methods. Furthermore, interpreting the vast amounts of data collected, which can often be noisy or incomplete, requires advanced analytical techniques and substantial computational resources.
- **Unexpected Geological Conditions**: The subsurface of the Earth can be highly variable and unpredictable. Unexpected geological features can complicate drilling efforts and the scientific interpretation of data.

6. Human Factors

- **Skill and Expertise**: Deep drilling projects require highly skilled personnel who are knowledgeable in geology, engineering, and other specialized fields. Training and retaining such personnel can be challenging.
- **Safety Risks**: The operation of heavy machinery and work in potentially hazardous environments pose significant safety risks to personnel.

Despite these challenges, scientific deep drilling continues to be a critical tool for advancing our understanding of Earth's geological processes, history, and properties. The knowledge gained from such projects often justifies the considerable investment and effort required to overcome these obstacles.

Dengue virus

- **The WHO noted that at least five countries, including India, were grappling with the onset of monsoon season, which created suitable conditions for the breeding and survival of Aedes mosquito.**
- **Urbanisation and population movements have also played a pivotal role in the increasing burden in the region. Dengue is endemic in more than 100 countries in the WHO regions of Africa, the Americas, the Eastern Mediterranean, South-East Asia, and the Western Pacific.**
- **The Americas, Southeast Asia, and Western Pacific regions were the most seriously affected, with Asia accounting for around 70% of the global disease burden. However, it also noted that dengue is spreading to new areas in Europe, the Eastern Mediterranean, and South America.**

How does dengue spread and how is it treated?

- **Dengue virus is transmitted to humans through the bite of infected mosquitoes, with the primary vector that transmits the disease being Aedes aegypti**
- **According to the WHO, factors contributing to the increasing risk of dengue epidemics include the changing distribution of the Aedes aegypti vector, urbanization, and human activities that create conducive environments for vector-host interaction, and climate change-induced shifts in weather patterns.**

Star tortoise

- **(*Geochelone elegans*)**
- **The Indian star tortoise (*Geochelone elegans*) is a threatened tortoise species native to India, Pakistan and Sri Lanka where it inhabits dry areas and scrub forest.**
- **It has been listed as Vulnerable on the IUCN Red List since 2016, as the population is thought to comprise more than 10,000 individuals, but with a declining trend. It is threatened by habitat loss and poaching for the illegal wildlife trade.**
- **It was upgraded to CITES Appendix I in 2019 by full consensus among all member states, giving it the highest level of international protection from commercial trade.**

- **Conservation group TRAFFIC found 6,040 were seized globally that were intended to be sold in the pet trade.**
- **Currently they are commonly bred in many countries to be sold as pets.**

Mineral nanoparticles from water

- **In a bucket of water, water molecules at the surface can participate more easily in chemical reactions than those in the bulk.**
- **But even at the surface, they'll need to be supplied with some energy before they can participate.**
- **The water molecules of microdroplets do one better: because they have so little room and are packed closely together, they're more eager to participate in chemical reactions. Microdroplets are also good carriers of electric charge**
- **A microdroplet can also become electrically charged in other ways.**
- **For example, when a larger droplet loses some water by evaporation and shrinks, the water molecules left behind are pushed closer together and establish (weak) hydrogen bonds between themselves.**
- **This often results in a water molecule shedding one of its hydrogen atoms and becoming a negatively charged hydroxyl ion (OH-).**
- **The free protons could have squeezed themselves into crystal layers, which they scraped the mineral off from within if supplied some energy.**
- **The study suggests the electric Fields produced by the charged surface could have provided this energy. Surface tension the force that keeps droplets spherical could have been involved as well.**
- **Plants absorb silica in the form of nanoparticles to help them become taller. Supplying soil with silica nanoparticles could have a positive impact on agriculture.**
- **This research provides 'a way to convert unproductive soil, unproductive fields or even desertified areas into productive areas'**
- **Silica makes up half of sand. Plants absorb silica in the form of nanoparticles to help them become taller.**

- **The rice crop usually has high levels of silica. Supplying soil with silica nanoparticles could thus have a positive impact on agriculture.**
- **"Here is a way to convert unproductive soil, unproductive fields or even desertified areas into productive areas**
- **India's Manufacturing sector -key points**
- **First, India has a massive employment-creation requirement. About half of Indian labour remains mired in low-productivity agriculture.**
- **If India's attempts to enact major farming reforms are successful, there could be a fast, massive transition of employment out of agriculture. A second reason behind India's desire to boost manufacturing is the nation's goods trade deficit.**
- **The United States has a stake in India's success in building a robust manufacturing base for two reasons.**
- **First, improvements to India's industrial base will have direct and indirect effects on India's ability to underwrite its emerging role in regional security which is increasingly important given China's rising aggression.**
- **Second, some amount of manufacturing will not come back onshore.**
- **Having this manufacturing based in friendly countries improves the viability of U.S. supply chains.**

Digital Competition Law (CDCL)

- **The Ministry of Corporate Affairs (MCA) constituted a Committee on Digital Competition Law (CDCL) to examine the need for a separate law on competition in digital markets.**

What is an ex-ante framework?

- **The Competition Act, 2002 is the primary legislation concerned for preventing practices that have an adverse effect on competition.**
- **It establishes the Competition Commission of India (CCI) as the national competition regulator. As with competition law in all other jurisdictions, the Competition Act, 2002 is based on an ex-post framework.**

- **This means that the CCI can use its powers of enforcement only after the anti-competitive conduct has occurred. In the case of digital markets, the CDCL has advocated for an ex-ante competition regulation.**
- **This means that they want the CCI's enforcement powers to be supplemented such that it allows it to pre-empt and prevent digital enterprises from indulging in anti-competitive conduct in the first place.**
- **Ex-ante competition regulation is unusual. The term ex-ante (sometimes written ex-ante or ex-ante) is a phrase meaning "before the event".**
- **The European Union is the only jurisdiction where a comprehensive ex-ante competition framework, under the Digital Markets Act, is currently in force.**
- **The CDCL agrees with this approach because of the unique characteristics of digital markets.**
- **First, digital enterprises enjoy economies of scale and economies of scope, that is, reduction in cost of production per unit as the number of units increase and reduction in total costs of production with increase in number of services respectively**

What is the draft's basic framework?

- **The draft Bill follows the template of the EU's Digital Markets Act.**
- **It does not intend to regulate all digital enterprises, and places obligations only on those that are "dominant" in digital market segments.**
- **At present, the draft Bill identifies ten 'core digital services' such as online search engines, social networking services, video sharing platform services etc.**
- **The draft Bill prescribes certain quantitative standards for the CCI to identify dominance of digital enterprises.**
- **These are based on the 'significant financial strength' test which looks at financial parameters and 'significant spread' test based on the number of users in India.**
- **Even if the digital enterprise does not meet quantitative standards, the CCI may designate an entity as a "systemically significant digital enterprise (SSDE)" based on qualitative standards.**

- **The primary obligation of SSDEs is to not indulge in anti-competitive practices.**
- **These require the SSDE to operate in a fair, non-discriminatory and transparent manner with its users.**
- **The draft Bill prohibits SSDEs from favouring its own products on its platform over those of third parties (self-preferencing); restricting availability of third party applications and not allowing users to change default settings; restricting businesses users of the service from directly communicating with their end users (anti-steering) and tying or bundling of non-essential services to the service being demanded by the user.**
- **SSDEs also cannot cross utilise user data collected from the core digital service for another service and non-public data of users cannot be used to give unfair advantage to the SSDE's own service**
- **María Elena Solar Power Plant**
- **María Elena Solar Power Plant is a concentrated solar power plant with a molten-salt technology system that is currently under construction in the commune of María Elena in the Antofagasta Region of Chilé.**
- **About ECOWAS**
- **The military leaders of Niger, Mali and Burkina Faso broke away from regional grouping ECOWAS earlier this year and formed a confederation of their own**

.

- **About ECOWAS**

- **The Heads of State and Government of fifteen West African Countries established the Economic Community of West African States (ECOWAS) when they signed the ECOWAS Treaty on the 28th of May 1975 in Lagos, Nigeria.**
- **The Treaty of Lagos was signed by the 15 Heads of State and government of Benin, Burkina Faso, Côte d'Ivoire,**
- **The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Sierra Leone, Sénégal and Togo, with its stated mission to promote economic integration across the region.**

- **The Senegalese President was represented by the Minister for Foreign Affairs. Cabo Verde joined the union in 1977.**
- **The only Arabic-speaking Member Mauritania withdrew in December 2000. Mauritania recently signed a new associate-membership agreement in August 2017**
- **The Authority of Heads of State and Government of the Economic Community of West African States (ECOWAS) held its 65th Ordinary Session in Abuja, Nigeria, today July 7, 2024**

What is iCET?

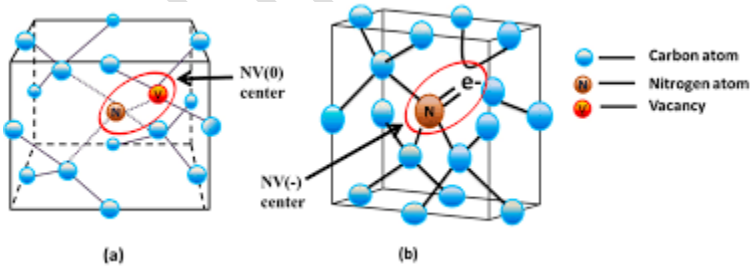
- **The Initiative on Critical and Emerging Technologies is a framework agreed upon by India and the U.S. for cooperation on critical and emerging technologies in areas including artificial intelligence, quantum computing, semiconductors and wireless telecommunication.**
- **It was launched in January 2023 to strengthen their strategic partnership and drive technology and defence cooperation.**
- **Mr. Modi and Mr. Biden first announced the framework on the sidelines of the Quad meeting in Tokyo in May 2022.**
- **"The United States and India affirm that the ways in which technology is designed, developed, governed, and used should be shaped by our shared democratic values and respect for universal human rights**

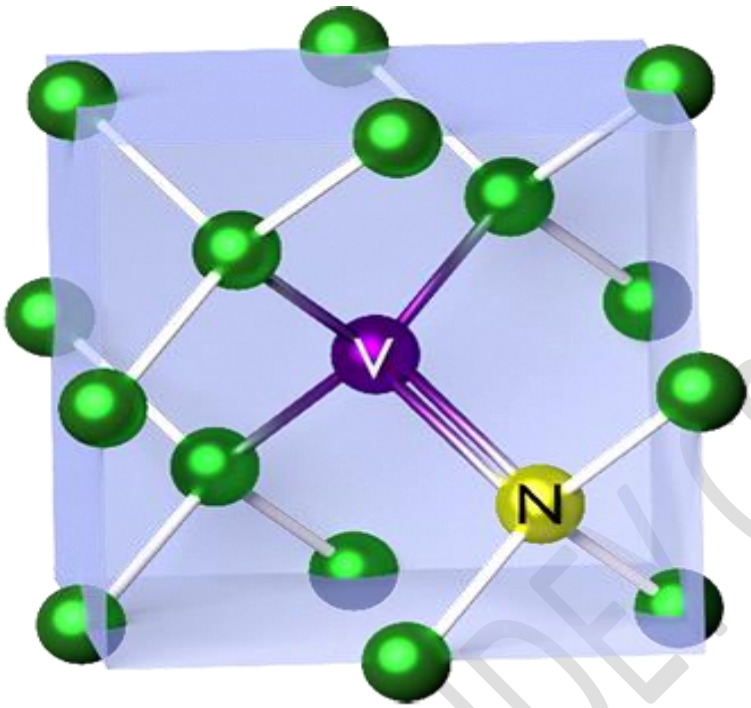
What are the focus areas of the initiative?

