January 2024

SAURABH PANDEY
CSE

PDF Monthly compilation 2024

For IAS/Civil Service Exams
Coverage of all important Articles of UPSC CSE

About Author

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

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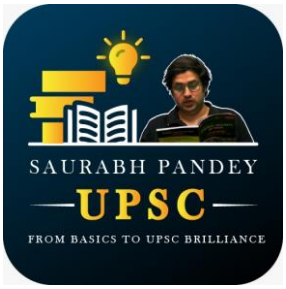

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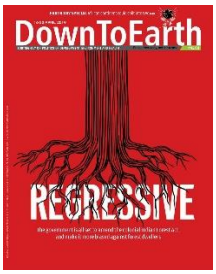

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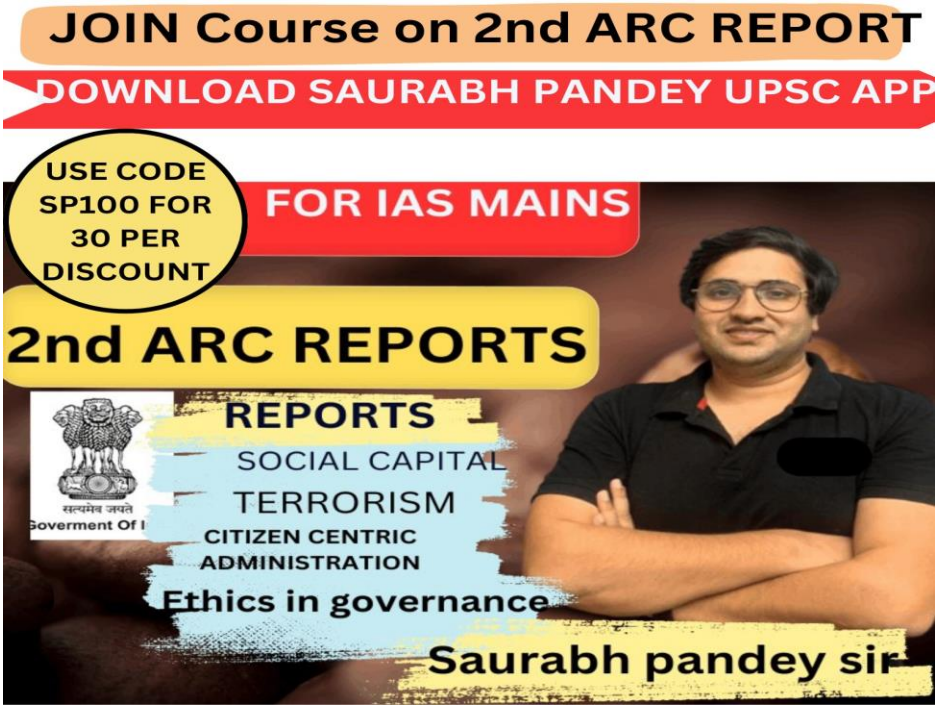

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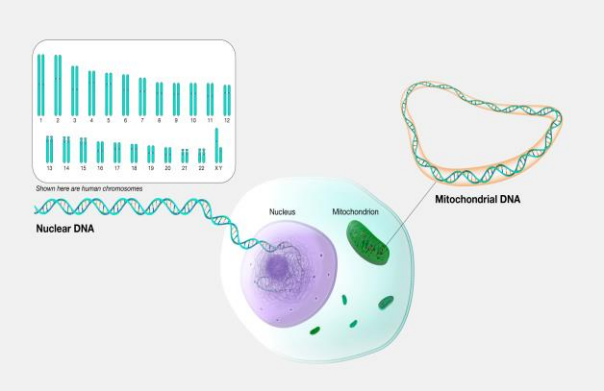
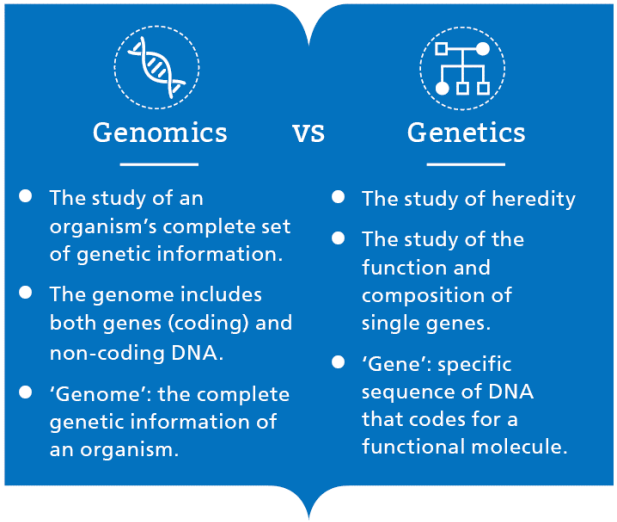
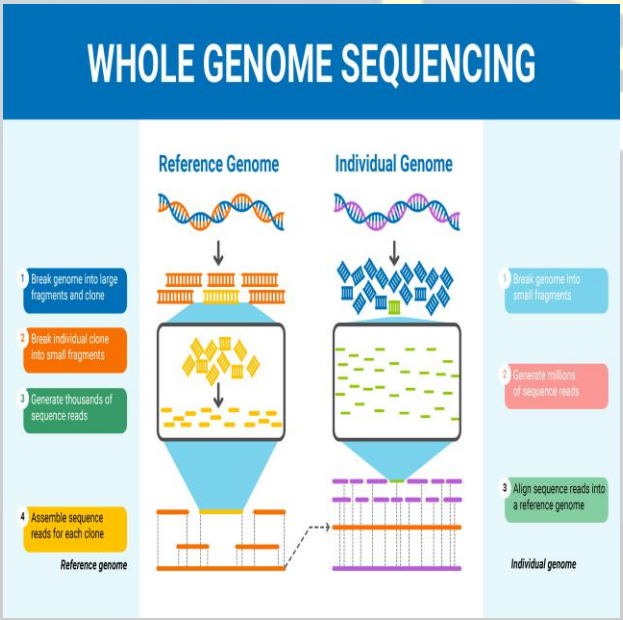
Current Affairs 1st January 2024 by Saurabh Pandey

Genome sequencing AND HEALTH





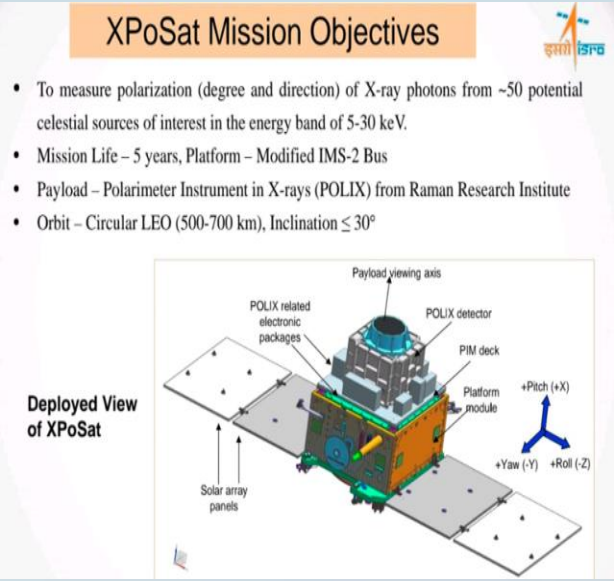


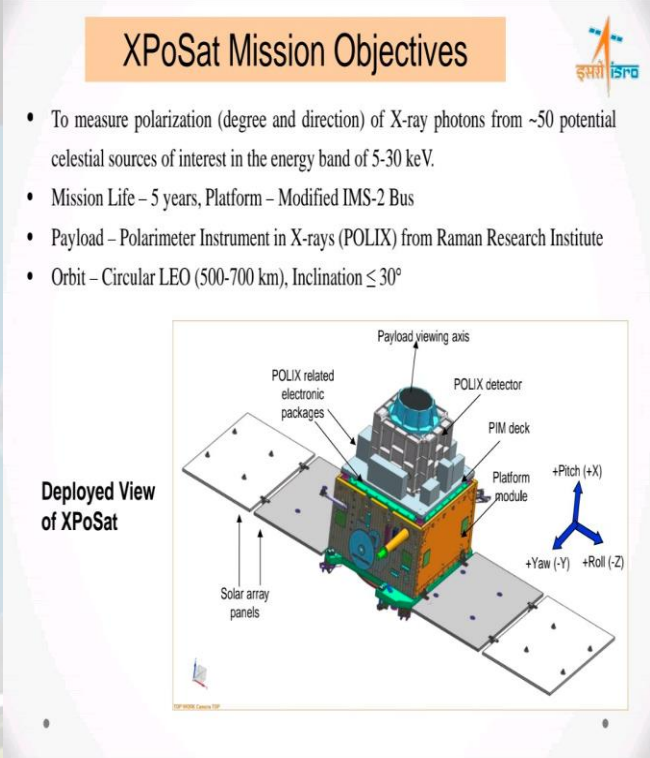
- **In the last two decades, the landscape of genomics and the utility of genetic information in healthcare have both undergone a revolutionary transformation, marked by the increasing affordability and accessibility of personal genomes. Today turned mainstream, offering to empower individuals with unprecedented insights into their genetic makeup.**
- **The lower costs associated with genome sequencing technologies particularly with advancements in next-generation sequencing- have played a pivotal role in this democratization. This accessibility has catalyzed large-scale initiatives and population-wide projects that try to harness the power of genetic data to improve healthcare.**
- **The convergence of technology and biology has also paved the way for more population-scale whole genome sequencing endeavours.**
- **Personal genome sequencing in particular can help us tailor treatments to individual genetic profiles and predict individuals' susceptibility to specific diseases**
- **Researchers have been analyzing the prevalence of incidental and actionable genetic information via population scale genome sequencing**

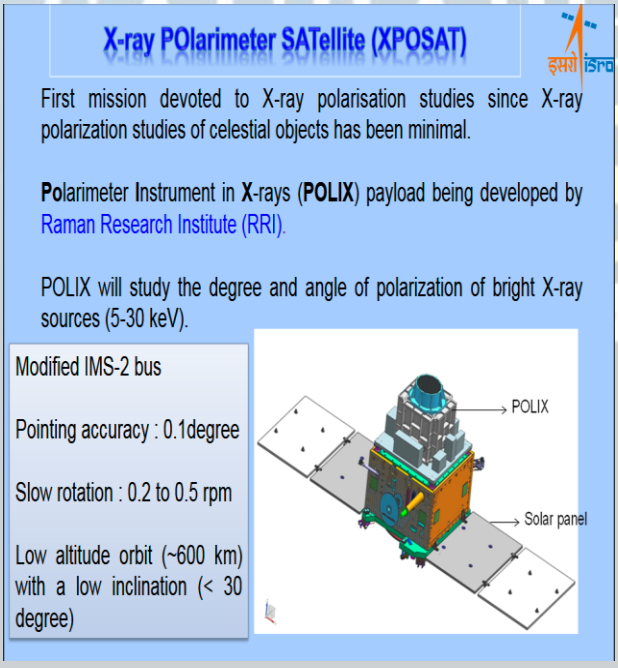
programs currently underway in many countries

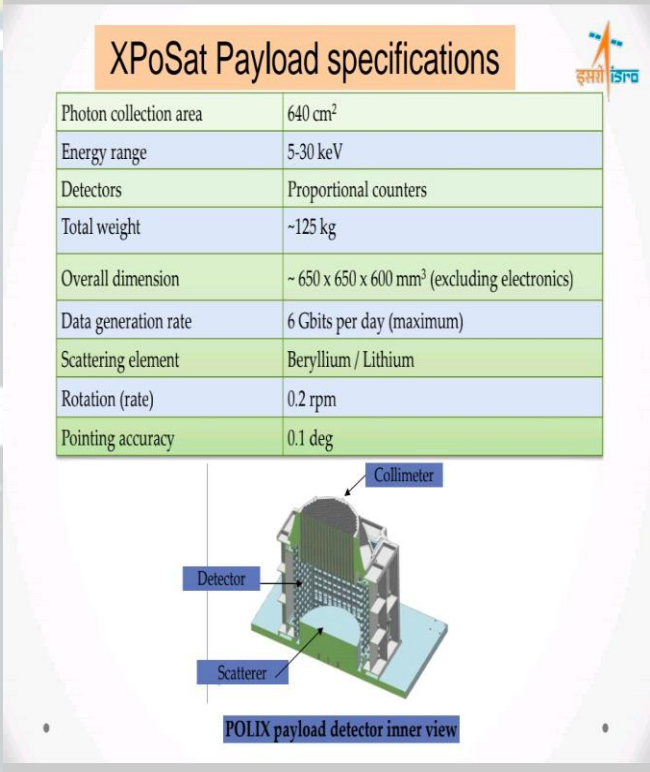
- **The Hindu**

XPoSat









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Mapping in news

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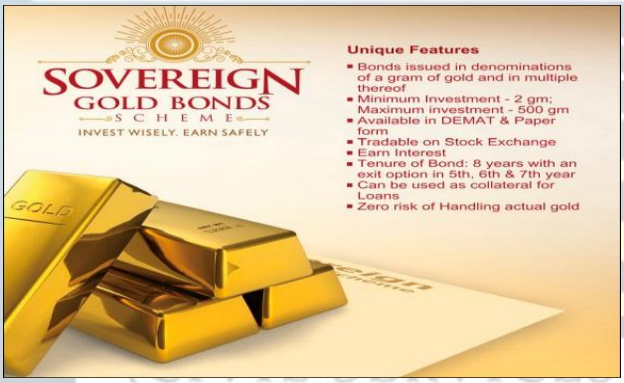
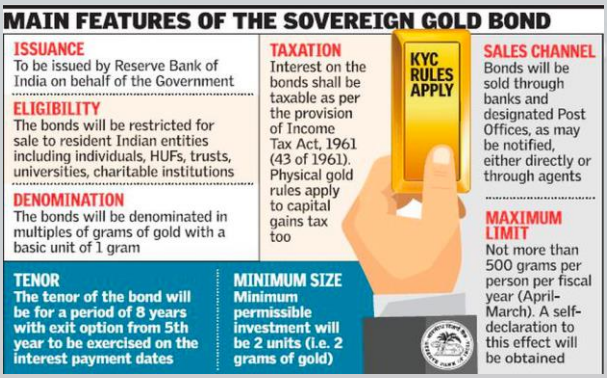
Broadcasting Regulation bill