- **Primarily, the iCET seeks to position New Delhi and Washington D.C. as "trusted technology partners" to build supply chains and support the co-production and codevelopment of item**
- **Key takeaways include setting up a research agency partnership to drive collaboration in areas like AI; developing a new defence industrial cooperation roadmap to accelerate technological cooperation for joint development and production; developing common standards in AI;**
- **developing a roadmap to accelerate defence technological cooperation and 'innovation bridge' to connect defence startups;**

- **supporting the development of a semiconductor ecosystem; strengthening cooperation on human spaceflight; advancing cooperation on development in 5G and 6G; and adopting Open RAN network technology in India.**
- **A new initiative to advance cutting edge technology cooperation, known as the India U.S. Defence Acceleration Ecosystem (INDUSX), is set to be launched during the visit.**
- **India and the U.S. have also concluded a roadmap for 'Defence Industrial Cooperation' to guide the policy direction for the next few years.**
- **The two countries have also established a Strategic Trade Dialogue to remove regulatory "barriers" and review existing export control norms to take forward strategic technology and trade collaborations envisaged under iCET**

"Nitrogen vacancy" centre

- **Quantum researchers are interested in their "defects".**
- **It is the unique arrangement of carbon atoms in a diamond which gives it the properties of hardness, electrical conductivity and manipulation of light.**
- **However, the atomic structure of some diamonds sometimes have two missing carbon atoms.**
- **They are substituted by a nitrogen atom as well as a "hole" or what is called a "nitrogen vacancy" centre.**
- **These "Centres' are sensitive to the slightest variations in magnetic Fields and thereby open vistas of investigation.**
- 



- **An electron at such a centre can be individually tweaked and made to behave like a qubit. Qubits analogous to the bits and bytes of classical computers are the logic states of quantum computers and in theory allow calculations, beyond the capacity of existing supercomputers, to be done in a trice.**

Nociceptor cells

- **Nociceptor cells have bare nerve endings, and they are found across our skin, bones, joints, and muscles.**
- **The receptors detect extreme pressure, temperature, and chemical signals released by the body when it is injured, turn them into electrical signals, and relay them to the brain via the spinal cord.**
- **The brain finally reads the message and perceives pain.**
- **nociceptor sensitization: a phenomenon in which the threshold for pain is lowered by external factors, causing the receptors to respond to stimuli that they'd otherwise ignore.**
- **Dorsal root ganglion a cluster of nerve cells located near the spinal cord**
- **orexin B, a neurotransmitter that regulates wakefulness, produced sensitization in male rodents but not female rodents.**

- **The study presents a unique concept: nociceptors are either male or female.**

World-oldest cave painting

On the ceiling of a limestone cave on the Indonesian island of Sulawesi, scientists have discovered artwork depicting three human-like figures interacting with a wild pig in what they have determined is the world's oldest-known confidently dated cave painting created at least 51,200 years ago.

- **The researchers used a new scientific approach to determine the minimum age of the newly disclosed painting inside the Leang Karampuang cave in the Maros-Pangkep region of South Sulawesi province by using a laser to date a type of crystal called calcium carbonate that formed naturally on top of the painting.**

Vaccine development

- **The whole scenario changed with the amendment of the U.S. Patent Act in the 1980s allowing the patenting of genetically modified organisms (GMOs) and life processes, and the introduction of Bayh-Dole Act to legalise publicly funded scientists setting up companies.**
- **With the eventual globalization of U.S. patent laws through the World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) since 1995, vaccine development and innovation changed drastically.**
- **Vaccine innovation underwent significant changes in terms of its organisation, patenting strategies and even distribution practices in academia and industry. An important element of this 'value addition' is legalization of the conversion of public 'research' into private 'development' and its monopolization by patenting.**
- **This facilitated the change of hands in vaccine development and production from the public to private sector the world over, aided by the politics of liberalization and globalization.**
- **Earlier, the Indian Patent Act (1970) abolished patenting products and allowed only processes, that too excluding agricultural and biological patents. This enabled the growth of domestic industries to become the pharmacy of the world within two decades.**

- **They manufactured low-cost generic drugs and vaccines, often within a couple of years after they were introduced in the global north.**
- **The first rDNA vaccine produced in India for Hepatitis-B not only entered the market within five years under the process patent but also dropped the price to an order of magnitude cheaper than in the global north.**
- **On the other hand, under the current product patent regime, a locally made DNA vaccine against cervical cancer had to wait for two decades till the expiry of the product patents before its indigenous 'generic' version was made available**

Patents	Significance	India	Most other nations
Process	Any new invention in process or improvement in existing process	Applicable	Applicable
Product	Entirely new discovery	Applicable	Applicable
	Discovery of new use for known substance	Not Applicable as per section 3(d)	Applicable
	Discovery of new form of old substance with no enhancement of the known efficacy	Not Applicable as per section 3(d)	Applicable
	Mere discovery of a new property of known substance	Not Applicable as per section 3(d)	Applicable

HPv

- **HPV, or human papillomavirus, is a common virus that can cause cancers later in life.**
- **Human papillomavirus infection (HPV infection) is caused by a DNA virus from the *Papillomaviridae* family**
- **Many HPV infections cause no symptoms and 90% resolve spontaneously within two years.**

What is rDNA Vaccine?

- **In recombinant DNA vaccines, the antigens are not directly injected into the body.**

- **Instead the rDNA containing the gene for coding the antigen in a vector is incorporated into the body. The gene produces antigens inside the body and the immune responses are elicited for that antigen. Then the memory of the antigen is retained by the immune system.**

The Delhi Preservation of Trees Act (DPTA), 1994

- **The Delhi Preservation of Trees Act (DPTA), 1994 provides legal protection to trees in the national capital against actions that could harm their growth or regeneration.**
- **Delhi's forest cover constitutes 13.15% of its geographical area, while its tree cover spans 147 sq. km (9.91%).**
- **Amid an extreme heatwave, rampant tree felling in the world's second most populous city will only worsen hardships faced by the people.**

What is regenerative braking?

- **Japan and the Philippines signed a key defence pact allowing the deployment of Japanese forces for joint drills in the Southeast Asian nation that came under brutal Japanese occupation in the Second World War but is now building an alliance with Tokyo as both face an increasingly assertive China.**
- **The Reciprocal Access Agreement, which similarly allows Filipino forces to enter Japan for joint combat training**

Under water

All hands on deck: Rescue workers riding a boat past an inundated house on Sunday during flooding caused by a dam breach in Dongting lake in China's Hunan province. The breach occurred on Friday, inundating farmland and forcing nearly 6,000 people to evacuate. AFP

Dongting Lake

- **Dongting Lake is a large, shallow lake in northeastern Hunan Province, China.**
- **It is a flood basin of the Yangtze River, so its volume depends on the season.**
- **The provinces of Hubei and Hunan are named after their location relative to the lake: *Hubei* means "North of the Lake" and *Hunan*, "South of the Lake".**
- **Dongting Lake is famous in Chinese culture as the place of origin of dragon boat racing**

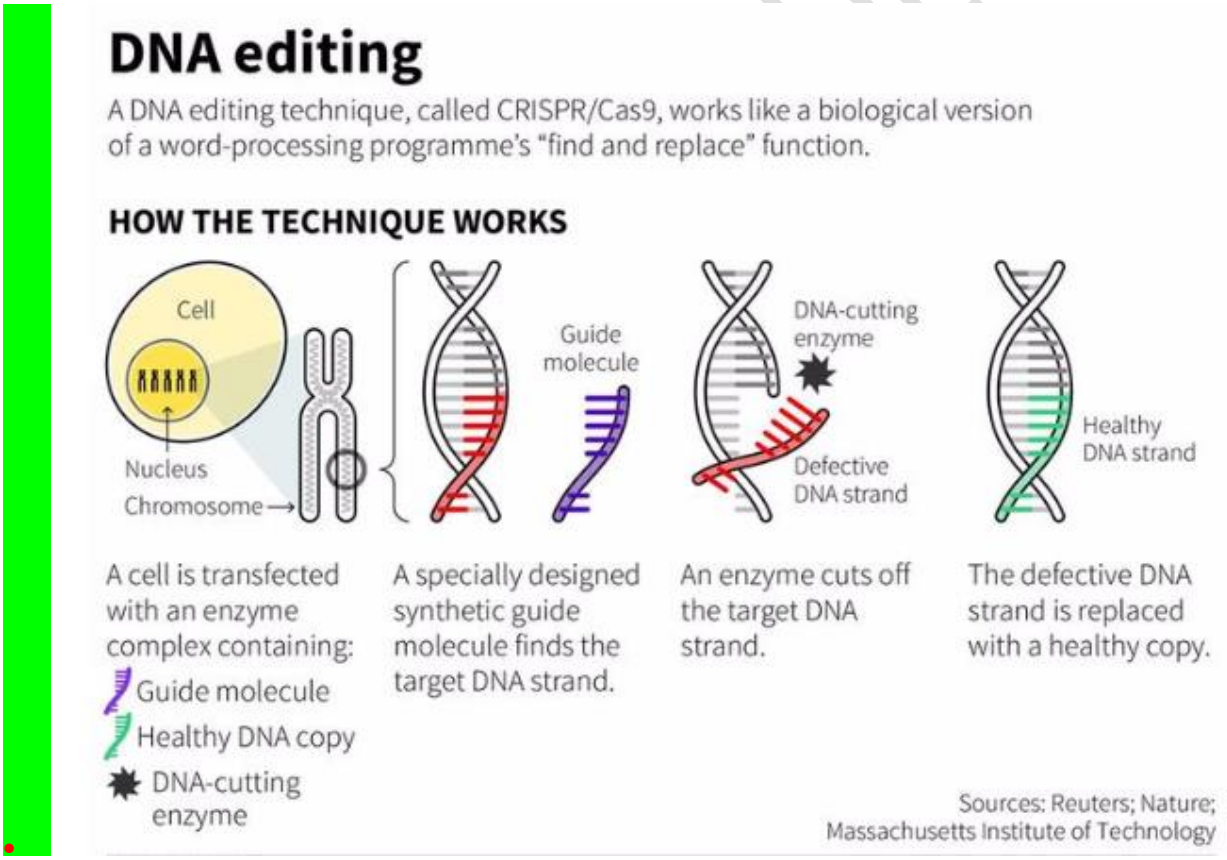
The green chromide

- **The green chromide (*Etroplus suratensis*) is a species of cichlid fish that is native to fresh and brackish water habitats in some parts in India such as Kerala, Goa, Chilika Lake in Odisha and Sri Lanka.**

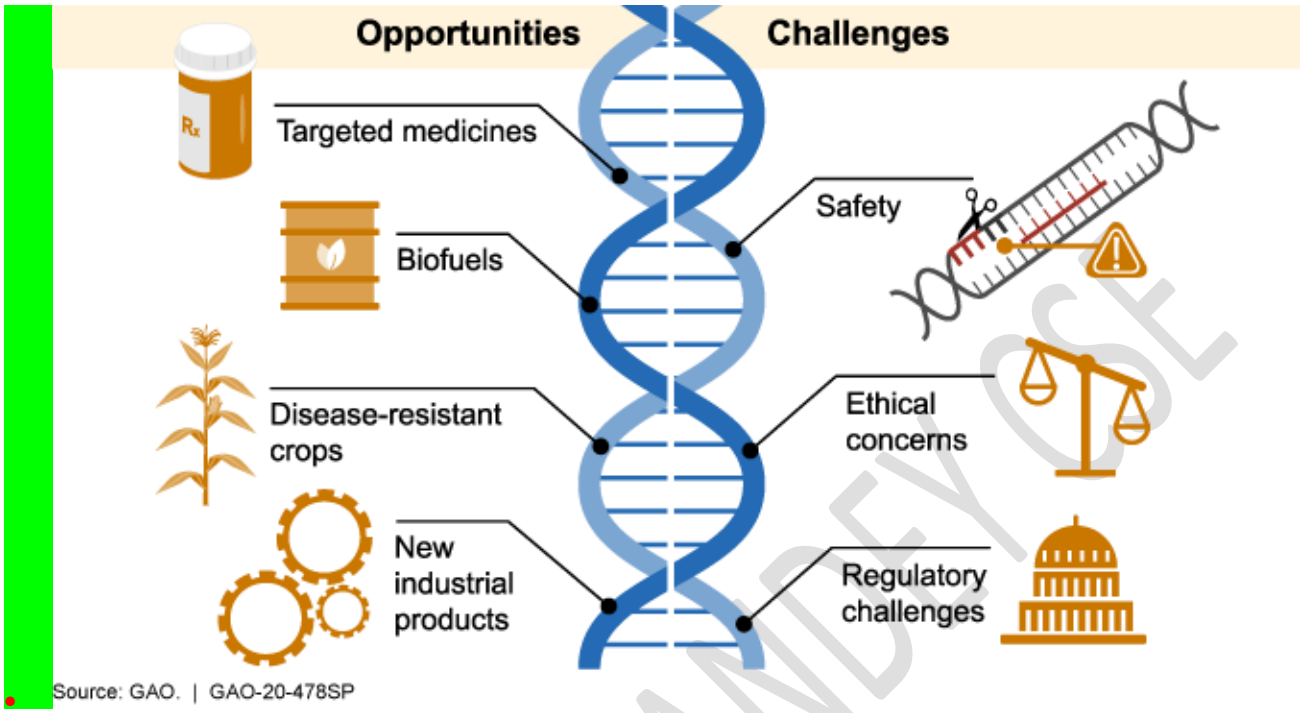
- **The species was first described by Marcus Elieser Bloch in 1790.**
- **This species and other members of the genus *Etroplus* are relatively closely related to the *Paretroplus* cichlids from Madagascar.**
- **Other common names include pearl spot cichlid, banded pearl spot, and striped chromide**
- **The green chromide lives in brackish water habitat types, such as river deltas.**
- **It eats mainly aquatic plants, including filamentous algae and diatoms, but it consumes the occasional mollusk and other animal matter.**

Why in News??

- **Kerala varsity to launch genome editing mission to boost pearl spot production.**



New uses of Gene Editing

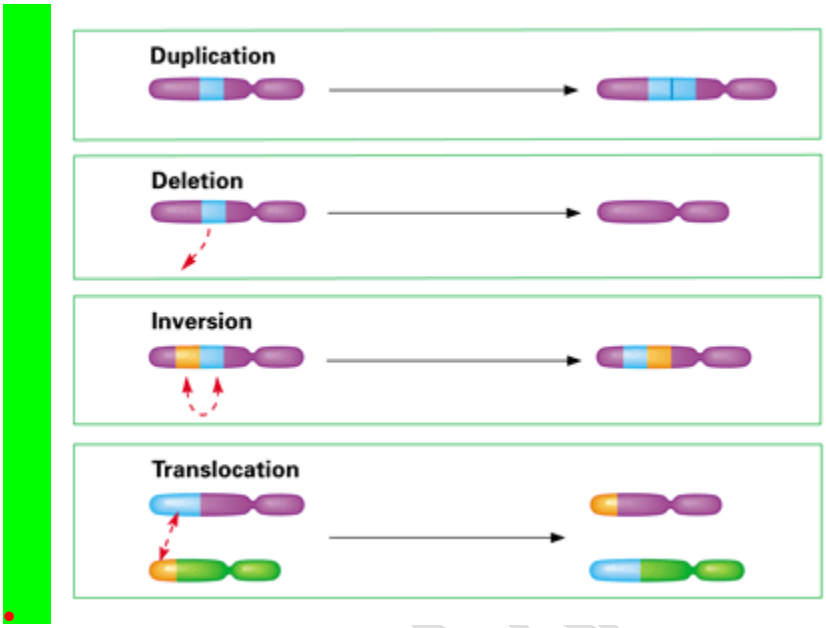


Sleeping beauty and transposon

- **Transposons influence the effects of genes by turning 'on' or 'off' their expression. They have the ability to rearrange the genome and thus enable nature's diversity Researchers have reconstructed a transposon called 'sleeping beauty' using the genomes of a fish.**
- **It had been dormant for millions of years. A similar synthetic transposon may, in the future, allow us to turn off a problem gene or over-express another**
- **What are transposon??**
- **transposon, class of genetic elements that can "jump" to different locations within a genome.**
- **Although these elements are frequently called "jumping genes," they are always maintained in an integrated site in the genome. In addition, most transposons eventually become inactive and no longer move.**
- **A new RNA-guided gene editing system that uses bacterial transposons can treat a wide variety of genetic diseases: a functional copy of a gene can be replaced in a given genomic location.**

- **It may also be able to treat chromosomal inversions or deletions**

Chromosome Aberration



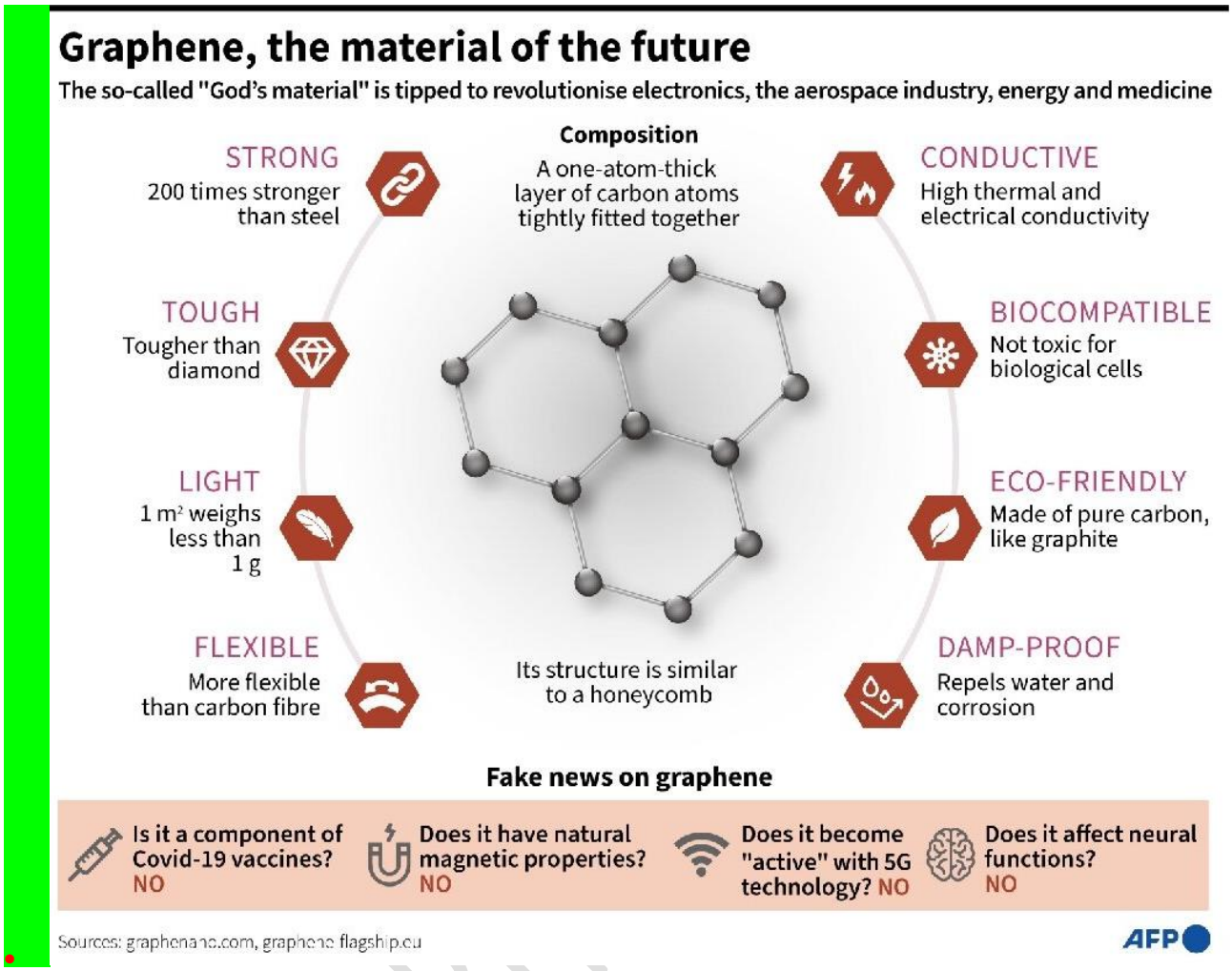
RNA bridge

- **Scientists found this RNA could bind to two pieces of DNA, rather than the usual one piece, and form a bridge between them.**
- **This is a very useful ability. In the new study, the researchers used the bridge RNA to edit the DNA.**
- **The two loops of the RNA can independently bind to two separate pieces of DNA.**
- **One of the loops identies the target site in the genome that needs to be altered.**
- **The other loop specifies the DNA to be inserted in its place.**
- **Each loop is independently programmable, which means researchers can mix and match any target and donor DNA sequences of interest.**

All about Graphene

- **When the same element is able to exist in different forms, the forms are called allotropes.**

- **Graphene, thus, is an allotrope of carbon, along with diamond and graphite. It consists of a single layer of carbon atoms that are linked to each other in a honeycomb pattern. Graphene is among the most versatile materials known to humankind.**
- **As a nanomaterial, it is stronger than diamond, more conductive than silver, more elastic than rubber, and lighter than aluminium.**
- **Many people called it a "wonder material".**
- **It is simple to make graphene: use scotch tape to peel away the lead of a pencil for a while.Under a microscope, you should be able to see graphene residue left on the tape.**
- **However, scientists use more sophisticated techniques in laboratories, like chemical vapour deposition, to deposit graphene in order to make stronger car tires or when making chips to replace those made of silicon in smartphones.**
- **When graphene is mixed with concrete, the latter becomes 25% stronger and less carbon-intensive.**
- **Graphene also develops some unusual properties in a twisted bilayer form.**
- **In 2019, for example, physicists found that when one sheet of graphene is placed above another and rotated by 1.1 degrees relative to the bottom layer, the stack becomes a superconductor at low temperature.**



Vadhavan port project

- **The Indian government recently approved a significant project that could prove pivotal for the country's commerce and economy. Named the 'Vadhavan Port Project,' it is estimated to cost approximately Rs 76,220 crores.**
- **Located in Palghar district, Maharashtra, Vadhavan Port will be a modern, all-weather deep-water port. The total project cost, including land acquisition, is Rs 76,220 crores.**
- **The Vadhavan Port Project proposes to develop a greenfield deep-draft port in Maharashtra's Vadhavan.**
- **The objective is to construct a state-of-the-art container port that will elevate India's maritime trade to new heights.**

Why is this Port Project Important?

- **The significance of this project lies in its potential to redefine India's maritime trade. Designed to accommodate large container ships, Vadhavan Port aims to handle a cumulative capacity of 298 million metric tons (MMT) of cargo annually, including approximately 23.2 million Twenty-Foot Equivalent Units (TEUs) of containers. This will position it among Asia's largest ports.**
- **It will be an integral part of the India-Middle East-Europe Corridor (IMEC), empowering India to compete in global trade and bolstering the country's economic development.**

What is PAM??

- **Primary amoebic meningoencephalitis or PAM is caused by Naegleria fowleri, an amoeba that thrives in warm freshwater lakes, ponds and rivers.**
- **It can also survive in poorly maintained swimming pools in rare cases.**
- **As it can infect the brain and destroy the tissues there, this one-celled organism is also called 'brain-eating amoeba'.**
- **These infections, though rare, are fatal and 97% of the patients don't survive.**
- **The infection happens when people go for a swim in lakes, ponds or rivers, during the summer.**
- **Experts say that it could occur if the atmospheric temperature is high and water levels are low.**
- **The amoeba enters the body through the nose and reaches the brain. It destroys brain tissues and causes their swelling. In recent cases, children have been found to be more vulnerable to it.**
- **The infection does not spread from people to people. Swallowing water containing the amoeba does not lead to it either**