Sovereign Gold bond





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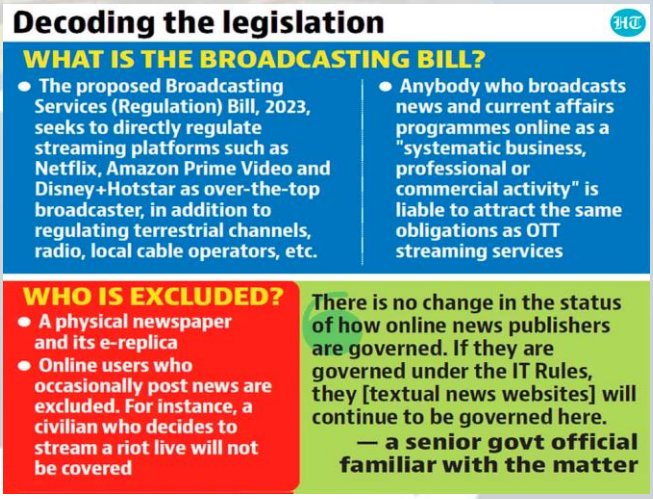

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The Broadcasting Services (Regulation) Bill broadens regulation to cover OTT platforms and digital content, introducing mandatory registration and a three tier regulatory system.

- **No person or broadcasting company can provide services or run a network without formal registration or intimation to the government.**
- **Cable and satellite operators must also gain approval to transmit programs. The Bill extends rules to internet based broadcasting services like IPTV and OTT platforms based on subscriber/viewer thresholds.**
- **A Content Evaluation Committee (CEC) is proposed for the certification of programs, and a self- regulatory framework involving committees and councils is outlined.**
- **The Bill allows government inspections without notice, and potential equipment seizures for violations, and mandates compliance within 30 days upon seizure.**
- **Critics fear potential censorship, its impact on free speech, and creativity, expressing concerns about excessive delegation of rulemaking and its subjective nature impacting online content creators' freedom.**

What are the main concerns?

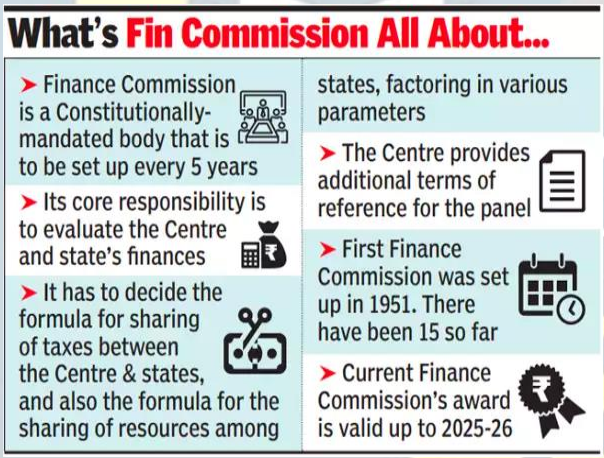
- **The broad scope of the Bill for traditional broadcasters, such as cable TV, and the evolving OTT space, which essentially has a different business model and content delivery mechanism, has drawn a mixed response from legal experts and advocates for digital freedom.**
- **Digital rights organisation Internet Freedom Foundation (IFF) has called for a cautious examination of the Bill due to the proposed codes' similarity to the Code applicable to cable TV and the increased censorship of TV programmes as a consequence.**
- **"This may affect the publisher's online free speech, freedom of journalistic expression and artistic creativity, & the citizen's right to access differing points of view because publishers will be compelled to only produce content which is palatable to the Union Government,".**
- **The group claims that exerting executive control over OTT content will lead to "over compliance and self-censorship" because platforms would aim to avoid the government's broad discretion when it comes to punishments.**
- **The IFF further notes that the Bill has left several provisions to be determined later by the Centre, arguing that such excessive**

delegation of rulemaking would create uncertainty for stakeholders.

The Hindu

16th finance commission

- **The government on appointed former NITI Aayog Vice Chairman Arvind Panagariya Chairman of the 16th Finance Commission, which will recommend the tax revenue sharing formula between the Centre and States for the five year period beginning April 2026.**



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Psychoanalysis

- The Delhi Police said the six individuals accused in the Parliament breach incident underwent psychoanalysis at a government institute in the city in order to ascertain their motives.
- The term 'psychoanalysis' is usually restricted to the medical literature on mental health when it isn't provoking suspicious questions
- Psychoanalysis is a type of treatment based on the theory that our present is shaped by our past.
- The unacknowledged meaning of personal experiences can influence our mood and behaviour, and contribute to problems with relationships, work, and self-esteem
- We are often unaware of how experiences can affect us.
- Painful feelings can remain in the unconscious mind influence our current mood and behavior and contribute to problems with self-esteem, personality, relationships, and work.
- Psychoanalysis helps a person take control of these influences by tracing them back to their origins and understanding how they have developed over time.

The unconscious mind

According to psychoanalysis, the unconscious mind gives hints of the unacknowledged meaning of experiences in different ways. Such hints may include:

- Repetitive behavior
- topics that the person finds difficult to talk about dreams daydreams, the nature of the patient–therapist relationship.
- The Hindu

India in 2023

- Developing countries, including India, asked rich nations to vacate carbon space by achieving negative carbon emissions, and not merely reaching net zero by 2050.
- India also submitted its third national communication to the U.N. Framework Convention on Climate Change on December 9.
- According to it, the country reduced GDP emission intensity by 33% between 2005 and 2019, achieving the target 11 years in advance.

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- On the wildlife front: an estimation exercise found the number of tigers has gone up in the Shivalik Hills Gangetic Plains landscape, central India and the Sundarbans, but dwindled in the Western Ghats and the Northeast Brahmaputra Plains due to habitat loss, fragmentation, and poaching.
- The cheetah conservation project drew sharp criticism over the deaths of six of the 20 adults imported from Namibia and South Africa.
- India also launched the International Big Cat Alliance, to conserve the world's seven principal big cats: tigers, lions, snow leopards, leopards, jaguars, pumas, and cheetahs. The Alliance is open to 97 countries and organisations.
- The government also amended forest conservation and biodiversity laws, inviting sharp criticism from several state governments, policy experts, and conservationists.
- The Forest (Conservation) Amendment Act applies to land recorded as 'forest' in government records, exempting certain categories of land from its purview.
- Conservationists argue that limiting the applicability of the FCA would invalidate the Supreme Court's 1996 judgment in the T.N. Godavarman Thirumulpad case, which said the Act was applicable to land covered under the "dictionary meaning of forests" or "deemed forests" (forests not officially recorded as forests).
- The amended Act exempts forest land up to 10 ha for constructing security related infrastructure and the area falling within 100 km of international borders, Line of Control and Line of Actual Control for "strategic and security related projects of national importance".
- The government also introduced changes to the Biological Diversity Act to help protect plants and resources in India.
- The goal was to encourage growing medicinal plants instead of taking them from the wild, support traditional Indian medicine, make it easier for research and patents, and involve more foreign investments.
- The Hindu

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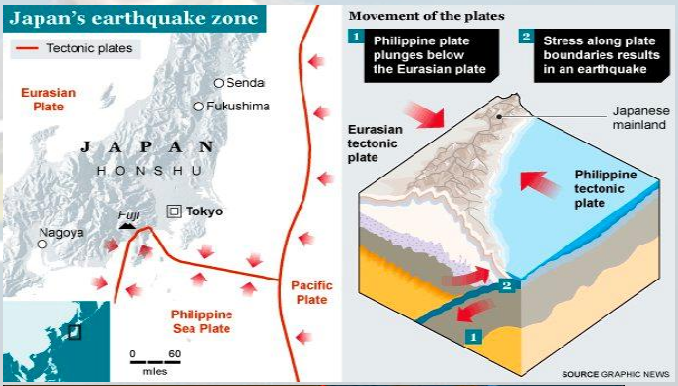
MOHAMMED Yunus

- Nobel peace laureate Muhammad Yunus was convicted on of violating Bangladesh's labour laws in a case decried by his supporters as politically motivated.
- Mr. Yunus, 83, is credited with lifting millions out of poverty with his pioneering microfinance bank but has earned the enmity of longtime Prime Minister Sheikh Hasina, who has accused him of "sucking blood" from the
- "banker to the poorest of the poor", was awarded the Peace Prize in 2006 for his work loaning small cash sums to rural women, allowing them to invest in farm tools or business equipment and boost their earnings.
- Grameen Bank, the microfinance lender he founded, was lauded for helping unleash breakneck economic growth in Bangladesh, and its work has since been copied by scores of developing countries.
- The Hindu

Why earthquake in japan?

- Earthquakes are common in Japan, one of the world's most seismically active areas.
- The island nation sits on the so-called Pacific "Ring of Fire"-- a term coined to refer to the Circum-Pacific Belt.
- Simply put-- it is a path along the Pacific Ocean characterised by active volcanoes and frequent earthquakes. According to scientists, the majority of Earth's volcanoes and earthquakes take place along the "Ring of Fire".
- 

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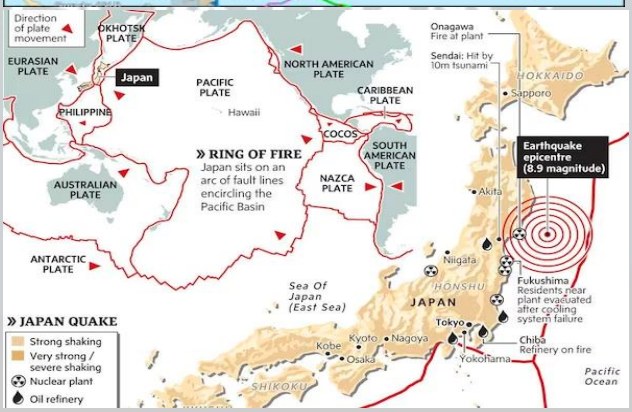
- 

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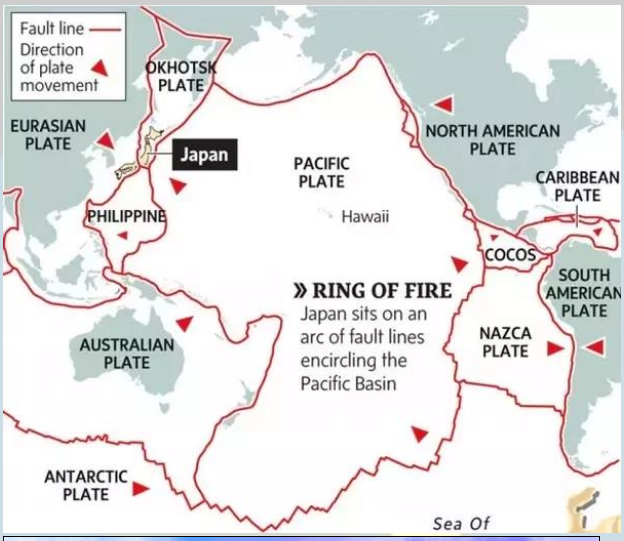
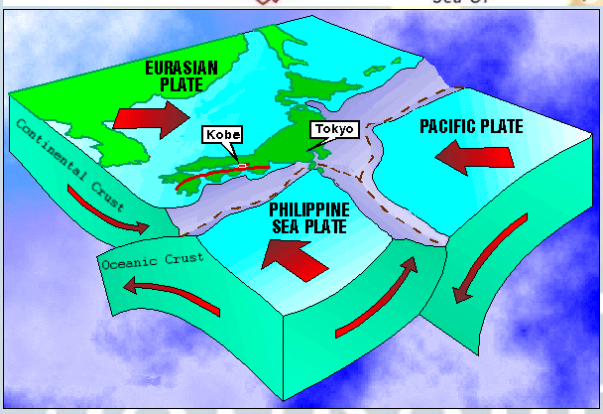




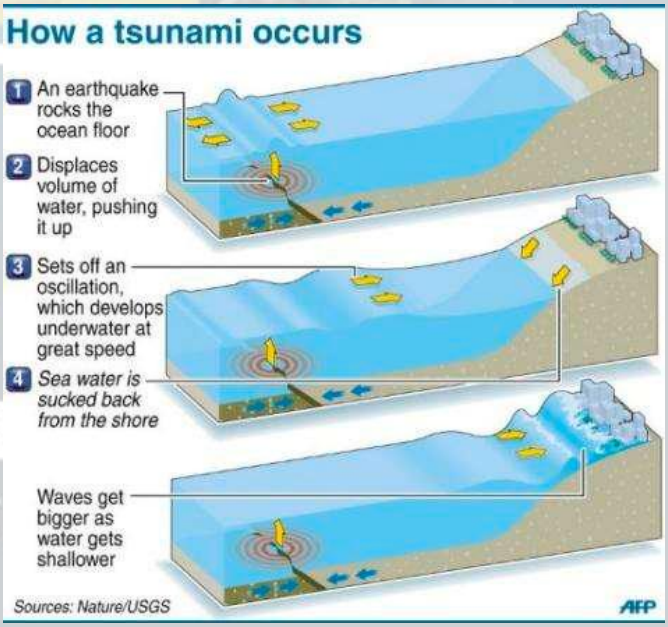
- **An earthquake occurs due to the stresses caused by the movements of tectonic plates that comprise the earth.**
- **Japan and earthquakes go hand in hand due to the country's position along the "Pacific Ring of Fire," where it lies across three tectonic plates, including the Pacific Plate under the Pacific Ocean and the Philippine Sea Plate.**

What is Tsunami

- **According to the National Ocean Service, tsunamis are giant waves caused by earthquakes or volcanic eruptions under the sea.**

Out in the depths of the ocean, tsunami waves do not dramatically increase in height.

- **But as the waves travel inland, they build up to higher and higher heights as the depth of the ocean decreases.**
- **The speed of tsunami waves depends on ocean depth rather than the distance from the source of the wave.**



- **Tsunami waves may travel as fast as jet planes over deep waters, only slowing down when reaching shallow waters.**
- **While tsunamis are often referred to as tidal waves, this**

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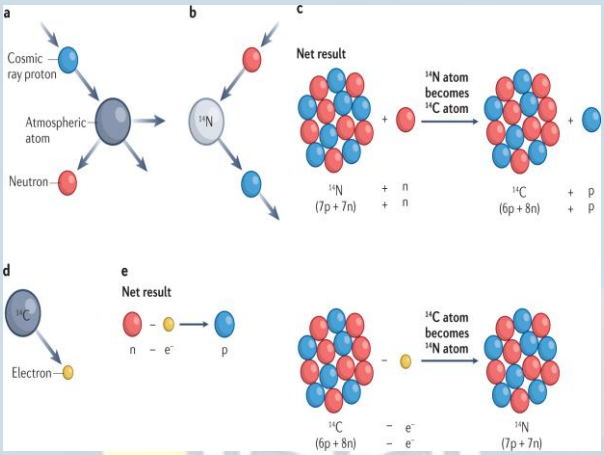
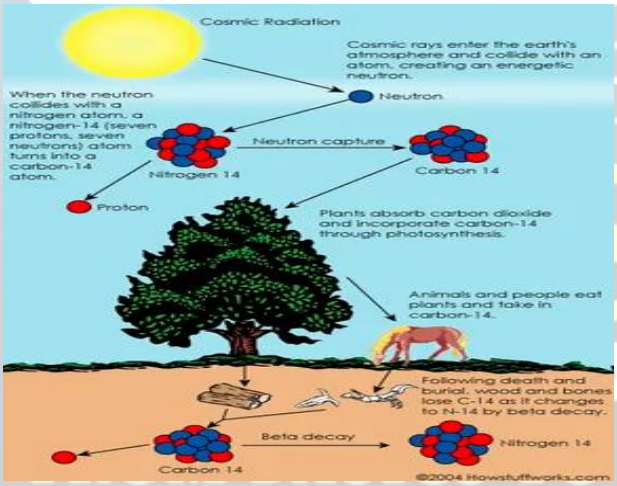
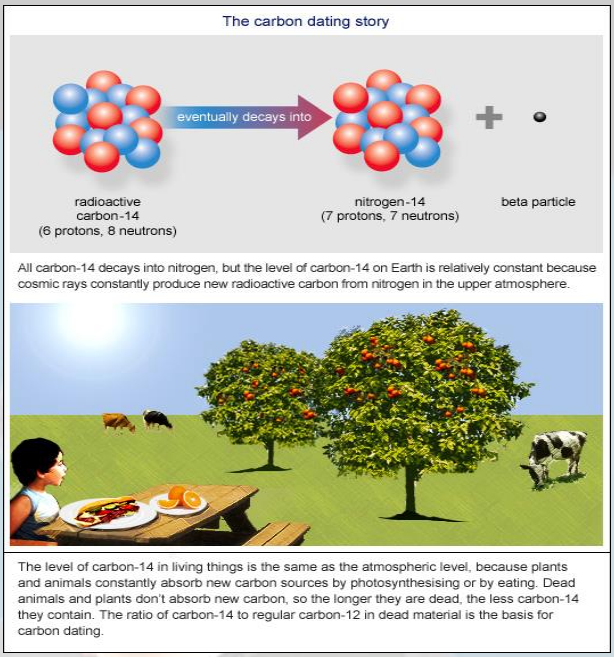
name is discouraged by oceanographers because tides have little to do with these giant waves.

The Hindu

Carbon dating







- **In the early 1940s, the American chemists Martin Kamen and Sam Ruben found a way to synthesise carbon 14 in the lab as well as that its half life – the time taken to decay to half its original mass – was around 5,000 years, and not a few hours as expected.**
- **In 1939, the Finnish American Physicist Serge Korff found that it's possible to produce carbon 14 by bombarding nitrogen 14 with neutrons – as cosmic rays do.**
- **Inspired by these findings, the American physical chemist Willard Libby is credited with conceiving the idea of using carbon 14 to date organic materials**

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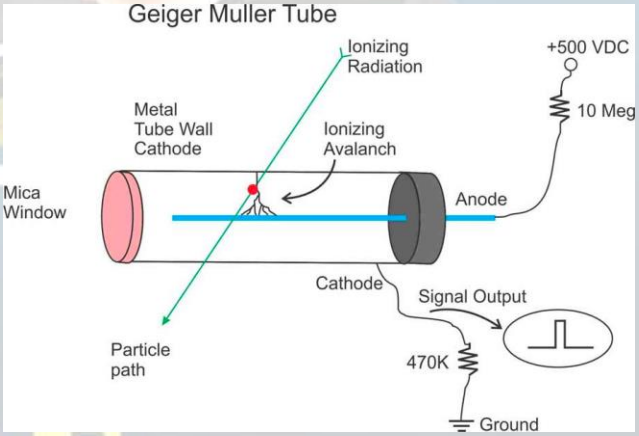
- Libby's idea made two assumptions that weren't exactly known to be true at the time.
- First, the concentration of carbon14 in the earth's atmosphere doesn't change across thousands of years. If it did, radiocarbon dating which dates organic materials by measuring the amount of carbon 14 they contain wouldn't work.
- Second, carbon 14, in the form of carbon dioxide and other carbon compounds, would have to be able to diffuse into the earth's various ecosystems such that the concentration of carbon 14 in the atmosphere was comparable to the concentration of carbon 14 in the planet's other biospheres.
- **What are the tools of radiocarbon dating?**
- The instrument of choice in Libby's time to study radioactive decay was the Geiger counter.
- It consists of a Geiger Muller tube connected to some electronics that interpret and display signals.
- The Geiger Muller tube contains a noble gas, such as helium or neon, and a rod passing through the centre.
- A high voltage is maintained between the tube's inner surface and the rod.
- The gas is insulating, so no current can pass between the two.
- But when energetic particles (including gamma radiation), such as those emitted during radioactive decay, pass through the gas, they can energise electrons in the gas's atoms and produce an electric discharge.



- The modern radiocarbon dating setup is more sophisticated, of course.
- For example, one of the most sensitive dating setups uses accelerator mass spectrometry (AMS), which can work with organic samples as little as 50 mg.

The Hindu

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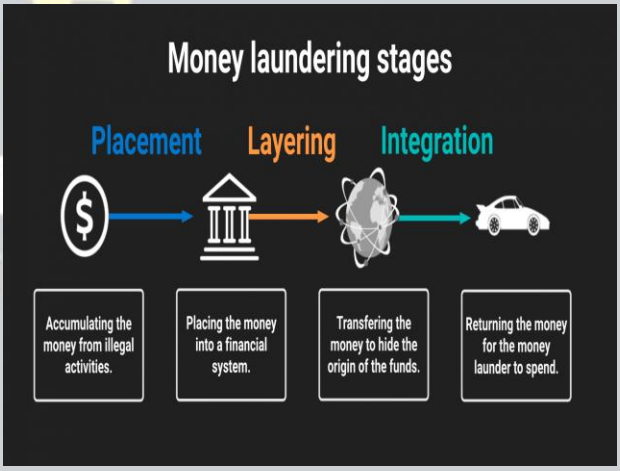
S. Venkitaramanan

- **S. Venkitaramanan** led RBI's efforts during India's severe balance of payments stress in 199091, including initiatives to raise international loans and pledging India's gold reserves, which salvaged the country's financial reputation and prevented a potential default.
- Under his leadership, RBI implemented import compression measures by raising cash margins on imports.
- This stringent strategy significantly reduced the current account deficit, stabilising the balance of payments.
- He also displayed openness by inviting diverse opinions and experts, including critical voices, to discuss critical economic matters, demonstrating an inclusive and non-hierarchical approach to decision making.

Financial Intelligence Unit India (FIU IND)

- the Financial Intelligence Unit India (FIU IND) issued show cause notices to nine offshore virtual digital asset service providers (VDA SPs), including Binance, Kucoin, Huobi, Bitfinex and MEXC Global, among others.
- This was for "operating illegally" without complying with the provisions of the Prevention of Money Laundering Act, 2002 (PMLA)



What considerations emerge when looking to regulate VDAs?

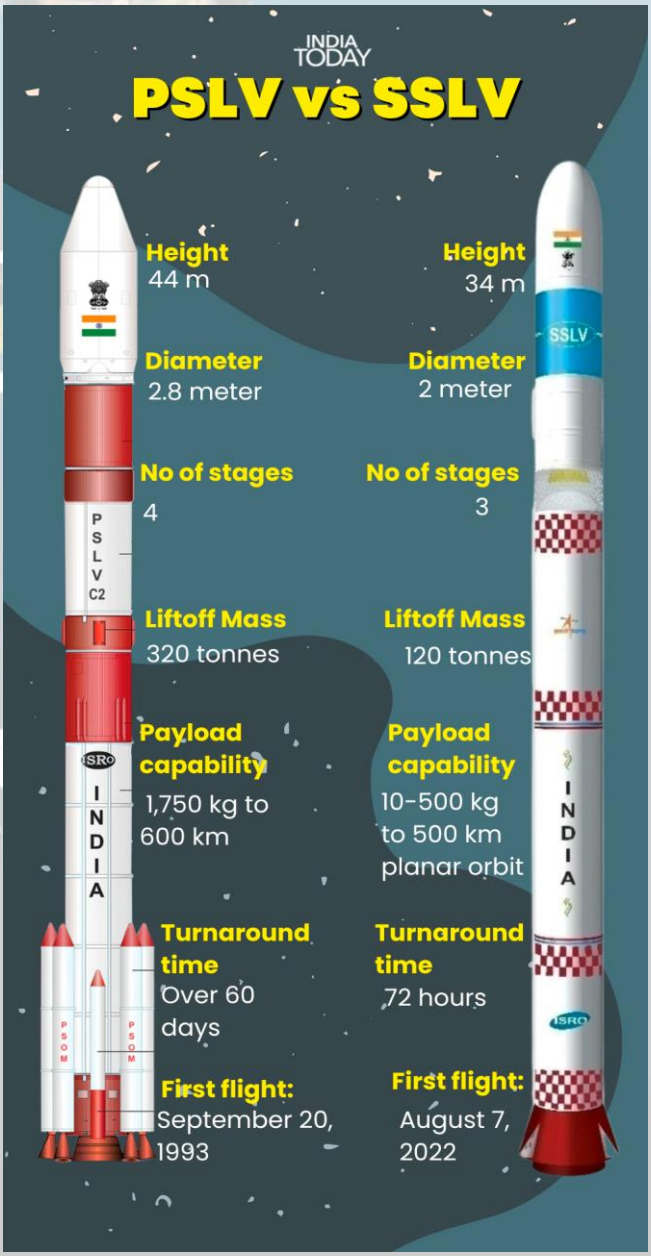
- The Bureau for International Settlements (BIS), which is the

global forum for cooperation among central banks, in a report about financial stability from crypto assets in emerging economies (August 2023) observed three high level policy options under consideration.