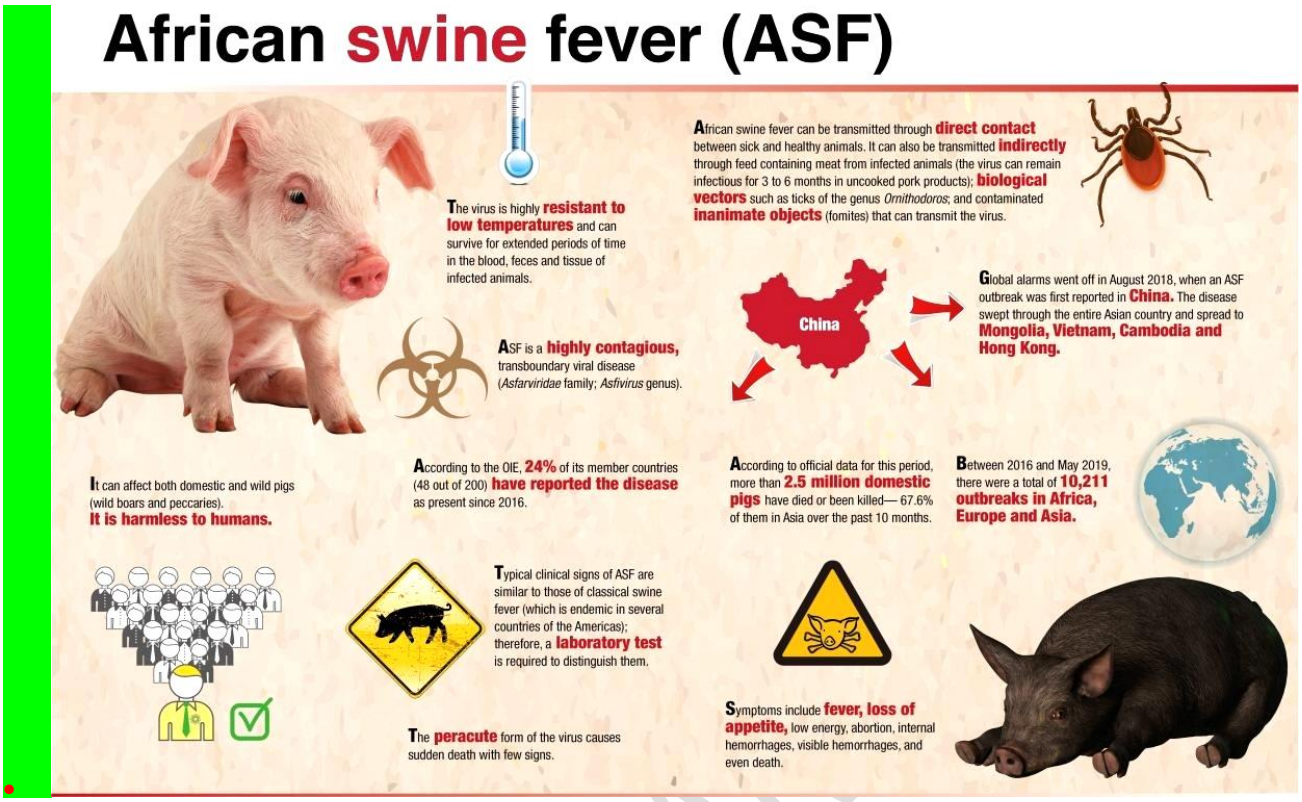
Denisovans

- **The Denisovan are an extinct species of ancient human that lived at the same time and in the same places as Neanderthals and Homo sapiens.**
- **Only a handful of Denisovan remains have ever been discovered by archaeologists.**

- **Little is known about the group, including when they became extinct, but evidence exists to suggest they interbred with both Neanderthals and Homo sapiens.**
- **The scientists identified one rib bone as belonging to a new Denisovan individual.**
- **Their new analysis has identified a new Denisovan fossil and shed light on the species' ability to survive in fluctuating climatic conditions including the ice age on the Tibetan plateau from around 200,000 to 40,000 years ago**
- **Baishiya Karst Cave is a high-altitude paleoanthropological site and a Tibetan Buddhist sanctuary located on the northeastern edge of the Tibetan Plateau in Xiahe County, Gansu, China.**
- **This karst cave is the site of the discovery of the earliest hominin fossil found on the Tibetan Plateau, the Xiahe mandible**

African Swine Fever (ASF)

- **African Swine Fever (ASF) is a highly contagious and deadly swine disease that can affect both farm-raised and feral (wild) pigs.**
- **ASF doesn't infect people, but it is readily passed from one pig to another by direct contact with bodily fluids from an infected pig.**
- **The practice of feeding uncooked food waste (that has not been appropriately heat treated) to pigs can also result in transmission of the virus if the food waste being fed to pigs contains contaminated pork products.**



Freedom of religion

- **The framers of the Indian Constitution had subordinated the freedom of religion to all other fundamental rights.**
- **It has further been subjected to public order, health, and morality, with additional powers being given to the state to bring in social reforms.**
- **The courts have further restricted the freedom to only the 'essential religious practices'.**
- **Justice Swaminathan observed that privacy is not lost if an individual is in a public place.**
- **In an interesting analogy, the learned judge, in paragraph 21 of his judgment, held that 'If the right to privacy includes sexual and gender orientation, it certainly includes one's spiritual orientation also.'**
- **It is open to a person to express this orientation in the manner he deems fit subject to rights of others.**

- **The leading Supreme Court judgment on the freedom of religion was Sri Shirur Mutt (1954) where the Court had observed that Article 25 guarantees freedom not only to entertain such religious belief as may be approved of by one's judgment and conscience, but also to exhibit his belief in such outward acts as he thinks proper.**
- **The Court further held that religion does prescribe rituals, ceremonies and modes of worship which are regarded as an integral part of religion.**
- **The Court was categorical in saying that 'what constitutes the essential part of religion is primarily to be ascertained with reference to the doctrines of that religion itself'.**
- **A five-judge Bench in The Durgah Committee, Ajmer (1961) said that freedom of religion protects only essential and integral practices of a religion and does not extend to practices, though religious in character may have sprung from merely superstitious beliefs and be extraneous and unessential accretions to religion itself**

Why Uplink frequency is greater than downlink frequency?

Factors Influencing Uplink Frequency Being Greater Than Downlink

Bandwidth Allocation

In telecommunications networks, the uplink frequency is often allocated more bandwidth than the downlink frequency. This is primarily due to the asymmetrical nature of data traffic, where users tend to consume more data than they transmit. By allocating more bandwidth to the uplink frequency, network operators can ensure a smoother and more efficient data transmission process.

Interference Management

Another factor that contributes to the uplink frequency being greater than the downlink frequency is interference management. In wireless communication systems, uplink transmissions are more susceptible to interference from external sources compared to downlink transmissions. By allocating a higher frequency band to the uplink, network operators can mitigate interference issues and improve overall signal quality.

Power Consumption

Efficient power management is a critical consideration in telecommunications networks. Transmitting data from user devices to base stations (uplink) typically requires more power than transmitting data in the opposite direction (downlink). By prioritizing the uplink frequency, network operators can optimize power consumption and enhance the overall energy efficiency of the network.

Network Capacity

In scenarios where network capacity is limited, prioritizing the uplink frequency can help optimize resource utilization. By allocating more resources to the uplink, network operators can accommodate the increasing demand for data transmission from user devices. This proactive approach ensures that the network can handle higher traffic volumes without compromising performance.

Security Considerations

Security is a paramount concern in modern telecommunications networks. By allocating a higher frequency band to the uplink, network operators can enhance the security of data transmissions from user devices to base stations. This approach helps safeguard sensitive information and prevents unauthorized access to the network, thereby ensuring data privacy and integrity.

Real-World Applications

Mobile Networks

In the context of mobile networks, the uplink frequency being greater than the downlink frequency is a common practice to support the asymmetric data traffic patterns of mobile users. By prioritizing the uplink frequency, mobile operators can deliver a seamless and reliable communication experience to their subscribers.

Satellite Communications

Satellite communications also rely on uplink frequencies being greater than downlink frequencies to facilitate efficient data transmission between ground stations and satellites. This approach helps optimize signal quality and minimize latency in satellite communication systems.

Internet of Things (IoT) Devices

The proliferation of IoT devices has further underscored the importance of uplink frequencies in enabling seamless connectivity and data exchange. By prioritizing the uplink frequency for IoT applications, network operators can ensure efficient data collection, transmission, and processing across a wide range of connected devices.

Future Trends in Uplink and Downlink Frequencies

5G and Beyond

The evolution of 5G technology and beyond is expected to bring significant advancements in uplink and downlink frequencies. With higher data rates and lower latency requirements, future networks will likely prioritize the uplink frequency to meet the growing demands of diverse applications and services.

Spectrum Sharing

Spectrum-sharing initiatives aim to optimize the utilization of available frequency bands by dynamically allocating resources based on demand. By leveraging spectrum sharing technologies, network operators can effectively manage uplink and downlink frequencies to enhance network efficiency and performance.

Emerging Technologies

Emerging technologies such as massive MIMO (Multiple Input Multiple Output) and beamforming are poised to revolutionize the way uplink and downlink frequencies are utilized in telecommunications networks. These technologies offer enhanced signal processing capabilities and improved spectral efficiency, paving the way for more robust and reliable communication systems.

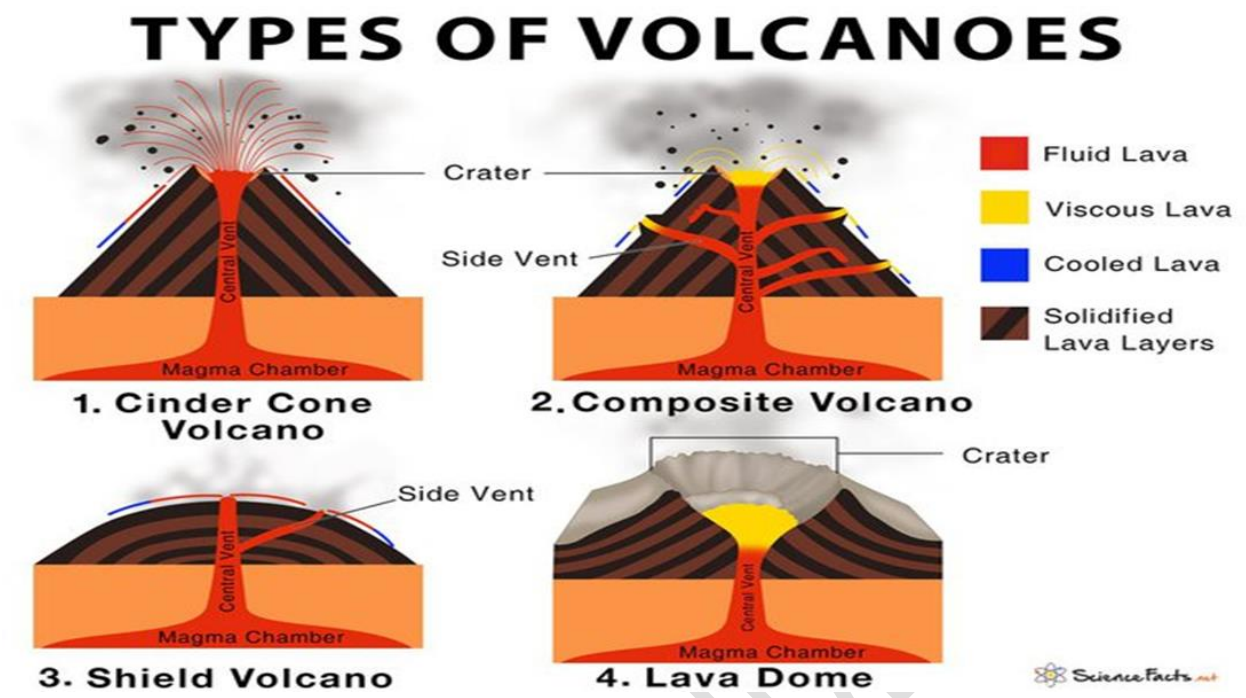
Conclusion

In conclusion, the decision to make the uplink frequency greater than the downlink frequency in telecommunications networks is driven by a combination of technical, operational, and strategic considerations. By understanding the factors influencing this disparity and exploring its real-world applications and future trends, we can gain valuable insights into the dynamic landscape of modern communication systems. As technology continues to evolve, optimizing uplink and downlink frequencies will remain a key priority for network operators seeking to deliver superior connectivity and performance to users worldwide.

Mount Etna & what is stratovolcano??

- **Craters erupt from Mount Etna, the largest active volcano in Europe, in Sicily, an island in Italy**
- **Mount Etna, active volcano on the east coast of Sicily.**
- **The name comes from the Greek Aitne, from *aithō*, "I burn."**
- **Mount Etna is the highest active volcano in Europe, its topmost elevation being about 10,900 feet (3,320 metres).**
- **Like other active volcanoes, it varies in height, increasing from deposition during eruptions and decreasing from the periodic collapse of the crater's rim.**

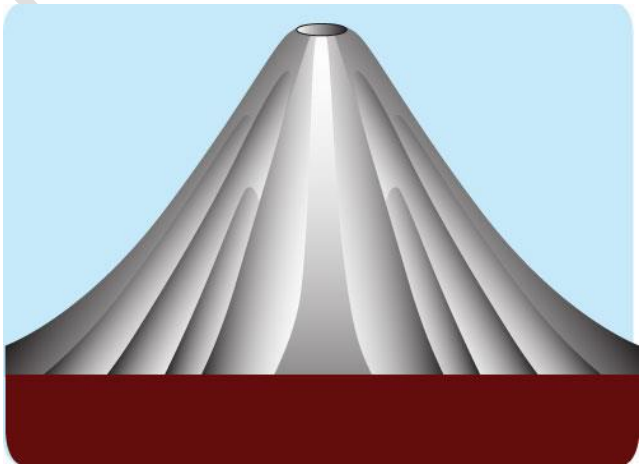
Mount Etna is the highest Mediterranean island mountain and the most active stratovolcano in the world.