- These include an outright ban, containment and regulation. BIS observed that an outright ban may not prove enforceable.
- This is because of the pseudo anonymous nature of crypto markets.
- There could be a possibility that regulators lose all sight of the market, further shrinking their transparency and making them less predictable.
- Containment would imply controlling the flows between crypto markets and traditional financial systems
- About regulation, motivation to regulate the asset varies across jurisdictions.
- The report holds that it must be ensured that the benefits of regulating and supervising are greater than the costs involved.
- Furthermore, for emerging market economies three issues are of importance, that is: defining the (regulatory) authority or entity and their scope, then the scope of regulation in terms of either activity or entity, and lastly, filling in the data gaps to understand the technology and interconnections

The Hindu

PSLV



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The Hindu

INDIA KOREA

- A challenge that persists is the absence of a shared vision for a new comprehensive defence Framework, one that can provide a robust structure under which both nations can operate and align their policies to construct a novel and sustainable emerging regional order.
- The imperative for India and Korea is to transcend the confines of bilateral cooperation, and embrace a paradigm shift that cultivates a more profound understanding of their roles in the swiftly evolving global scenario
- It is incumbent upon Korea to comprehend that India is not merely the largest consumer of defence products.
- Rather, it stands as a regional power capable of substantial contributions to peace and stability in the Indo Pacific.
- A departure from Cold War mentalities, where the Korean government perceived India as standing in the opposite Soviet bloc, is imperative for Korea to forge a deeper, more meaningful partnership with India.
- This paradigm shift in Korean government strategic thinking is indispensable for any meaningful engagement between the two nations
- The unwavering focus of the Korean defence establishment on profit driven weapons sales to India,
- The emerging coalition of North Korea, China, and Russia poses a new serious challenge to

collaborative efforts between the two nations. Divergent stances may arise, necessitating a nuanced appraisal of each party's strategic imperatives

- Leveraging their technological capabilities, India and South Korea are aiming to collaborate in developing advanced defence systems and equipment.
- In an era where defence against space warfare, information warfare, and cybersecurity is paramount, both nations can further explore opportunities for cooperation
- Strengthening coordinated efforts to counter terrorism aligns seamlessly with the shared concerns of India and South Korea.
- There is potential for collaboration in maritime security, including joint patrolling and information sharing, given the significant maritime interests both countries have in the Indian Ocean.
- India and South Korea can leverage their United Nations peacekeeping expertise for collaborative efforts.
- Sharing insights and resources in peacekeeping operations can enhance regional and global stability, underscoring their joint commitment to peace and security.
- Additionally, joint exercises and the exchange of best practices in Humanitarian Assistance and Disaster Relief (HADR) demonstrate the shared responsibility of both nations in addressing vulnerabilities to natural disasters.
- Lastly, mutual growth is found in enhancing joint army exercises, fostering interoperability, and strengthening the capabilities of both armies for effective collaboration in diverse scenarios.

The Hindu

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Global nuclear order

- The global nuclear order (GNO) was no exception but, today, it is under strain.
- The GNO was created in the shadow of the Cold War, with the U.S. and the U.S.S.R., leading the western and the Socialist blocs, respectively.
- Following the 1962 Cuban Missile Crisis, when the two came perilously close to launching a nuclear war, both U.S. President John F. Kennedy and General Secretary Nikita Khrushchev understood two political realities.

- First, as the two nuclear superpowers, they needed bilateral mechanisms to prevent tensions from escalating to the nuclear level.
- And, second, nuclear weapons are dangerous and, therefore, their spread should be curbed. This convergence created the GNO. The third element of the global nuclear order came into existence in 1975.
- India had chosen not to sign the NPT, and in 1974, stunned the world by conducting an underground peaceful nuclear explosive, or PNE
- Today's nuclear world is no longer a bipolar world. The U.S. faces a more assertive China, determined to regain influence, regionally and globally.
- This rivalry is different from the Cold War because both economies are closely intertwined and further, and China is an economic and technological peer rival.
- Changing geopolitics has taken its toll on the treaties between the U.S. and Russia.
- In 2002, the U.S. withdrew from the Anti-Ballistic Missile (ABM) Treaty and in 2019, from the Intermediate Range Nuclear Forces (INF) Treaty on grounds that Russia was violating it.
- The only remaining agreement, New START, will lapse in 2026; its verification meetings were suspended during the COVID19 outbreak and never resumed.
- Strategic stability talks began in 2021 following the Geneva meeting between Presidents Joe Biden and Vladimir Putin, but collapsed with the Ukraine war.
- Last year, Russia DE ratified the CTBT to bring it on a par with the U.S.,

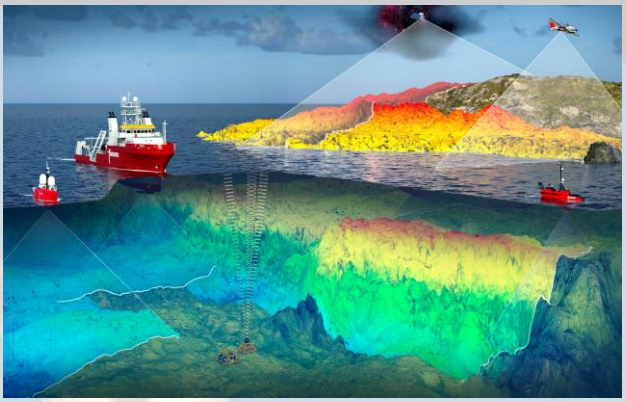
raising concerns about the resumption of nuclear testing.

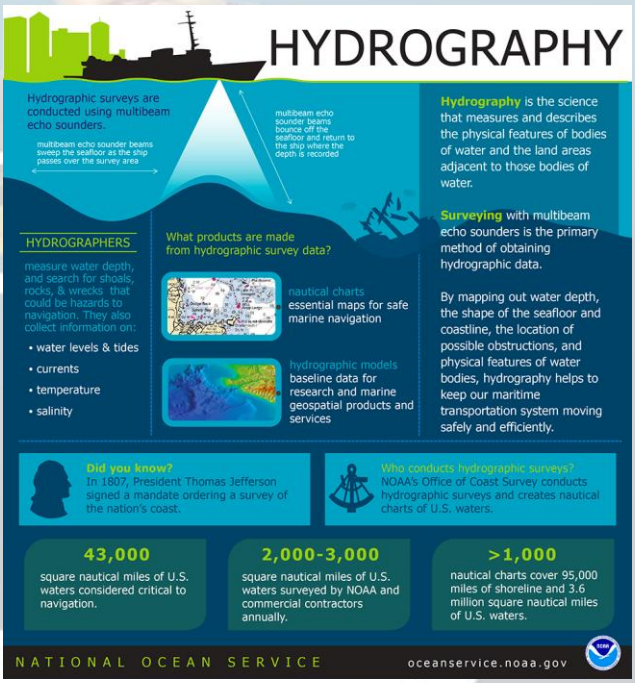
- During the Cold War, the U.S.'s nuclear umbrella tied its European allies closer.
- Today, domestic compulsions are turning the U.S. inwards, raising questions in the minds of its allies about its 'extended deterrence' guarantees, especially in East Asia.
- Japan, South Korea, and Taiwan have the technical capabilities to develop an independent nuclear deterrent within a short time, given political will.
- It is only a matter of time before U.S. pragmatism reaches the inevitable conclusion that more independent nuclear deterrent capabilities may be the best way to handle the rivalry with China.

The Hindu

Hydrography - India and Maldives

- The recent decision by the Maldives to revoke an agreement with India for joint hydrographic surveys in Maldivian waters has caused considerable dismal in Indian media and strategic circles.
- The move by Male, in mid-December 2023, came a few weeks after the archipelagic state formally asked New Delhi to withdraw its Indian military presence from its shores.



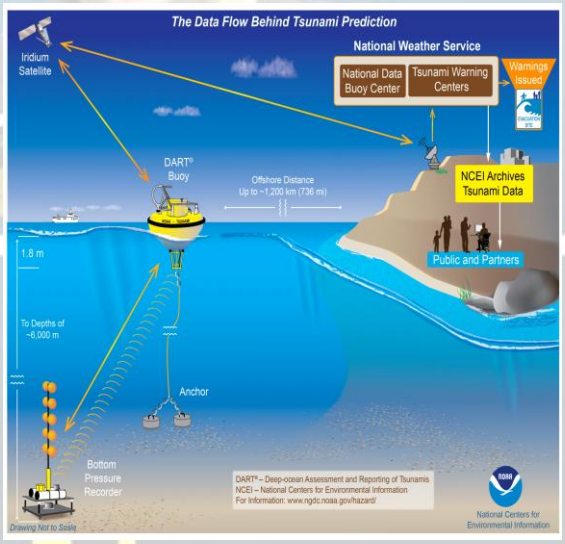


- Since the election of Mohamed Muizzu as Maldivian President in November 2023, there has been a deliberate, if predictable, attempt by Male to create a distance with New Delhi.
- The Maldives would like the world to believe that terminating the

hydrography pact is a way of asserting its autonomy and agency.

- **It is not. Far from balancing ties with India, Male has thrown in its political lot with China.**
- **It is worth noting that hydrographic data inherently has a dual nature in that the information collected from the seas can be used for civilian and military purposes.**
- **Marine scientists maintain that the data that helps advance nonmilitary objectives, such as ensuring navigational safety, marine scientific research, and environmental monitoring, can also be used to facilitate military aims such as surveillance of a nation's vital coastal installations and warfighting assets.**
- **Even so, China is unique in using its marine and seabed surveys to advance a largely strategic agenda**
- **Indian observers point out that China's ocean surveys play an important part in enhancing China's antisubmarine warfare capabilities.**
- **The United Nations Convention on the Law of the Sea (UNCLOS) does not explicitly authorised a coastal state to regulate hydrographic surveys or military surveys conducted beyond its territorial sea; a littoral state may only regulate marine scientific research in its exclusive economic zone (EEZs).**
- **By implication, foreign maritime agencies conducting hydrographic surveys are free to map the seas outside a coastal state's territorial waters. It is this prospect that Male finds problematic.**
- **The Hindu**

Tsunami and NDMA Guidelines



- **After the 2004 Indian Ocean Tsunami, India has now developed a state-of-the art Tsunami Early Warning System in the country.**
- **The critical gaps that now remain are the lack of public awareness on tsunami risk and vulnerability in the coastal areas, the weak enforcement and compliance of town planning byelaws, development control regulations and building codes in the**

coastal areas, and the challenges in implementation of appropriate technologies to disseminate and communicate the early warning to the coastal inhabitants located in the near vicinity of a near source tsunami.

- Tsunami Hazard Assessment
- Tsunami Vulnerability Assessment
- Geographic Information Systems (GIS)
- Role of the Indian Naval Hydrographic Department (INHD): INHD shall regularly provide bathymetry information to authorized agencies for drawing the inundation maps
- Use of Satellite Imageries in Monitoring:
- Guidelines
- Preparedness
- Warning System Components and Instruments
- Decision Support System and Standard Operating Procedures
- Tsunami Bulletins and Warning Categorization
- Tsunami Early Warning Dissemination
- Coordination Mechanisms
- Research and Development Efforts
- There is need to develop high-resolution models for tsunami wave propagation in the Indian Ocean.
- Public Awareness
- Medical Preparedness

Structural Mitigation Measures

Need for New Standards for Protection of Structures against Tsunami

- Bureau of Indian Standards (BIS) will develop other necessary standards for the safety of natural habitats against tsunami and storm surge.
- BIS will also periodically review the standards and codes prepared by them and wherever necessary.
- Shelters for Storm Surges and Tsunamis

Tsunami Mitigation Measures

- Construction of large scale submerged sand barriers in water depths of about 6 to 8 meters.
- Developing sand dunes along the coast with sea weeds or shrubs or casuarinas trees for stabilization of the sand dunes.

Regulation and Enforcement of Techno-Legal Regime

Land Use

- Coastal land use should be so designed so as to incur minimal losses to life and property due to these events.

Bio-Shields

- Mangrove forests constitute provided biological mechanisms for protecting coastal communities from the fury of cyclones, coastal storms, tidal waves and tsunamis., which also safeguards ecological and livelihood security of fishing and farming communities living in the coastal zone

Monitoring Shelterbelt Plantations and Mangrove Regeneration Zones

Emergency Tsunami Response

Tsunami Response Requirement

- A coordinated and effective response system would be required for management of tsunami at central, state, district and community levels

Community-Based Disaster Response

- A number of organisations, like NGOs, Self Help groups, Community Based Organisations, youth organizations, women's groups, volunteer agencies, civil defence, home guards, etc. normally volunteer their services in the aftermath of any disaster.

- **Free movement zone**

- The 1,643-km-long India-Myanmar border, which passes through Mizoram, Manipur, Nagaland and Arunachal Pradesh, currently has FMR. It was implemented in 2018 as part of India's Act East policy.

- The Free Movement Regime (FMR), which allows people residing close to the India-Myanmar border to venture 16 km into each other's territory without visa, will be ended soon

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- The Free Movement Regime is a pact between India and Myanmar that allows tribes living along the border on either side to travel up to 16 km inside the other country without a visa.
- FMR is being seen as a part of the India's Act East policy.

Rationale behind FMR

- The boundary between India & Myanmar was demarcated by the British in 1826.
- This effectively divided people of the same ethnicity and culture into two nations without seeking their opinion.
- Hence, need was felt to enable ethnically similar communities living across the borders to move freely without the need of a visa.
- The FMR was supposed to provide impetus to local trade and business.
  - However, it has been criticized for unintentionally aiding illegal immigration, drug trafficking, and gun-running

WHY FMR TO END?