- **A stratovolcano, also known as a composite volcano, is a conical volcano built up by many layers of hardened lava and tephra**

Stratovolcano

- **Stratovolcanoes have relatively steep sides and are more cone-shaped than shield volcanoes. They are formed from viscous, sticky lava that does not flow easily.**
- **The lava therefore builds up around the vent forming a volcano with steep sides. Stratovolcanoes are more likely to produce explosive eruptions due to gas building up in the viscous magma.**



- **Andesite (named after the Andes Mountains), is perhaps the most common rock type of stratovolcanoes, but stratovolcanoes also erupt a wide range of different rocks in different tectonic settings.**

Gharial (Gavialis gangeticus)

Distinguished from other crocodilians by its elongated snout, the gharial (Gavialis gangeticus) was believed to have been wiped out from the Brahmaputra river system during the 1950s, though there were claims of sightings in 1990.

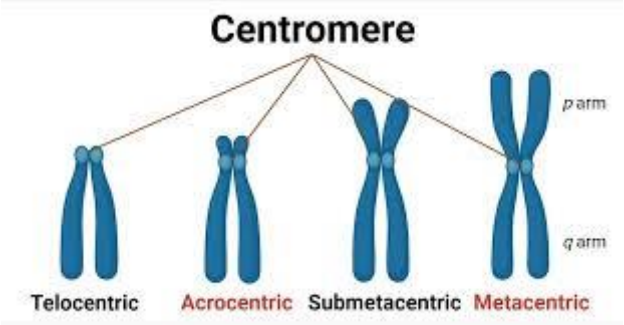
- **Gharials were once widely distributed in the large rivers that flow in the northern part of the Indian subcontinent.**
- **These included the Indus, Ganga, Brahmaputra, and Mahanadi-Brahmani-Baitrani river systems of India, Bhutan, Bangladesh, Nepal and Pakistan.**
- **They are also thought to have been found in the Irrawaddy River of Myanmar.**
- **Today, their major population occur in three tributaries of the Ganga River: the Chambal and the Girwa Rivers in India and the Rapti-Naryani River in Nepal.**
- **The Gharial reserves of India are located in three States – Uttar Pradesh, Madhya Pradesh and Rajasthan.**
- **Conservation status:**
- **IUCN: Critically Endangered**

  IWPA: Schedule I

- **CITES: Appendix I**

What is bio dosimetry?

- **Bio dosimetry allows one to determine the amount of radiation to which an individual was exposed based on changes in blood, urine, or hair.**
- **It would be particularly useful in a radiological event where the exposed individuals do not carry any personal radiation monitoring devices.**
- **The gold standard bio dosimetry assay is measurement of chromosome aberrations, in white blood cells.**
- **When irradiated, DNA in the blood cells gets broken and is repaired within a few hours.**
- **In some cases, there is an incorrect repair, joining fragments from different chromosomes, forming a 'Dicentric Chromosome (DC)' – a chromosome with two centromeres.**
- **Because a DC can only be formed by radiation, measuring these chromosomes is a specific and sensitive indicator of past radiation exposure**



Five-year climate agenda for India

- **First, it has laid the foundation for global institutions such as the International Solar Alliance, the Coalition for Disaster Resilient Infrastructure, and the Global Biofuels Alliance, as well as shaped the Green Development Pact under its G-20 presidency last year.**
- **Second, for the first time, India has started talking about bolder and more ambitious emission mitigation targets.**
- **The 2070 net-zero target and ambitious Nationally Determined Contributions (NDC) are milestones.**
- **With the net-zero announcement, India has acknowledged the criticality of absolute emission reductions over the near-term relative emissions-intensity-based targets.**
- **The net-zero goal has changed the debate domestically with various actors, policymakers and the private sector.**
- **Third, sustainability-linked domestic economic policies are no longer on the margins.**
- **'Go wider' means India has to adopt and strongly communicate sectoral emission reduction targets that go beyond the power sector.**
- **India has achieved significant progress in the power sector and will continue to do so to keep pace with its international non-fossil share-related and domestic renewable energy capacity targets.**
- **The next step is to broaden the target to other sectors.**
- **For instance, it could be related to the private mobility space, giving a clear target for zero-carbon two- and four-wheelers.**

- **This is not just an urban India project.**
- **It will help rural India become mobile, drive jobs in clean energy and sustainability, and promote economic growth**
- **Finally, going deeper implies that sub-national climate action and resilience must come to the fore**

Poliovirus

- **Poliovirus containment is focused on eradicating polioviruses. Wild poliovirus type 2 (WPV2) and wild poliovirus type 3 (WPV3) were declared eradicated in 2015 and 2019, respectively.**
- **There are three types of wild poliovirus (WPV): type 1, type 2, and type 3. People must protect themselves against all three types of the virus to prevent polio disease. Polio vaccination is the best protection.**
- **Type 2 wild poliovirus was declared eradicated in September 2015. The last detection was in India, in 1999.**
- **Type 3 wild poliovirus was declared eradicated in October 2019. It was last detected in November 2012. Only type 1 wild poliovirus remains.**
- **There are two vaccines used to protect against polio disease: oral polio vaccine and inactivated poliovirus vaccine.**
- **After wild poliovirus type 2 was declared eradicated in 2015, the world switched from trivalent OPV to bivalent OPV. Bivalent OPV contains poliovirus type 1 and 3.**
- **This switch means that the bOPV used globally no longer protects against WPV2.**
- **In rare instances, the vaccine-virus may be able to circulate over time and mutate in communities with insufficient immunity or immunocompromised individuals. These mutated OPV strains can cause polio disease.**
- **They are called poliovirus variants or vaccine-derived polioviruses (VDPVs).**

Inactivated poliovirus vaccine

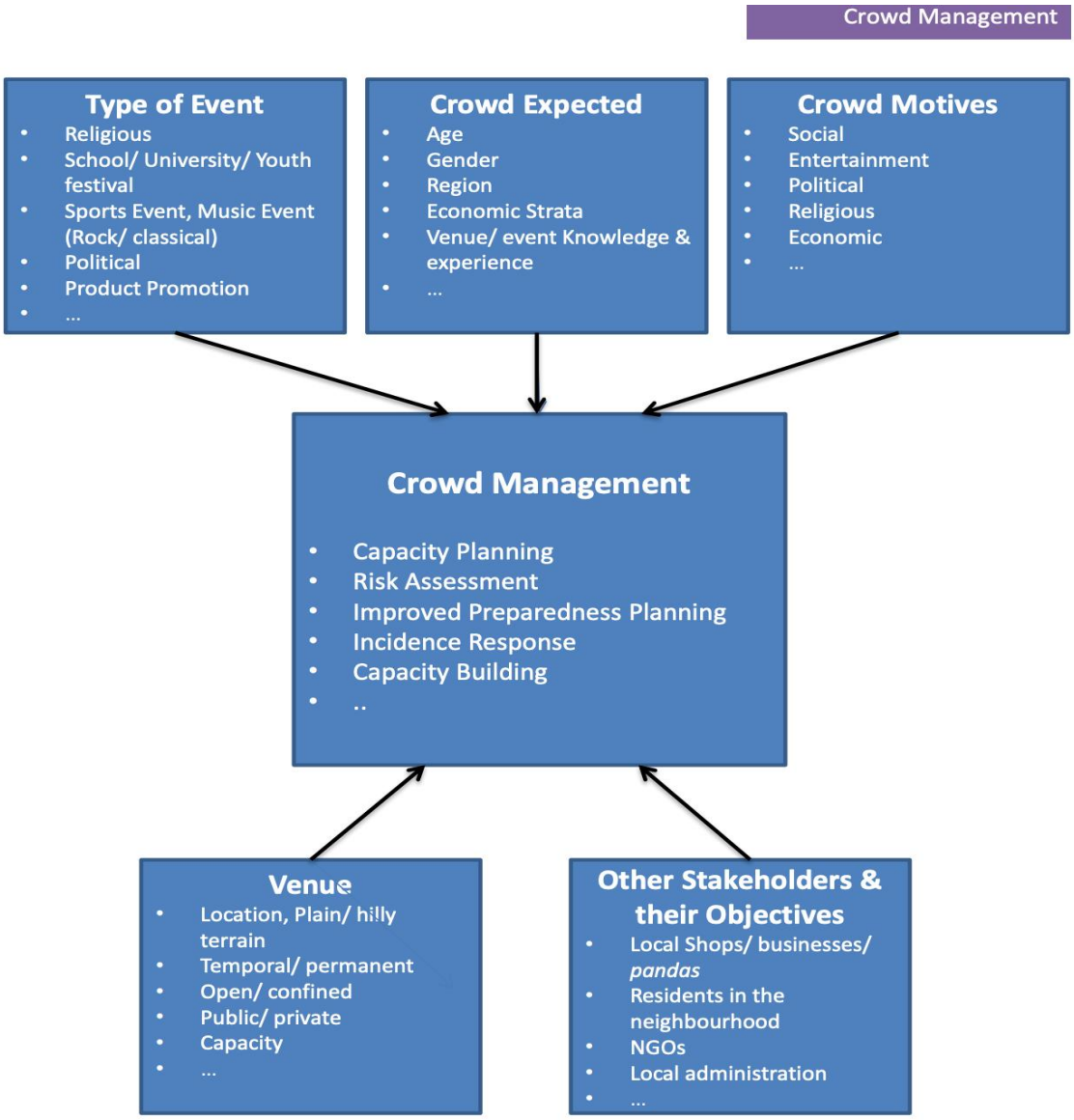
- **IPV protects people against all three types of poliovirus. IPV does not contain live virus and cannot cause disease. It protects people from polio disease but does not stop transmission of the virus.**
- **OPV can be used to contain a polio outbreak. Use of all OPV will stop when polio is eradicated globally. This will prevent re-establishment of transmission from VDPVs.**
- **Less than 1% of poliovirus infections result in paralysis.**
- **The virus is most often spread by the faecal-oral route.**
- **Poliovirus enters through the mouth and multiplies in the intestine. Infected individuals shed poliovirus into the environment for several weeks, where it can spread rapidly through a community, especially in areas of poor sanitation.**
- **The poliovirus consists of an RNA genome enclosed in a protein shell called a capsid.**
- **There are three serotypes of wild poliovirus type 1, type 2, and type 3 each with a slightly different capsid protein. Immunity to one serotype does not confer immunity to the other two.**
- **The ambitious goal of eradicating wild-type poliovirus type-1 (WPV1) by 2026 appears to have become tougher.**
- **WPV1, which is endemic only in Pakistan and Afghanistan, is showing signs of a resurgence since 2023. With Afghanistan and Pakistan reporting six WPV1 cases each in 2023**

Spiral galaxy

- **Spiral galaxies are twisted collections of stars and gas that often have beautiful shapes and are made up of hot young stars. Most of the galaxies that scientists have discovered so far are spiral galaxies, as opposed to the other two main categories of galaxy shapes elliptical and irregular.**
- **The Milky Way – the galaxy that includes Earth and our solar system – is an example of a spiral galaxy.**
- **Spiral galaxies make up roughly 72 percent of the galaxies that scientists have observed,**

- **Most spiral galaxies contain a central bulge surrounded by a flat, rotating disk of stars. The bulge in the center is made up of older, dimmer stars, and is thought to contain a supermassive black hole.**
- **Approximately two-thirds of spiral galaxies also contain a bar structure through their center, as does the Milky Way.**
- **One of the largest known spiral galaxies is NGC 6872, which is 522,000 light-years across from the tips of its outstretched spiral arms — that's about 5 times the size of the Milky Way.**
- **In 2017, astronomers discovered an 11-billion-year-old ancient spiral galaxy called A1689B11. Its discovery will help scientists understand how galaxies transition from "highly chaotic, turbulent discs" to more organized and thinner discs, like that of the Milky Way.**

NDMA Guidelines on crowd management



2.2.3. Crowd Control

- More than anticipated crowd at store/mall/political rallies/ examinations/ religious gatherings/ public celebrations
- Underestimation of audience, staffing, services
- People allowed in excess of holding capacity due to overselling of tickets for an event
- Limited holding area before the entrance
- Lack of access control
- Closed/locked exit
- Sudden opening of entry door
- Reliance on one major exit route
- Uncontrolled parking and movement of vehicles
- Callous indifference in regulating traffic
- Lack of adequate and strong railings to marshal the queue.
- Lack of sectoral partitions to segregate assembled crowd
- Lack of proper public address system to control crowd