- The idea is to not only to stop the misuse of FMR, which is used by insurgent groups to carry out attacks on the Indian side and flee towards Myanmar, but also put a halt to influx of illegal immigrants, and paralyse drugs and gold smuggling networks.
- Tendering for an advanced smart fencing system for 300 km of the India-Myanmar border is already in pipeline and the work will be started very soon
- Manipur shares around 390 km of porous border with Myanmar and only about 10 km has been fenced so far.
- Besides, Mizoram has seen an influx of anti-Junta rebels in thousands since the military coup in Myanmar on February 1, 2021
- Mizoram shares a 510-km-long porous border with Myanmar
- Arunachal Pradesh shares a 520-km border with Myanmar while Nagaland shares a 215-km border with the country.

The Hindu

Current Affairs 4rth January 2024 by Saurabh Pandey

Section 132 of income tax

- In August 2017, a nine-year judge Bench of the Supreme Court of India, in Justice K.S. Puttaswamy vs Union of India, declared to rousing acclaim that the Constitution of India guaranteed to persons, a fundamental right to privacy.
- Use of Section 132 of the Income Tax Act, 1961, which grants to the taxman, untrammeled police power to forcibly search persons and their properties, and seize goods found during such a search, including money, bullion, and jewelry.
- While this measure can be undertaken only where the authorities have, among other things, a "reason to believe" that a person has failed to disclose his income properly, the purported foundation underlying a search is subject to little safeguards under the statute.
- The Court ought to look not at the sufficiency or inadequacy of the reasons recorded for a search, but merely at whether the formation of the belief was honest and bona fide.
- This requires the court to review whether a measure is so "outrageous in its defiance of logic or of accepted moral standards that no sensible person who had applied his mind to the question to be decided could have arrived at it," and ask nothing more.
- To that end, a warrant for an income tax search must be founded on proper application of mind and must be amenable to the most penetrating rigours of judicial review.
- Any other interpretation would only bestow on the executive a form of extra-constitutional power, risking enormous public mischief.
- The Hindu

Debt vs development

- The IMF, in the report, states that India's government debt could be 100% of GDP under adverse circumstances by fiscal 2028.
- According to them, "Long-term risks are high because considerable investment is required to reach India's climate change mitigation targets and improve resilience to climate stresses and natural disasters.
- This suggests that new and preferably concessional sources of financing are needed, as well as greater private sector investment and carbon pricing or equivalent mechanism.

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- Government borrowings can play a vital role in accelerating development.
- However, the weight of debt can act as a drag on development due to limited access to financing, rising borrowing costs, currency devaluations and sluggish growth.
- As noted by the United Nations, "Countries are facing the impossible choice of servicing their debt or serving their people."
- According to the UN in 2022, 3.3 billion people live in countries that spend more on interest payments than on education or health. Global public debt has increased more than fourfold since 2000, while global GDP only tripled.
- Public debt has increased faster in developing countries compared to developed countries over the last decade.
- The rise of debt in developing countries is due to growing development financing needs, the cost of living crisis, and climate change, the burden of debt is asymmetric between developed and developing countries as the latter have to pay higher interest rates.

The challenge for India

- Apart from managing public debt deftly, India faces challenges in enhancing its credit ratings.
- Elevated debt levels and substantial costs associated with servicing debt impact credit rating.
- Even with the tag of being the fastest growing major economy, sovereign investment ratings for India have remained the same for a long time.
- Despite handsome growth in tax collections, there is the possibility of fiscal slippage in FY24, according to a report by India Ratings and Research (IR&R).
- IR&R attributes this to higher expenditure on employment guarantee schemes and subsidies.
- The Hindu

Detail agreement of ULFA

- According to the memorandum of settlement, the ULFA has agreed to renounce violence, disarm, disband the armed organisation, vacate their occupied camps, and participate in peaceful democratic process established by the law.
- Marking a shift toward nonviolence, it aims to ensure the integrity of the

country contrary to what the ULFA had initially demanded.

- The Ministry of Home Affairs will make a time bound programme to fulfil the demands of the outfit and a committee would be formed for its monitoring.
- The pact underlines a comprehensive package entailing an investment of ₹1.5 lakh crore for the all-around development of Assam.
- The Ministry of Home Affairs will make a time bound programme to fulfil the demands of the outfit and a committee would be formed for its monitoring.
- The pact underlines a comprehensive package entailing an investment of ₹1.5 lakh crore for the all-around development of Assam.
- The most significant part of the accord is the commitment to address the political demands of the ULFA.
- These include maintaining the territorial integrity of Assam through amicable settlement of boundary disputes with neighboring States in the Northeast and continuation of the "guidelines and methodology" adopted for the delimitation exercise conducted in 2023 in future delimitation processes.
- The pact envisages ensuring maximum representation for indigenous communities in the 126-member Assam Assembly by keeping non-original inhabitants, primarily migrant Muslims, out.
- The 2023 delimitation is said to have made it impossible for non-indigenous communities to contest 106 of these seats.
- Apart from the legislative safeguard, the pact seeks exemption for Assam from Section 3 of the Citizenship Act of 1955 dealing with people who have renounced Indian citizenship or whose citizenship has been terminated, to conditionally stop people of one constituency from being registered in another, and prepare an error-free National Register of Citizens, whose updated complete draft had put 19.06 lakh people out of 3.3 crore applicants on the rejection list.
- The Hindu

Upskilling Rural youth

How can migration be controlled?

- To control the migration of these youth to urban areas in search of meaningful employment, it becomes imperative to provide vocational training to students to imbibe relevant rural skills in them so that

they can secure a living where they currently live

- The current vocational education landscape in rural India is interspersed with Industrial Training Institutes to upskill rural populations but with little to no placement opportunities

How can education be improved?

- Effective rural education should be tailored such that technical as well as life skills, needed to empower youth in these areas, become accessible to them through formal education.
- There are many ways this could be done, as educational evidence from other developing economies suggests such as Mexico's tele schools and Bhutan's well being nfused curriculum.
- The tele schools provide lessons on subject matters as well as values, thereby providing a much higher level of access to value based secondary education for remote areas where secondary schools are scarce.
- This has shown to have trickling benefits in the local economy with improved attitudes and increased aspirations among children and parents.
- Closer to home, organisations such as NIIT Foundation and Pratham Institute are working with children in rural areas to provide upskilling opportunities.
- Hybrid life skilling programs are offered both by NIIT in collaboration with UNICEF through its self learning platform, and Pratham, which offers courses in both industry specific skills (such as in healthcare, electrical, and construction) and life skills.
- By offering rural populations skills in fields like agricultural mechanization, pollution monitoring, nursing and digital technologies via eLearning, rural India can boost employability in both traditional and nontraditional trades, leading to a vibrant economy

- Six space missions in 2024

1. Europa Clipper

- NASA will launch Europa Clipper, which will explore one of Jupiter's largest moons, Europa.
- Europa is slightly smaller than the earth's moon, with a surface made of ice.
- Beneath its icy shell, Europa likely harbours a saltwater ocean, which scientists expect contains over twice as much water as all the oceans here on Earth combined.

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- With Europa Clipper, scientists want to investigate whether Europa's ocean could be a suitable habitat for extraterrestrial life

- 2. Artemis II launch
- The Artemis programme, named after Apollo's twin sister in Greek mythology, is NASA's plan to go back to the moon.

- It will send humans to the moon for the first time since 1972, including the first woman and the first person of color.
- Artemis also includes plans for a longer-term, sustained presence in space that will prepare NASA for eventually sending people even farther to Mars.

- Artemis II is the first crewed step in this plan, with four astronauts planned to be on board during the 10-day mission.

- The mission builds upon Artemis I, which sent an unscrewed capsule into orbit around the moon in late 2022.

- Artemis II will put the astronauts into orbit around the Moon before returning them home. It is currently planned for launch as early as November 2024.

3. VIPER to hunt water on the moon

- VIPER, which stands for Volatiles Investigating Polar Exploration Rover, is a robot the size of a golf cart that NASA will use to explore the moon's south pole in late 2024.

- This robotic mission is designed to search for volatiles, which are molecules that easily vaporize, like water and carbon dioxide, at lunar temperatures.

- These materials could provide resources for future human exploration on the moon.

- The VIPER robot will rely on batteries, heat pipes, and radiators throughout its 100-day mission, as it navigates everything from the extreme heat of lunar daylight.

4. Lunar Trailblazer and PRIME1

- NASA has recently invested in a class of small, low cost planetary missions called SIMPLEx, which stands for Small, Innovative Missions for Planetary Exploration.
- These missions save costs by tagging along on other launches as what is called a rideshare, or secondary payload.
- One example is the Lunar Trailblazer.

- Like VIPER, Lunar Trailblazer will look for water on the moon.

- But while VIPER will land on the moon's surface, studying a specific

area near the south pole in detail, Lunar Trailblazer will orbit the moon, measuring the temperature of the surface and mapping out the locations of water molecules across the globe.

- PRIME1 will drill into the moon it's a test run for the kind of drill that VIPER will use. But its launch date will likely depend on whether earlier launches go on time.

- 5. JAXA's Martian Moon eXploration
- The JAXA MMX mission concept to study Phobos and Deimos, Mars' moons.

- The Japanese Aerospace Exploration Agency, or JAXA, has a robotic mission in development called the Martian Moon eXploration, or MMX, planned for launch around September 2024.

- The mission's main science objective is to determine the origin of Mars' moons.

- Scientists aren't sure whether Phobos and Deimos are former asteroids that Mars captured into orbit with its gravity or if they formed out of debris that was already in orbit around Mars.

- 6. ESA's Hera mission

- Hera is a mission by the European Space Agency to return to the Didymos Dimorphos asteroid system that NASA's DART mission visited in 2022. But DART didn't just visit these asteroids, it collided with one of them to test a planetary defence technique called "kinetic impact."

- DART hit Dimorphos with such force that it actually changed its orbit.

- The kinetic impact technique smashes something into an object in order to alter its path.

- This could prove useful if humanity ever finds a potentially hazardous object on a collision course with Earth and needs to redirect it.

- The Hindu

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Camptothecin (CPT)

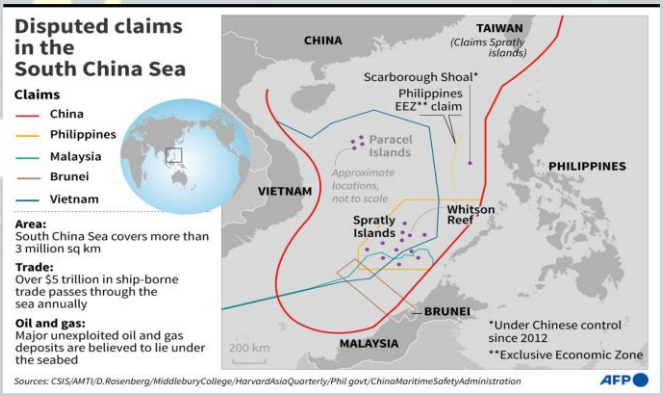
Researchers at the Indian Institutes of Technology Madras and Mandi have metabolically engineered plant cells to increase production of anti-cancer drug camptothecin (CPT). The allopathic medicine is produced using Nathapodytes nimmoniana, a native, endangered plant. It requires nearly 1,000 tonnes of plant material to extract 1 tonne of CPT.

Camptothecin is a molecule procured from nature and then (in a) onestep derivative it is produced as a drug.

We have provided a more sustainable way of producing camptothecin as it is majorly procured from plants. We have isolated the plant cell of Nothapodytes nimmoniana, which is native to India."

Camptothecin is majorly produced in Southeast Asian region, with the plant being largely found only in China and India. The Chinese variety of the plant used to extract the cell is listed as critically endangered.