2.2.4. Crowd Behaviour

- A wild rush to force the way towards entrance/exits
- Crowds attempting to enter a venue after the start/closing time
- A collision between large inward flows and outward flows
- Rush during distribution of disaster relief supplies
- A large number of pilgrims trying to board a ferry for a sacred island site
- Free distribution of gifts/toys/food/Prasad/alms/blankets/cash/clothes triggering a surge and crush
- Tussle to catching a glimpse/autograph of a celebrity
- A large (much more than expected) anxious and competitive crowd gathering because of limited period promotional events at malls
- Rush to get covered/free/unnumbered seats at the venue
- Scramble to get event tickets
- Crowds trying to re-enter the venue (flows inward/outward flows mixed)

Factory accident

- **According to the Convention, there must be sufficient qualified and well-provided inspectors and they shall enter the establishments freely and without prior notice at any time to secure due compliance of the labor laws, among others.**
- **Instead of liberalizing the inspection system, governments must ensure a strong labor market governance by implementing the provisions of the ILO Convention.**

- **Given the fast-paced changes taking place in technology, and the use of hazardous and chemical substances, the increased need for inspection is felt.**
- **Inspectors can both "inspect" and "facilitate" due compliance of laws by providing suitable advice to employers and unions. This is recognised by the ILO Convention. The recurrence of the same kind of industrial disasters shows a lack of learning**
- **The state cannot abrogate its fundamental duty to ensure a safe working and living environment.**

Clean sea initiative

- **Through the Clean Seas platform, UNEP is connecting and rallying individuals, civil society groups, industry and governments to catalyze change and transforming habits, practices, standards, and policies around the globe to dramatically reduce marine litter and its negative impacts.**
- **Since its launch in 2017, the campaign has become a catalyst for change, transforming habits, practices, standards, and policies around the globe.**
- **To date, 69 countries have joined, making the Clean Seas Campaign the biggest, most powerful global coalition devoted to ending marine plastic pollution. Commitments by signatory countries now cover more than 76 percent of the world's coastlines.**

  Land-locked countries are also coming on board, seeing the value of its source-to-sea approach. Countries, businesses, and individuals have pledged to turn the tide on plastic waste.

  The Clean Seas campaign contributes to the goals of the Global Partnership on Marine Litter, a voluntary open-ended partnership for international agencies, governments, businesses, academia, local authorities and non-governmental organizations to cooperate and innovate on tackling marine litter and plastic pollution.

Smart cities mission

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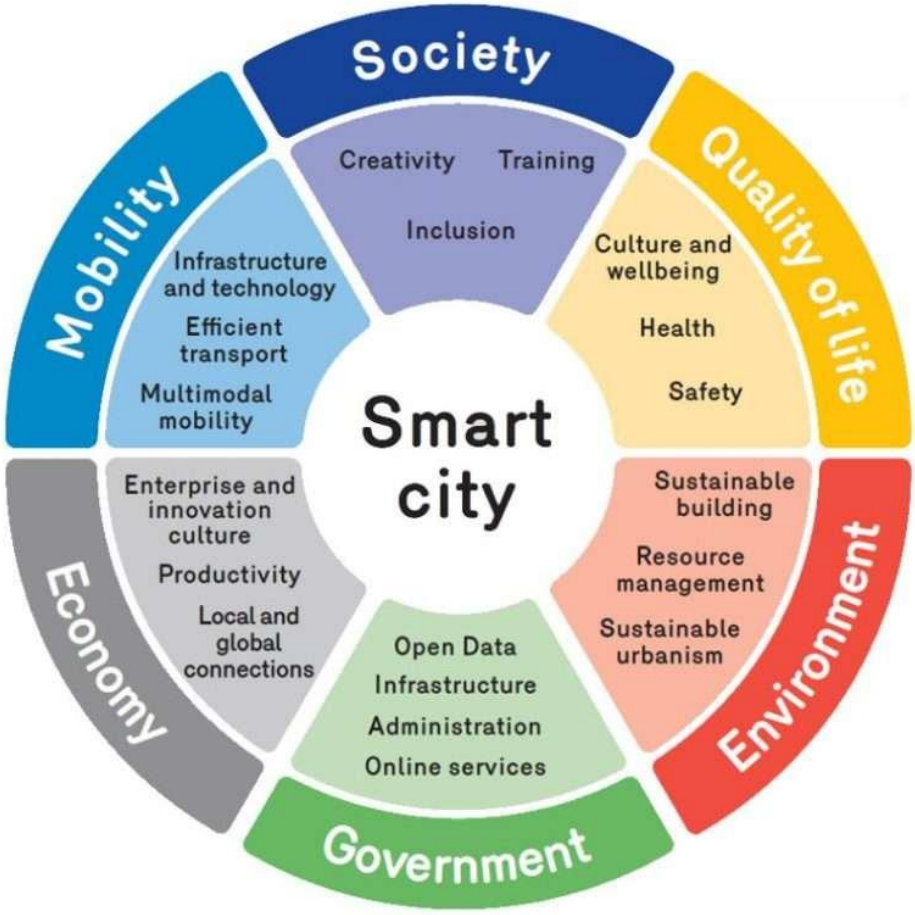
Smart Cities Mission (SCM)

- **The Centre has extended the Smart Cities Mission (SCM) under the Union Urban Development Ministry till March 31, 2025.**
- **Under the SCM, launched in June 2015, 100 cities were chosen through a competition to be developed as smart cities.**
- **The mission envisions developing areas within selected cities in the country as model areas based on an area development plan, which is expected to have a rub-off effect on other parts of the city and nearby cities and towns.**

mbagdtopics.com

Smart City Mission India



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Poliovirus

- **In the mid-20th century, researchers widely believed the poliovirus could only be grown in cultures of nerve cells. This misconception was propagated by their inability to infect rhesus macaques by the oral route, and only by directly injecting the virus into the nervous system.**
- **At the time, they didn't know the problem was with the poliovirus strains they were using. The poliovirus has only one natural host humans and many of the early strains of the virus were isolated from humans and wouldn't infect non-human primates.**
- **Since scientists kept passing the virus through the brain tissues of macaques, it adapted to that mode of infection.**
- **The inability to culture polio in non-nerve cells was a major roadblock to developing a polio vaccine.**
- **. Since Africa was declared polio-free in August 2020, the wild poliovirus has been restricted to rural pockets of Afghanistan and Pakistan.**
- **But according to a recent report in Science, the virus is beginning to reappear in big cities in these two countries.**
- **This reemergence is a result of vaccine hesitancy due to misinformation, conflict, poverty, and limited access to these isolated regions.**
- **The WHO's Global Polio Eradication Initiative is thus set to miss its deadline of eradicating polio by the end of 2024**

Vaccine development

- **Salk made the first successful vaccine using Enders' method to grow the virus. He inactivated the virus by treating it with formaldehyde, and injected it into his test subjects.**
- **The fragments of the inactivated virus were able to induce immunity .Albert Sabin developed the OPV that contained live polio strains weakened by growing them in macaque cells.**
- **Since Sabin's vaccine contained live virus particles, it had to rely on its natural mode of infection and was therefore administered orally**

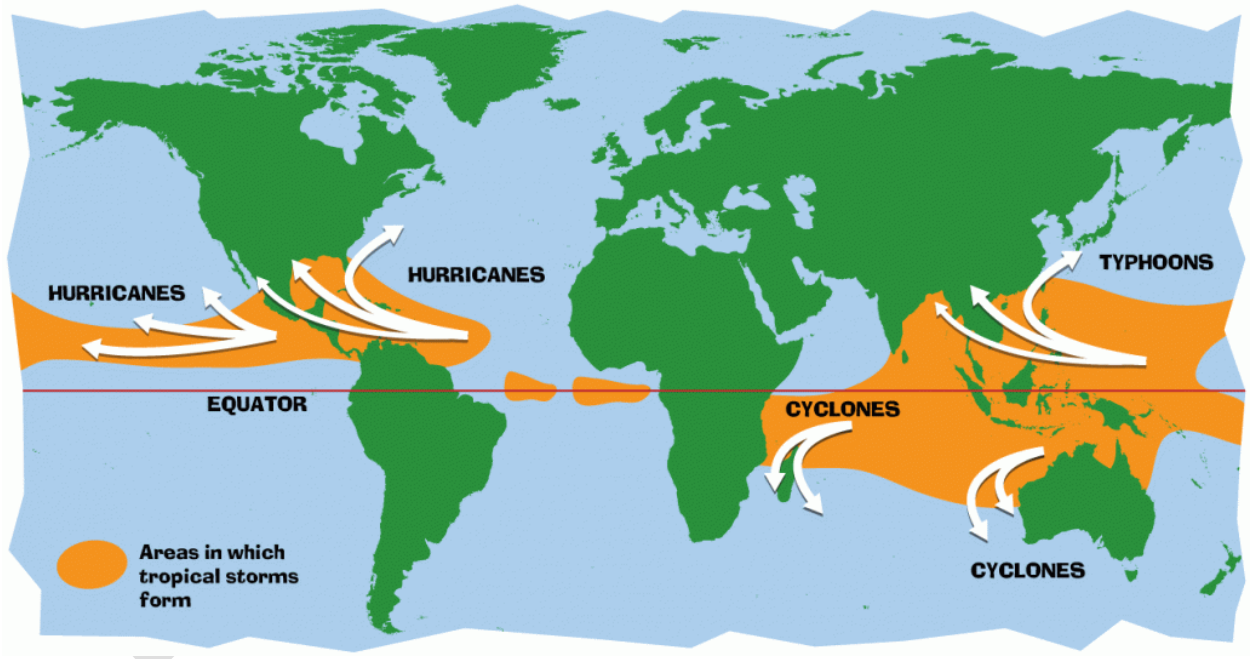
- **Occasionally, the weakened virus in the OPV would revert, and do the very job it was designed to prevent: cause polio.**
- **On the other hand, the IPV, while being a less potent vaccine, contained inactivated virus particles and carried no risk of causing vaccine-induced polio.**
- **The world has used both vaccines in the fight against polio. While some countries, such as Norway, Sweden, Finland, and Iceland, relied exclusively on IPV, most countries have used a combination of the two.**
- **The latter countries prefer the OPV for its superior protection and ease of administration. When the number of natural polio cases drops to zero, they switch to IPV for its enhanced safety**

How do we grow taller at night??

- **In a growing child, the growth hormone is secreted in pulses overnight.**
- **This acts through several intermediary steps to cause lengthening of the bones at the end-plates (epiphyses).**
- **Another factor concerns the inherent curvatures of the spinal column.**
- **This has a convexity backward in the thoracic or chest region, called kyphosis, and a concavity in the lumbar region or base of the back called lordosis.**
- **These curves vary with body weight and position**

BIG SHOT

- A pier at high tide after the passage of Hurricane Beryl in Oistins near Bridgetown, Barbados, on Monday. Hurricane Beryl brought devastating winds and heavy rain to several Caribbean islands on the day as the earliest-ever Category 4 storm on record churned westward. AFP



How do tropical storms and hurricanes get their names?

- **According to the World Meteorological Organization, there are six alphabetical lists of names for Atlantic storms and hurricanes that are rotated every six years. This means the 2024 list will be used again in 2030.**

- **The list, which is maintained by the WMO, covers only 21 letters of the alphabet, as "it is difficult to find six suitable names (one for each of the 6 rotating lists) starting with Q, U, X, Y and Z," per the WMO.**
- **The first storm of the season, which ends on Nov. 30, is given a name that begins with A, the second B, the third C and so on.**
- **The next storm or hurricane of the 2024 season will be called Debby, with the list ending in William.**
- **According to the WMO, assigning names to hurricanes and storms is done to make tracking and discussing specific storms more straightforward.**
- **"Naming also helps to avoid confusion among meteorologists, media, emergency management agencies and the public,"**
- **"Additionally, naming tropical cyclones can aid historical record-keeping and research on storm behaviour and impacts.**
- **A developing cyclone is named when it officially becomes a tropical storm, meaning it has sustained winds of at least 39 mph,**
- **A tropical storm becomes classified as a hurricane once maximum sustained winds reach 74 mph.**
- **The National Hurricane Center began keeping a list of names in 1953, per the WMO.**
- **Only female names were initially used before male names were introduced, alternating with the female ones, in 1979. The six current lists have been in rotation since then, with a few names having been retired and replaced.**
- **The decision to remove names is determined at a committee meeting.**

But what happens if the list of alphabetical names runs out?