Mapping-South China



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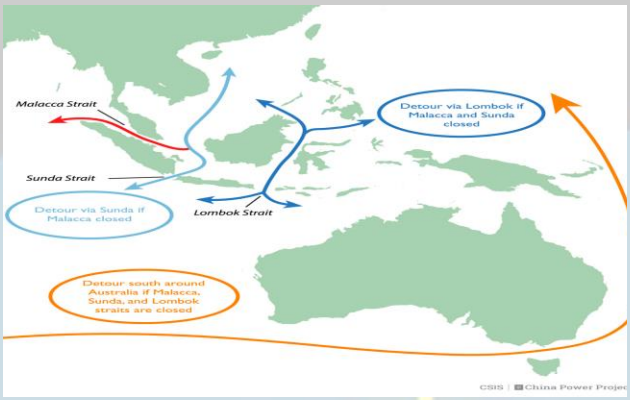
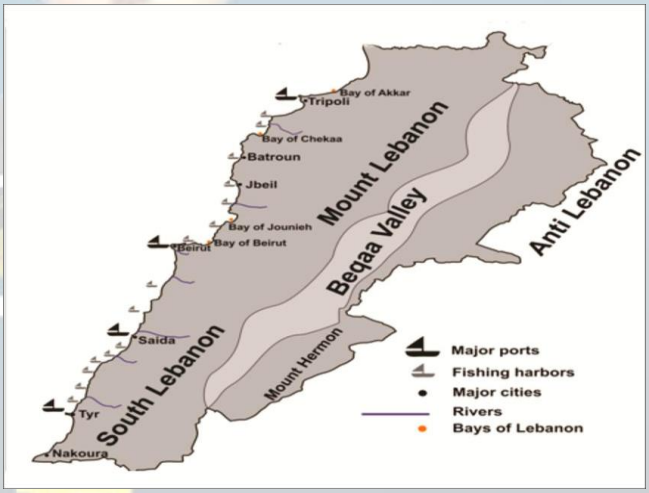
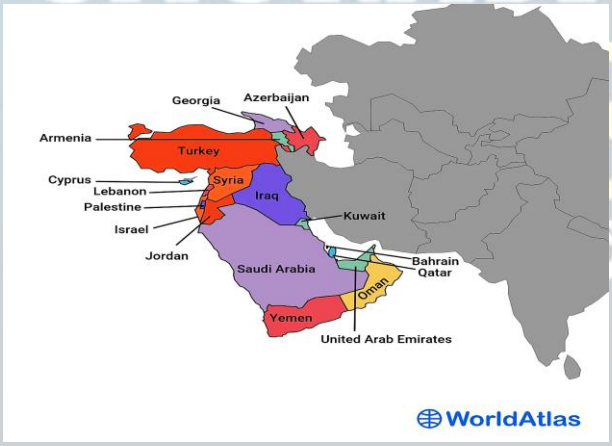


Mapping -west Asia





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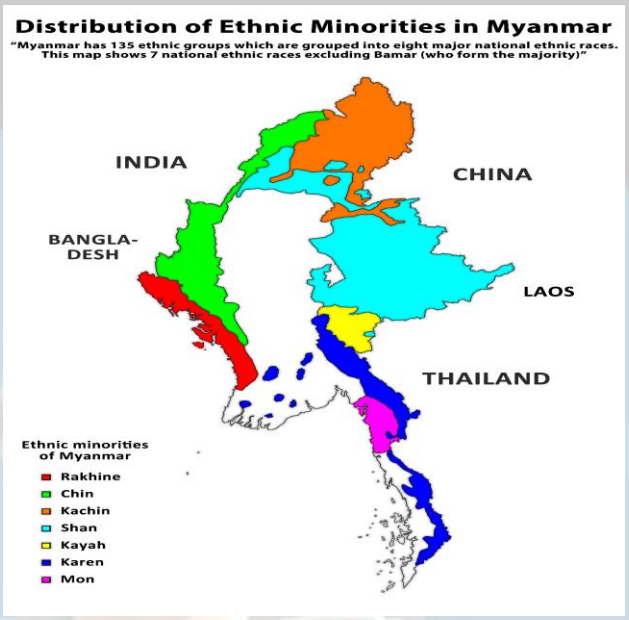
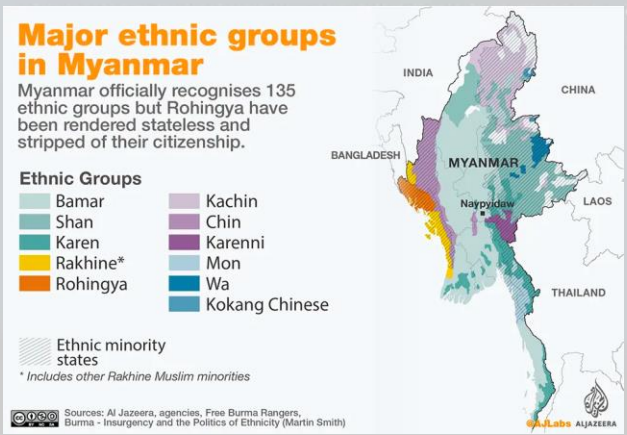


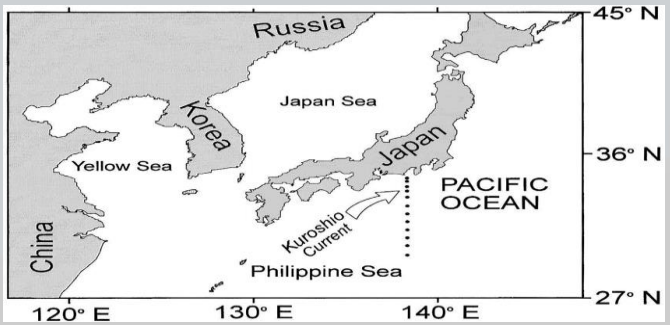
The Hindu

Mapping - ethnic groups



Combat-ready

Fiery trial: A South Korean Army tank takes part in a joint combat firing drill between South Korean and U.S. troops, near a demilitarised zone bordering North Korea, in Pocheon, South Korea on Tuesday. REUTERS



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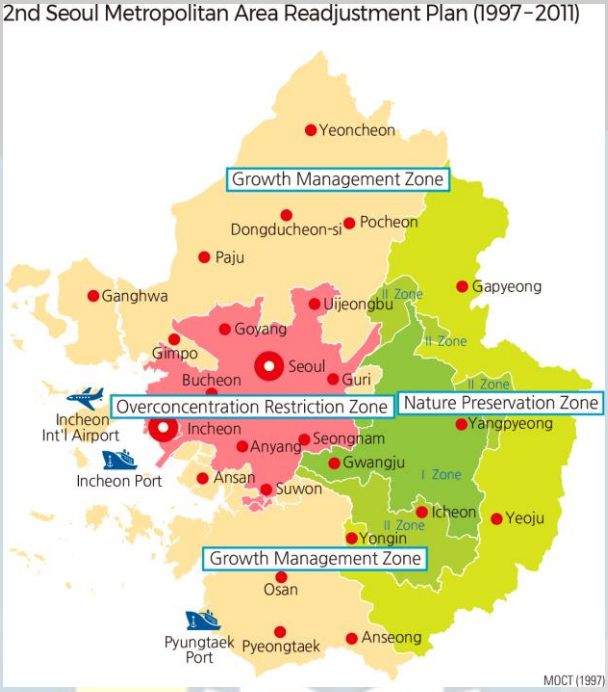

ECGC schemes

The ECGC Ltd. (formerly known as Export Credit Guarantee Corporation of India Ltd.) wholly owned by the government of India, was set up in 1957 with the objective of promoting exports from the country by providing credit risk insurance and related services for exports.

Over the years it has designed different export credit risk insurance products to suit the requirements of Indian exporters.

ECGC is essentially an export promotion organisation, seeking to improve the competitiveness of Indian exports by providing them with credit insurance covers.

ECGC Ltd. also administers the National Export Insurance Account (NEIA) Trust which caters to project exports of strategic and national importance.

ECGC provides

(i) A range of insurance covers to Indian exporters against the risk of non-realization of export proceeds due to commercial or political risks

(ii) different types of credit insurance cover to banks and other financial institutions to enable them to extend credit facilities to exporters and

(iii) Export Factoring facility for MSME sector which is a package of financial products consisting of working capital financing, credit risk protection, maintenance of sales ledger, and collection of export receivables from the buyer located in an overseas country.

The **ECGC Limited** (**Formerly Export Credit Guarantee Corporation of India Ltd**) is a government owned export credit provider. It is under the ownership of Ministry of Commerce and Industry, Government of India based in Mumbai, Maharashtra.[1] It provides export credit insurance support to Indian exporters. Its topmost official is designated as **Chairman and Managing Director** who is a central government civil servant under ITS cadre.

ART

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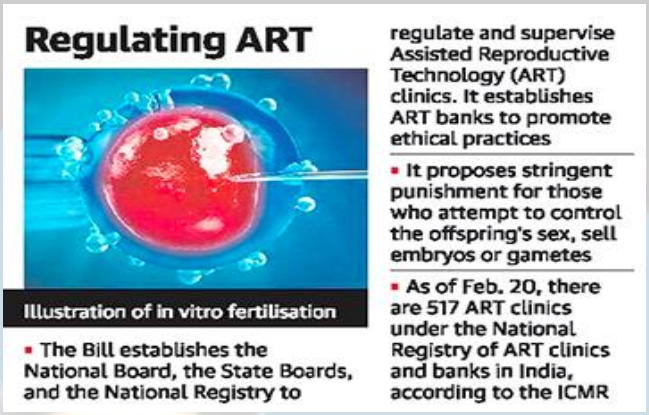
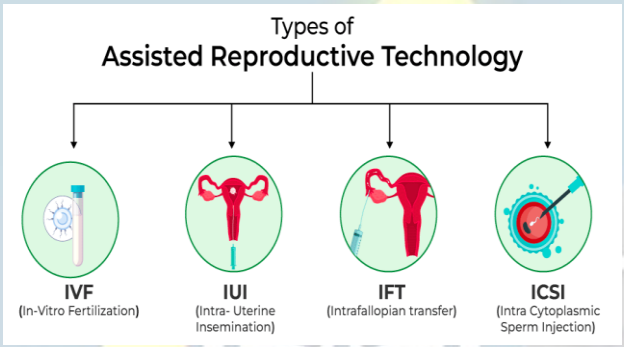
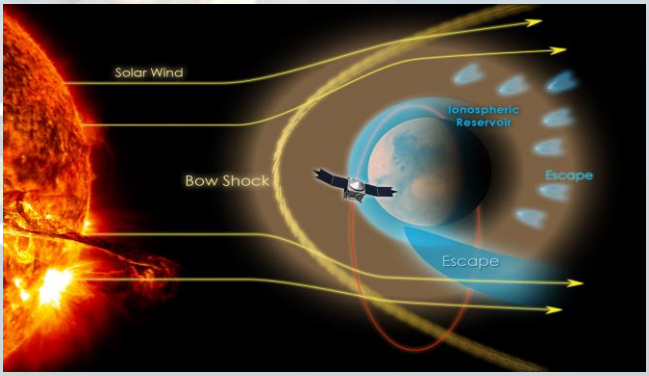
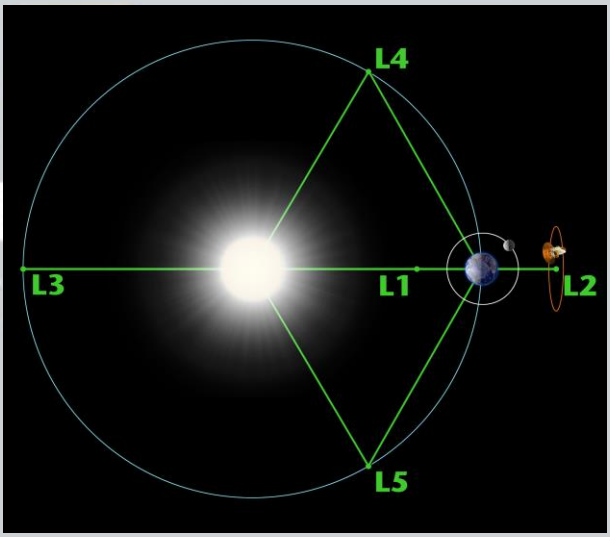


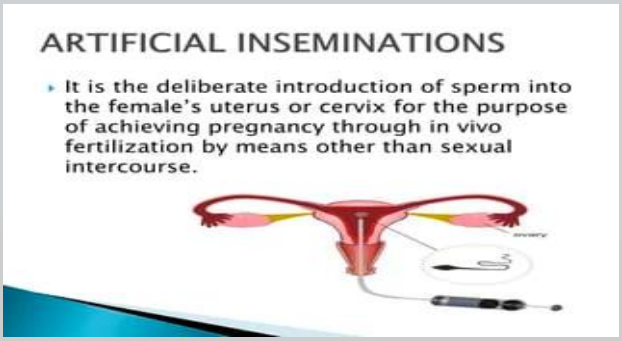


The Hindu

Aditya L1 - what is L1?





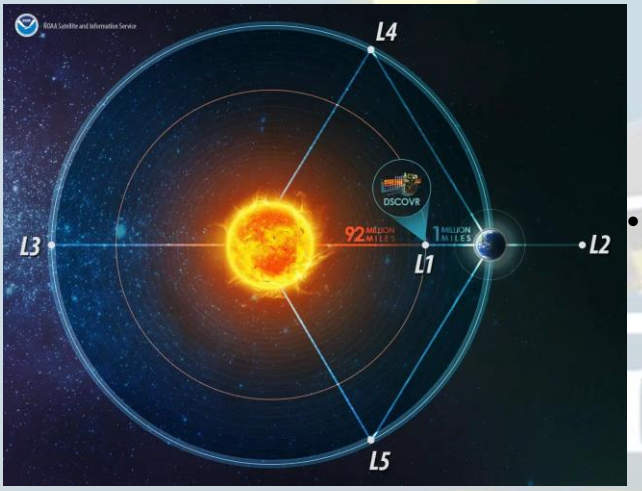


What is Lagrange points?

- Lagrange Points are positions in space where the gravitational forces

of a two body system like the Sun and the Earth produce enhanced regions of attraction and repulsion.

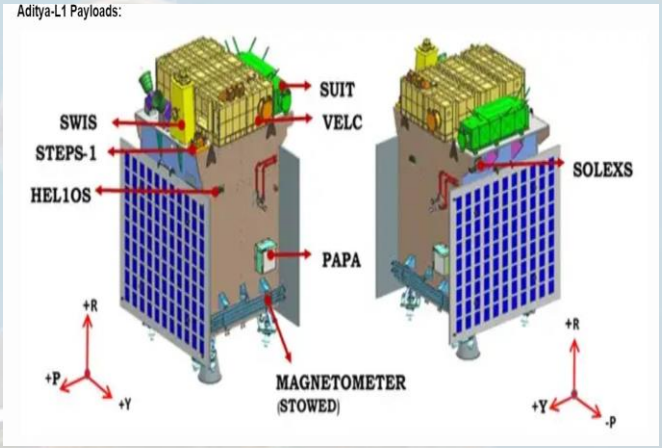
- These can be used by spacecraft to reduce fuel consumption needed to remain in position.
- Lagrange points are named in honor of Italian-French mathematician Josephy-Louis Lagrange.



- **Aditya L1 will be ISRO's 2nd space-based astronomy mission after AstroSat, which was launched in 2015.**

  Aditya 1 was renamed as Aditya-L1. The Aditya 1 was meant to observe only the solar corona. Aditya L1 is the first space-based Indian mission to study the Sun from a halo orbit around the Lagrangian point 1 (L 1) of the Sun-Earth system.

- This mission with seven payloads on board to observe the photosphere, chromosphere and the outermost layers of the Sun (the corona) will provide greater advantage of observing the solar activities and its effect on space weather, according to officials of Indian Space Research Organisation (ISRO).



Type	Sl. No.	Payload	Capability
Remote Sensing Payloads	1	Visible Emission Line Coronagraph(VELC)	Corona/Imaging & Spectroscopy
	2	Solar Ultraviolet Imaging Telescope (SUIT)	Photosphere and Chromosphere Imaging- Narrow & Broadband
	3	Solar Low Energy X-ray Spectrometer (SoLEXS)	Soft X-ray spectrometer: Sun-as-a-star observation
	4	High Energy L1 Orbiting X-ray Spectrometer(HEL1OS)	Hard X-ray spectrometer: Sun-as-a-star observation
In-situ Payloads	5	Aditya Solar wind Particle Experiment(ASPEX)	Solar wind/Particle Analyzer Protons & Heavier Ions with directions
	6	Plasma Analyser Package For Aditya (PAPA)	Solar wind/Particle Analyzer Electrons & Heavier Ions with directions
	7	Advanced Tri-axial High Resolution Digital Magnetometers	In-situ magnetic field (Bx, By and Bz).

The Hindu

Current Affairs 6th January 2024 by Saurabh Pandey

Antimicrobial resistance

- The 'First Multicentric Point Prevalence Survey of Antibiotics '
- Over 70% of the patients in tertiary care hospitals across 15 States and two Union Territories were prescribed antibiotics; over 50% of antibiotics prescribed have the potential to cause AMR.
- But the most crucial reveal was that 55% of the patients surveyed were prescribed antibiotics as prophylaxis (The term prophylaxis means preventive.), or as a preventive; only 45% were prescribed antibiotics to actually treat infections; of this, only 6% were prescribed the drugs after identifying the specific bacteria.
- AMR occurs when pathogens evolve, fortifying themselves against drugs, and stop responding to antimicrobial drugs.
- While it is the nature of pathogens to evolve, this ever increasing crisis is constantly being exacerbated by unsound medical, and animal husbandry practices.
- It is precisely the sort of misuse and overuse of antimicrobials, as revealed by the survey, which cause the development of drug-resistant pathogens that in turn pose great risk to life and exacerbate morbidity.
- The World Health Organization (WHO) estimates that bacterial AMR was directly responsible for 1.27 million global deaths in 2019 and contributed to 4.95 million deaths.
- AMR invalidates the multiple gains that modern medicine has achieved over the years, makes infections harder to treat, but also renders other medical procedures and treatments such as surgery, caesarean sections, and cancer chemotherapy, much more risky, WHO warns.
- Rational prescription of antibiotics, and curbs on the use of drugs to promote growth in animals and plants.
- It is also clear that there is an antibiotic research and development pipeline crisis, and urgent measures are required to develop new drug

candidates, and more equitable access to them.

- The role of doctors and the government in regulating the use of drugs is crucial in this battle, but more so the latter.
- Patients too are impatient with the medical process, expecting immediate relief to ailments; but medical science offers no magical remedy.
- The Hindu

PMI

The Purchasing Managers Index (PMI)

- The Purchasing Managers Index (PMI) is a measure of the prevailing direction of economic trends in manufacturing.
- The PMI is based on a monthly survey of supply chain managers across 19 industries, covering both upstream and downstream activity.
- The value and movements in the PMI and its components can provide useful insight to business decision makers, market analysts, and investors, and is a leading indicator of overall economic activity
- The headline PMI is a number from 0 to 100. A PMI above 50 represents an expansion when compared with the previous month.
- A PMI reading under 50 represents a contraction, and a reading at 50 indicates no change. The further away from 50 the greater the level of change.
- The PMI is calculated as:
- PMI = (P1 * 1) + (P2 * 0.5) + (P3 * 0)
- Where:
- P1 = percentage of answers reporting an improvement
- P2 = percentage of answers reporting no change
- P3 = percentage of answers reporting a deterioration.
- The Hindu

Competition commission of India

- The Competition Act, 2002 was passed by the Parliament in the year 2002, to which the President accorded assent in January, 2003.
- It was subsequently amended by the Competition (Amendment) Act, 2007.
- In accordance with the provisions of the Amendment Act, the Competition Commission of India and the Competition Appellate Tribunal have been established. The Competition Commission of India is now fully functional with a Chairperson and six members.

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- The provisions of the Competition Act relating to anti-competitive agreements and abuse of dominant position were notified on May 20, 2009.
- The Competition Act, 2002 was passed by the Parliament in the year 2002, to which the President accorded assent in January, 2003.
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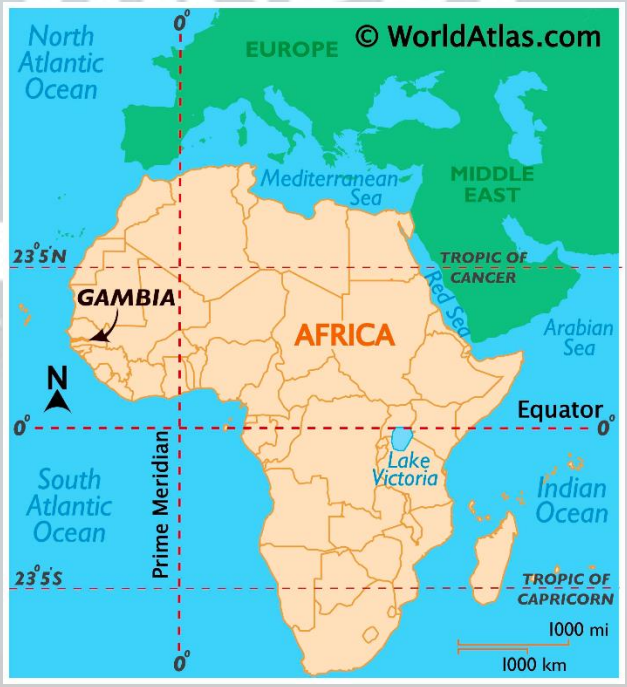
- The Competition Commission of India is now fully functional with a Chairperson and six members.
- The provisions of the Competition Act relating to anti-competitive agreements and abuse of dominant position were notified on May 20, 2009.
- The Competition Commission of India ('Commission') has been established to enforce the competition law under the Act. The Commission consists of a Chairperson and not more than 6 Members appointed by the Central Government.
- It is the statutory duty of the Commission to eliminate practices having adverse effect on competition, promote and sustain competition, protect the interests of consumers and ensure freedom of trade carried on by other participants, in markets in India as provided in the Preamble as well as Section 18 of the Act.
- The Commission is also mandated to give its opinion on competition issues to government or statutory authority and to undertake competition advocacy for creating awareness of competition law.

The Hindu

The Gambia



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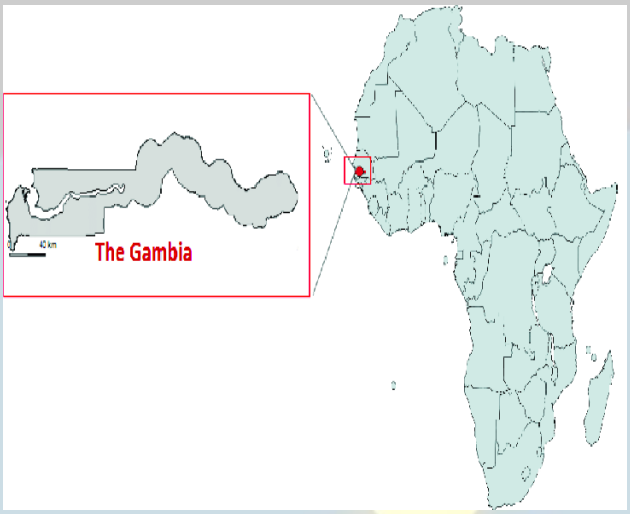
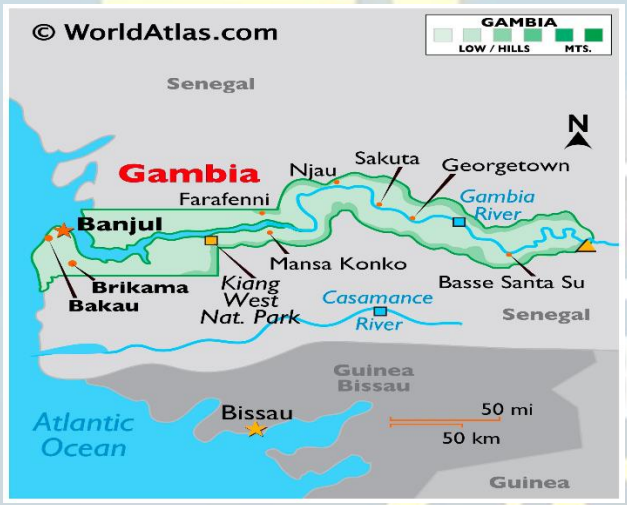
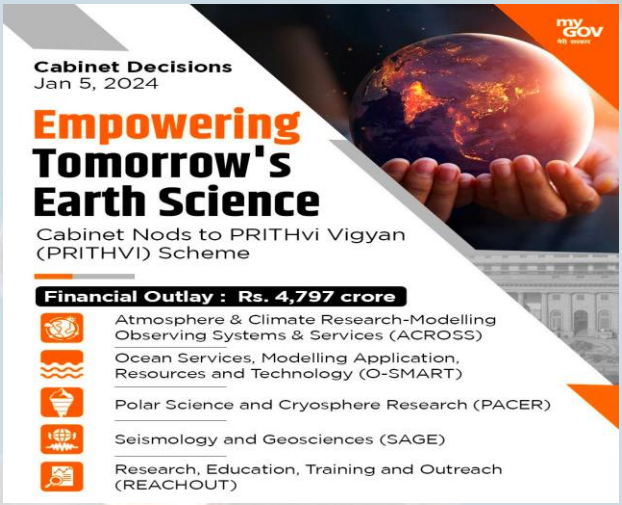




PRITHVI programme



- **The Union Cabinet cleared a ₹4,797-crore programme called 'Prithvi' (Earth) that is expected to subsume five existing schemes of the Ministry of Earth Sciences (MoES).**
- **These programmes are to improve and increase long term observations of the atmosphere, ocean, geosphere, cryosphere, and solid earth to track changes in the planet;**
- **Develop models to understand and predict weather, ocean and climate hazards, and understand the science of climate change; explore polar and high seas regions of the earth to discover new phenomena and resources; develop technology for exploration and sustainable harnessing of oceanic resources for societal applications; and translate knowledge and insights from earth**

system science into services for societal, environmental, and economic benefit.

- "A major component of the Ministry is the Deep Ocean Mission or DOM [one of whose objectives is to send a manned submersible 6,000 metres into the Indian Ocean].
- The Prithvi programme broadly subsumes all of our other major activities,
- The research and development and operational (services) activities of the Ministry are carried out by its 10 institutes.
- They are the India Meteorological Department, the National Centre for Medium Range Weather Forecasting, the Centre for Marine Living Resources and Ecology, the National Centre for Coastal Research, the National Centre for Seismology, the National Institute of Ocean Technology, the Indian National Centre for Ocean Information Service, the National Centre for Polar and Ocean Research, the Indian Institute of Tropical Meteorology, and the National Centre for Earth Science Studies

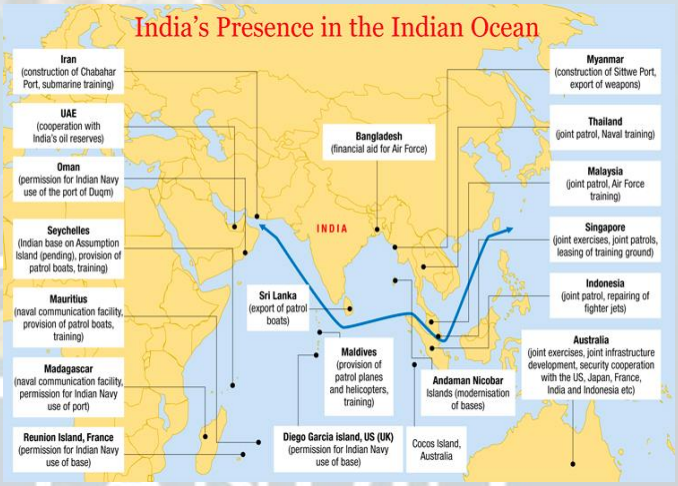
The Hindu

India's steps for maritime security

- The Government has taken a number of measures to strengthen coastal, offshore and maritime security.
- Broadly, these measures include capacity augmentation of maritime security agencies for surveillance and patrol of the nation's maritime zones; enhanced technical surveillance of coastal and offshore areas; establishment of mechanisms for inter-agency coordination; increased regulation of activities in the maritime zones; as also integration of the fishing and coastal communities.
- Indian Naval ships and aircraft are regularly deployed on 'Mission Based Deployments' in Indian Ocean Region to enhance maritime security.
- It also undertakes surveillance to enhance Maritime Domain

Awareness and address contingencies that may arise.