- **During a particularly active hurricane season, the WMO uses a supplemental list of names in lieu of the Greek alphabet, which was used until 2021.**
- **According to the WMO, extra names have only had to be used twice in 2005 and 2020.**

BIG SHOT

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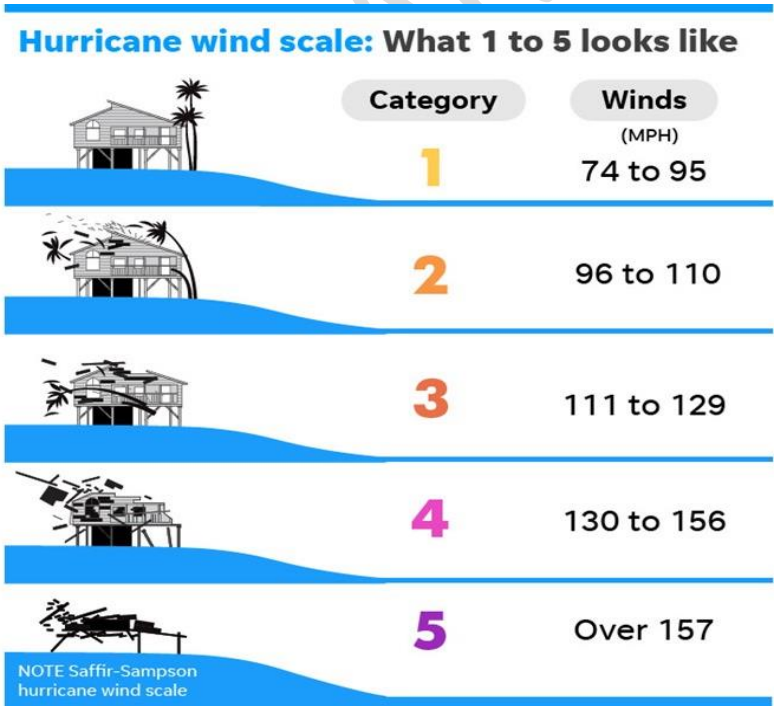
- 

Why is Hurricane Berryl unique??

- **the hurricane became the earliest major hurricane in the Atlantic in 58 years, as well as the only hurricane in June to reach Category 4 intensity.**

- **Experts say the chart-topping hurricane forming so early into the season which spans June to November is due to climate change-linked rising ocean temperatures.**
- **Warm sea surface temperatures are conducive to providing the lower atmosphere the heat and moisture that fuel tropical storm systems."**

Polar Cyclone	Tropical Cyclone
Form in middle latitude belt of westerlies and move west to east	Form in belt of Tropical easterlies and move east to west
Active mainly in winter	Form in transition period i.e., transition summer to winter, winter to summer
Frontal in character	Non frontal vortex
Isobars are oval shaped	Isobars are circular in shape
Generally moderate pressure gradient	Steep to very steep pressure gradient
Strong winds are equator-ward and reach gale force of ≥39 mph	Strong winds are pole ward, exceed gale force, may reach hurricane force≥74 mph
Heavy rain near the center	Heavy rain in SE quadrant
Decay after occlusion	Rapidly weaken after striking coast due to land friction
Spiraling of wind may go upto 20 km	Spiraling of wind not beyond 14 km
No eye in the center	May develop an eye in the center
Not associated with tidal wave	Accompanied with tidal wave storm/surge
Less destructive in nature	Very destructive on sea and coast
Cannot become tropical cyclone	May become extra-tropical cyclone

AI and Digital jurisprudence

- **One of the most persistent and contentious issues in Internet governance has been the fixing of liability on "intermediaries" for content hosted by them.**
- **The landmark Shreya Singhal judgment addressed this by upholding Section 79 of the IT Act which grants intermediaries 'safe harbor' protection against hosting content, contingent upon meeting the due diligence requirements outlined in Section 3(1)(b) of the Information Technology (Intermediaries Guidelines) Rules.**
- **However, its application to Generative AI tools remains challenging. There are contrasting views on the role of GAI tools.**

- **Some argue that they should be considered intermediaries since they are used almost like a search engine even though they do not host links to third-party websites.**
- **Others argue that they are mere "conduits" for user prompts, where altering the prompt leads to changes in output essentially making the generated content akin to third-party speech, and, therefore, attracting lesser liability for the content generated.**
- **In Christian Louboutin Sas vs Nakul Bajaj and Ors (2018), the Delhi High Court held that safe harbour protection applies solely to "passive" intermediaries, referring to entities functioning as mere conduits or passive transmitters of information.**
- **However, in the context of Large Language Models (LLMs), making a distinction between user-generated and platform-generated content is increasingly challenging.**
- **Additionally, liability in the case of an AI chatbot arises once the information is reposted on other platforms by the user; a mere response to a user prompt is not considered dissemination.**

The copyright conundrum

- **Section 16 of the Indian Copyright Act 1957 specifically provides that "no person" shall be entitled to protection of copyright except by the provisions of the Act.**
- **As in India, reluctance persists regarding the provisions of copyright protection to works generated by AI globally.**
- **The critical questions are: should existing copyright provisions be revised to accommodate AI?**
- **If AI-generated works gain protection, would co-authorship with a human be mandatory? Should recognition extend to the user, the program itself, and by extension, the programmer, or both?**
- **The 161st Parliamentary Standing Committee Report found that the Copyright Act of 1957 is "not well equipped to facilitate authorship and ownership by Artificial Intelligence".**

- **Under current Indian law, a copyright owner can take legal action against anyone who infringes on his/her work with remedies such as injunctions and damages.**
- **However, the question of who is responsible for copyright infringement by AI tools remains unclear.**
- **The landmark K.S. Puttaswamy judgment (2017) by the Supreme Court of India established a strong foundation for privacy jurisprudence in the country, leading to the enactment of the Digital Personal Data Protection Act, 2023 (DPDP).**
- **Generative AI introduces a new layer of complexity.**
- **The DPDP Act introduces the "right to erasure"as well as "right to be forgotten".**
- **However, once a GAI model is trained on a dataset, it cannot truly "unlearn" the information it has already absorbed. This raises a critical question.**
- **How can individuals exercise control over their personal information when it is woven into the very fabric of a powerful AI model?**

Steps to pursue

- **First, learning by doing. Consider granting GAI platforms temporary immunity from liability following a sandbox approach.**
- **Sandboxes allow AI technologies to be tested in a real-world setting under regulatory oversight. -**
- **This approach allows responsible development while gathering data to identify legal issues that could inform future laws and regulations.**
- **Second, data rights and responsibilities. The process of data acquisition for GAI training requires an overhaul.**
- **Developers must prioritise legal compliance by ensuring proper licensing and compensation for the intellectual property used in training models. Solutions could include revenue-sharing or licensing agreements with data owners.**

- **Third, licensing challenges. Licensing data for GAI is complex as web-data lacks a centralized licensing body similar to copyright societies in the music industry.**
- **A potential solution is the creation of centralized platforms, akin to stock photo websites such as Getty Images, which simplify licensing, streamline access to necessary data for developers and ensure data integrity against historical bias and discrimination**

The Access Network (AN) and the Core Network (CN)

- **The connectivity for mobile devices is enabled via a cellular (mobile) wireless network.**
- **A cellular network, such as a 5G network, includes a set of network equipment connected by communication links.**
- **They work together to move data between different devices and to other networks such as the Internet**
- **. A cellular network can be divided into two sub-networks: The Access Network (AN) and the Core Network (CN)**

What are access and core networks?

- **The AN consists of base stations that provide wireless connectivity to mobile devices in a limited geographical area, called the coverage area.**
- **A network operator usually installs base stations across the length and breadth of the region to be covered.**
- **These stations can be seen in the form of towers with boxes with antennae on top.**
- **The CN of a cellular network has equipment that provides connectivity to other networks, such as the Internet.**
- **Unlike AN base stations, the CN operates in a central location, and possibly far from any of the base stations.**
- **The CN is linked to a base station by an optical Fibre link called the backhaul.**

- **Data from a user's device must pass through both a base station and the CN to reach its desired destination, such as the Internet or another user's device.**
- **Even if two users are nearby and are connected to the same or adjacent base stations, the data must pass through the central CN.**
- **The CN is essential to support user mobility, a key feature offered by cellular networks.**

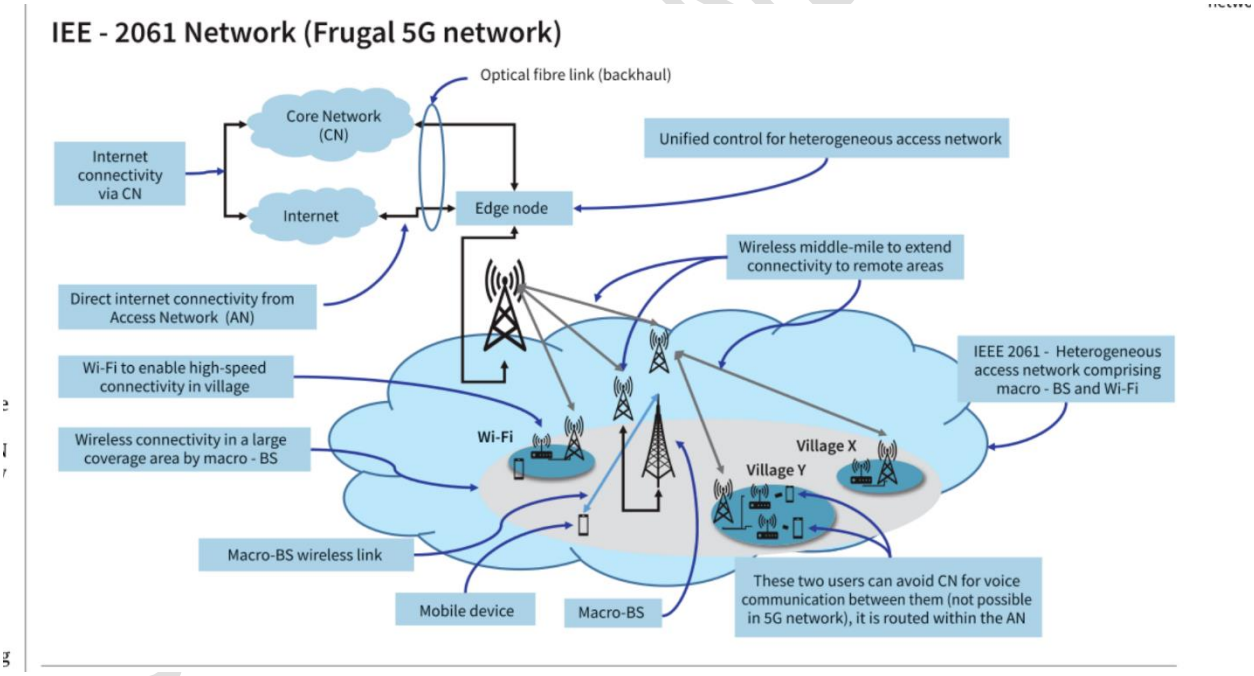
What impedes rural connectivity?

- **According to the latest Telecom Subscription Data from the Telecom Regulatory Authority of India, urban tele-density in the country is 127% while rural tele-density is 58%.**
- **Put another way, on average, an urban user has one or more mobile connections (1.27) whereas only one out of two rural users (0.58) is connected. This data suggests an urban-rural digital divide.**
- **The situation in most other developing countries is similar or worse.**
- **An important factor impeding the deployment and/or use of cellular networks in rural areas is the relatively lower income of the people here.**
- **A big chunk of the rural population Finds mobile services unaffordable.**
- **Other relevant characteristics of rural areas are lower population density, populations distributed in clusters (villages) often separated by vast empty spaces and remoteness.**
- **Taking fiber infrastructure to a far-of village, say, in the Himalayas, to connect the base station there may neither be cost-effective nor easy**

What is the IEEE 2061-2024 standard?

- **The standard defines a wireless network architecture for affordable broadband access in rural areas.**
- **It was approved on June 6 by the Institute of Electrical and Electronics Engineers (IEEE).**
- **The IEEE-2061 network also includes a CN and AN similar to cellular networks.**

- **However, the IEEE-2061 AN is heterogeneous wherein different types of base stations coexist: it includes base stations covering large coverage areas called macro-BS supplemented by small coverage area Wi-Fi.**
- **It is different from the 5G network, where the AN is homogeneous comprising base stations of the same type and typically smaller coverage area.**
- **The macro-BS in IEEE-2061 can be built with any cellular technology that can support a large coverage area.**
- **While the macro-BS provides large-area coverage but possibly lower data rate, Wi-Fi is deployed within villages to provide high-speed connectivity.**
- **A key capability of the system is that it allows a device to move from a Wi-Fi based connectivity to a macro-BS connectivity without any service disruption.**
- **This is enabled by an integrated AN control functionality in the IEEE-2061 network.**



What is a middle-mile network?

- **Further, the IEEE-2061 standard proposes the use of a multi-hop wireless middle-mile network to extend connectivity to areas where optical- • fibre links are not available.**

- **A multi-hop wireless middle-mile provides cost-effective connectivity over long distances, eliminating the need for costly and difficult-to-deploy optical fibres.**
- **An IEEE-2061 network can flexibly use one or more technologies like satellites, or long-range Wi-Fi for the middle-mile.**
- **The IEEE-2061 AN also has a direct and alternate path to the Internet, unlike the (4G/5G) network, where Internet connectivity is possible only via the CN.**

UNESCO Creative Cities Network (UCCN)

- **Kozhikode became part of the UNESCO Creative Cities Network (UCCN) as the city was awarded the title of "City of Literature" at the 16th annual conference of the network that began in Portugal**
- **The theme of the annual conference of UCCN this year is "Bringing youth to the table for the next decade"**
- **The new members, including Kozhikode and Gwalior, which was awarded the "City of Music" title, will get an opportunity to make a presentation on their respective traditions and cultures in a session.**
- **UNESCO offers 'Creative Cities' status to cities across the globe based on their cultural contributions and traditions in categories like design, film, literature, music, and folk art.**
- **The annual conference will provide the member cities with a platform to share knowledge, experiences, and good practices for building sustainable cities of tomorrow.**

Project - 75I & API

- **The Navy's mega-submarine deal under Project-75I, estimated at over ₹43,000 crores, has crossed a major milestone in the process with the field evaluation trials (FET) to check the compliance of the bids received now complete.**
- **There are two contenders in the fray: Germany's Thyssenkrupp Marine Systems (TKMS) and Navantia of Spain**

AIP Module

- **Air-independent propulsion (AIP), or air-independent power, is any marine propulsion technology that allows a non-nuclear submarine to operate without access to atmospheric oxygen (by surfacing or using a snorkel).**
- **AIP can augment or replace the diesel-electric propulsion system of non-nuclear vessels.**
- **Modern non-nuclear submarines are potentially stealthier than nuclear submarines;**
- **although some modern submarine reactors are designed to rely on natural circulation,**
- **most naval nuclear reactors use pumps to constantly circulate the reactor coolant, generating some amount of detectable noise.**
- **Non-nuclear submarines running on battery power or AIP, on the other hand, can be virtually silent.**
- **While nuclear-powered designs still dominate in submergence times, speed, range, and deep-ocean performance;**
- **small, high-tech non-nuclear attack submarines can be highly effective in coastal operations and pose a significant threat to less stealthy and less-maneuverable nuclear submarine**

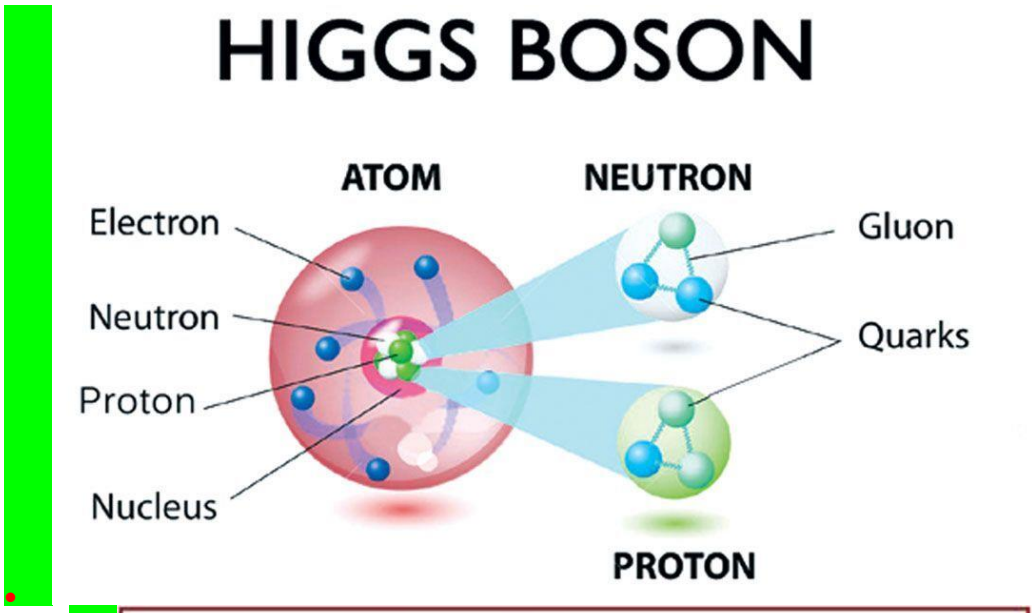
Top Quark

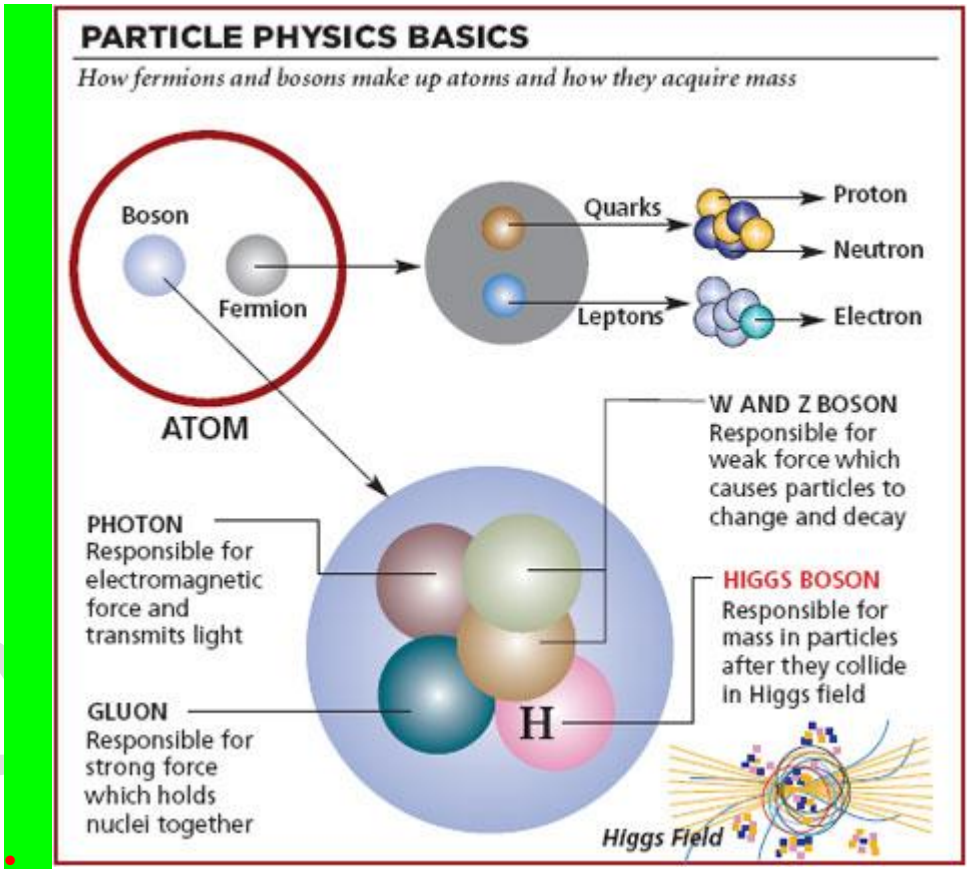
- **More energetic particles often break down into ones with less energy.**
- **The greater the difference in energy between that of a particle and the products of its decay, the less time the particle exists in its original form and the more quickly it breaks down.**
- **By the mass-energy equivalence, a more massive particle is also a more energetic particle.**
- **And the most massive particle scientists have found to date is the top quark.**
- **It is 10 times heavier than a water molecule, about three times as much as a copper atom, and 95% as much as a full caffeine molecule.**
- **As a result, the top quark is so unstable that it could break up into lighter, more stable particles in less than 10−25 seconds.**

- **The top quark's mass is very important in physics. A particle's mass is equal to the sum of masses contributed from multiple sources.**
- **An important source for all elementary particles is the Higgs field, which pervades the entire universe.**
- **A "field" is like a sea of energy and excitations in the field are called particles.**
- **This way, for example, an excitation of the Higgs field is called the Higgs boson just as an electron can be considered to be an excitation of an 'electron field'.**
- **All these fields engage with each other in specific ways. When the 'electron field' interacts with the Higgs field at energies much less than 100 GeV, for example, the electron particle will acquire some mass.**
- **The same thing goes for other elementary particles. (GeV, or giga-electron-volt, is a unit of energy used in the context of subatomic particles: 1 joule = 6.24 billion GeV.)**
- **If the top quark is the most massive subatomic particle, it is because Higgs bosons interact most strongly with it.**
- **By measuring the top quark's mass as precisely as possible, then, physicists can learn a lot about the Higgs boson as well**

What is Higgs Boson?

- **The Higgs boson, sometimes called the Higgs particle, is an elementary particle in the Standard Model of particle physics produced by the quantum excitation of the Higgs field, one of the fields in particle physics theory.**





Tianlong-3

- **Tianlong-3 is a medium-lift orbital launch vehicle developed by the Chinese private aerospace manufacturer Space Pioneer.**

- **It is designed to be partially reusable, with the first stage capable of performing an autonomous vertical landing and being reused up to 10 times**
- **Tianlong-3 is part of Space Pioneer's efforts to develop low-cost, reusable launch vehicles to compete in the growing commercial launch market.**
- **It aims to provide launch services for medium-sized payloads to low Earth orbit (LEO) and sun-synchronous orbit (SSO)**

Hosur Airport

- **Tamil Nadu Chief Minister M.K. Stalin announced in the legislative assembly plans for setting up an international airport on 2,000 acres of land, with the capacity to handle three crore passengers annually, in the industrial town of Hosur, which is 40 kms away from Bengaluru.**
- **While the airport has been a long standing demand of the industrialists in the area, one of the hurdles is that the concession agreement signed between the Centre and the Bangalore International Airport Ltd (BIAL), the operator of Kempegowda International Airport Bengaluru, does not allow for new or existing airports (except for Mysore and Hassan airports) within an aerial distance of 150 km before 2033.**

What do the Union Civil Aviation Ministry's guidelines state?

- **As per the present guidelines of the Civil Aviation Ministry, the regulator Directorate General of Civil Aviation (DGCA) while granting a licence to operate a greenfield airport should take into account that no greenfield airport would be allowed within an aerial distance of 150 km of an existing civilian airport.**
- **In case a greenfield airport is proposed to be set up within 150 km of an existing civilian airport, the impact on the existing airport would be examined and such cases would be decided by the government on a case-to-case basis.**
- **Such an application shall be first considered by the Steering Committee, headed by the Secretary of Civil Aviation.**
- **After considering the application, the Steering Committee shall make a suitable recommendation to the Ministry of Civil Aviation.**
- **The Ministry shall place the matter before the Union Cabinet for its consideration and the DGCA will grant a license only after their approval.**

- **In 2017, the Centre granted in-principle approval for a greenfield airport at Jewar in Greater Noida based on the recommendations of the Steering Committee on Greenfield Airports.**

What are Greenfield Airports?

- **Greenfield airports are aviation facilities built from scratch on previously undeveloped or empty land.**
- **The term "greenfield" emphasizes their environmentally friendly characteristics, as they aim to minimize the impact on nature during the construction and commissioning processed**
- **Kalaburagi (project cost Rs 175.57 crore)**
- **Orvakal (Kurnool) (project cost Rs 187 crore)**
- **Sindhudurg (project cost Rs 520 crore)**
- **Itanagar (project cost Rs 646 crore)**
- **Kushinagar (project cost Rs 448 crore)**
- **Mopa (project cost Rs 2870 crore)**

Of these, Kushinagar and Mopa are international airports.

What is IMAX?

- **IMAX is a motion picture film format. It consists of a production pipeline of high-resolution cameras, film formats, projectors, and theatres.**
- **Developed in Canada in the 1970s, IMAX seeks to give the viewer an immersive movie-watching experience with its large screens.**
- **IMAX theatre screens have a tall aspect ratio of 1.43:1, meaning that the width of the screen is 1.9 times the height of the screen**

Mule Account

- **A mule account is a trading account maintained with a stock broker or a dematerialized account or bank account linked with such trading account that is controlled by another person.**
- **These accounts could be used for illegal activities such as money laundering and avoiding taxes.**