- These are in consonance with the Government of India's vision of Security and Growth for All in the Region (SAGAR) and the Maritime Security Strategy to build its role as the 'Preferred Security Partner' in our extended maritime neighborhood.
- Besides this, India proactively engages with regional Navies to enhance friendship/cooperation and promote maritime security in the Indian Ocean Region (IOR).
- Operational interactions with friendly foreign countries include activities like Joint Exclusive Economic Zone (EEZ) Surveillance, Coordinated Patrols on annual / bi-annual basis along the International Maritime Boundary Line (IMBL), Maritime Exercises, etc.
- India also exchanges Maritime Information bilaterally with Friendly Foreign Countries to create Maritime Domain Awareness in IOR.
- This includes information on military and naval assets of hostile / adversarial countries; assessment of maritime activities of mutual concern and activities related to transnational maritime based threats.
- Besides these, India also participates in regional frameworks such as Association of Southeast Asian Nations Regional Forum (ARF), East Asia Summit (EAS) and the ASEAN Defence Ministers Meeting Plus (ADMM Plus) to expand its cooperation and exchanges with the Indo-Pacific region.



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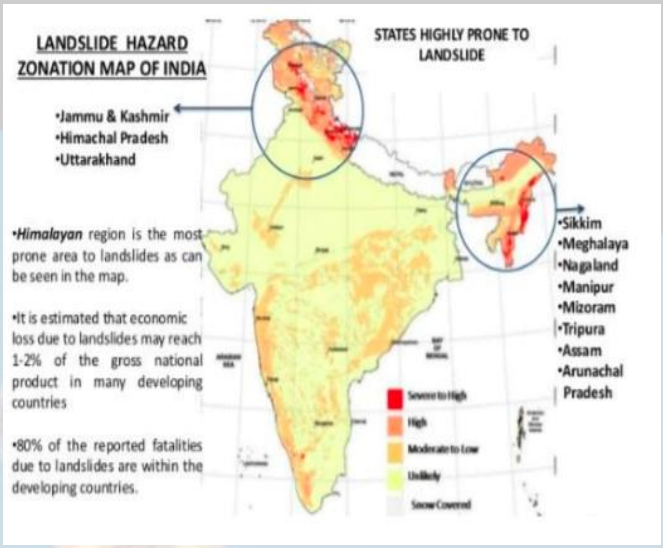
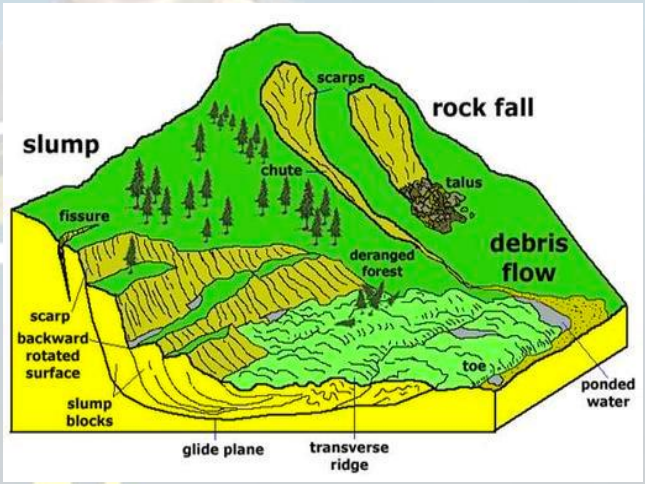
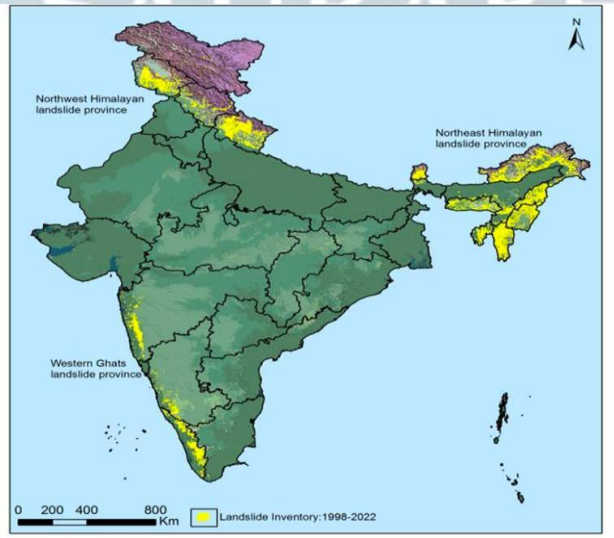
Landslide and technology

- **Landslides are a unique and deadly problem. They are less widespread and harder to track and study with satellites.**
- **Landslides happen in localised areas and affect only about 12% of the country.**
- **As a result, there is much less data of sufficient quality for typical machine learning models to work with**
- **Researchers prepared two elements for analysis: 150,000 data points for known landslide events and 16 factors that rendered an area susceptible to landslides.**







- **Information about these factors was collected for the whole country**
- **Machine learning models were used to make projections for all areas for which there wasn't any landslide data.**
- **That is, even if a landslide had not occurred at a particular place, the ensemble could estimate its susceptibility to one**

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- After all the analyses, and with the help of GSI's (geographical survey of India) extensive collection of landslide data, they developed a high-resolution landslide susceptibility map.
- The map acknowledged some well known regions of high landslide susceptibility, like parts of the foothills of the Himalaya, the Assam Meghalaya region, and the Western Ghats.
- The Hindu

Panspermia

- The question of how life began has invited numerous hypotheses. One that has prevailed since ancient Greece is panspermia.
- It was first posited by the Greek philosopher Anaxagoras (500-428 BC), who coined the term and first articulated life's potential to travel as 'seeds' between planets.
- While this concept found echoes in the thoughts of other philosophers of his time,
- Some of the more important studies demonstrated that microorganisms could endure the extreme conditions that come with being ejected from a planet, navigating the rigours of interplanetary travel, and withstanding the impact of reaching a new world.
- Nineteenth century researchers, including Swedish scientist Svante Arrhenius, also contributed to this discourse by suggesting mechanisms like radiation pressure from the Sun that microorganisms could be propelled by through space.
- In its modern version, the idea of panspermia advances three stages: escape from a planet, transit through interplanetary space, and landing on another planet.
- But because panspermia simply attributes the origin of life on one planet to a different planet, it doesn't actually explain how life came to be.

The Hindu

Rise of child marriage

- The Lancet paper titled 'Prevalence of girl and boy child marriage across States and Union Territories in India, 1993–2021: a repeated cross sectional study' highlights that one in five girls are still married below legal age in India.
- "The largest absolute increase in headcount was observed in West Bengal, representing an increase of 32.3% in headcount (difference n=500346)...

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- West Bengal saw the largest absolute increase with over 5,00,000 more girls getting married as children," the paper said.
- Researchers like Mr. Ahamed point out that surprisingly there is no direct correlation between literacy rate and child marriage.
- Despite high literacy, the incidence of child marriage is also disproportionately high in some districts.

The Hindu

Voice cloning

- voice cloning through Artificial Intelligence (AI) was just a phenomenon of mild amusement.
- AI generated songs by famous artistes like Drake and Ariana Grande were floating around online.
- However, fears around the AI software were realised when AI voice cloning related scams burgeoned.
- Indians have been found to be particularly vulnerable to scams of this nature.
- According to McAfee, 66% of Indian participants admitted that they would respond to a voice call or a phone call that appeared to be from a friend or family member in urgent need of money, especially if the caller was supposedly a parent (46%), spouse (34%) or their child (12%).

The Hindu

Red sea and trade

What is the impact on Indian trade flowing through the Red Sea?

- After the attacks, major cargo shipping lines decided they would not operate on this route.
- Even small feeder vessels have of late stopped plying in these waters.
- Almost 90% of western hemisphere cargo, both inbound or shipped from India, that used to go through the Red Sea is now getting rerouted through the Cape of Good Hope,
- Whether exporting to Europe, the U.S. east coast and even to countries in North Africa, the longer route is being used.

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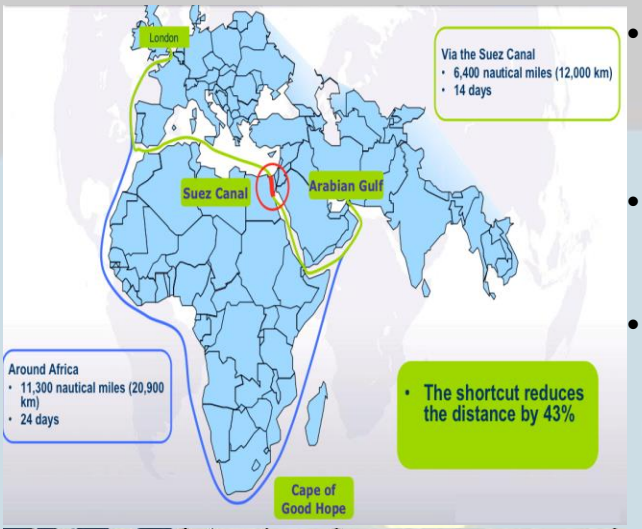

- **The remaining 10% of Indian import or export cargo is either not moving or using a transit facility.**
- **The impact of this move varies on the type of buyer seller contract.**
- **If it is FOB (free on board), the freight burden is on the buyer, and in CIF (cost, insurance and freight) or C&F (cost and freight) contracts, the freight has to be borne by the exporter.**
- **In cases of FOB, and where the buyers have comfortable inventory, they are asking the Indian exporter to hold back consignment.**
- **Likewise, exporters who have to bear the freight are requesting their buyers to allow them to hold the consignment given the increase in freight costs, which includes peak season surcharge and contingency surcharge.**
- **However, if there is zero inventory, the buyer would insist on shipment of the goods,**
- **Container Corporation of India is saying about 25% of its containers are being held back by Indian exporters. i.**
- **While all consignments are likely to be impacted by the increase in freight cost by up to sixfold in some cases**

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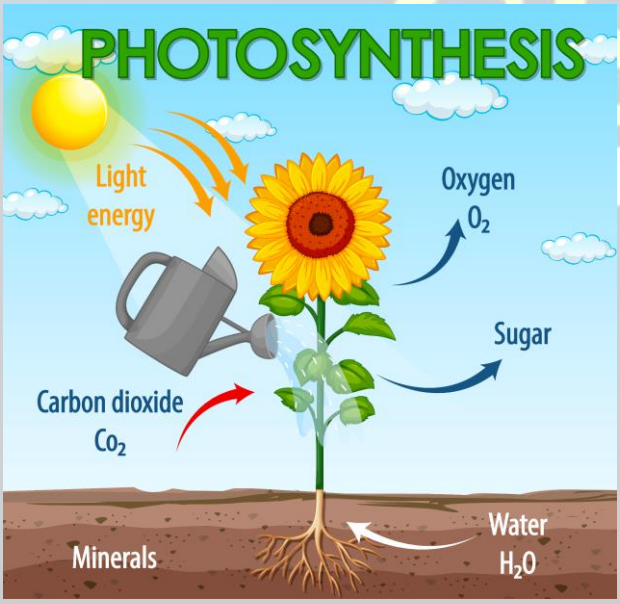
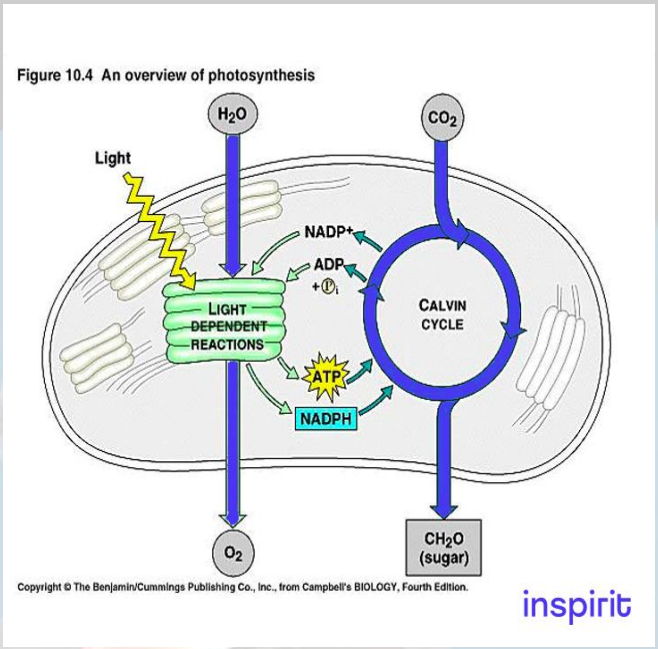
How does the crisis impact India's imports?

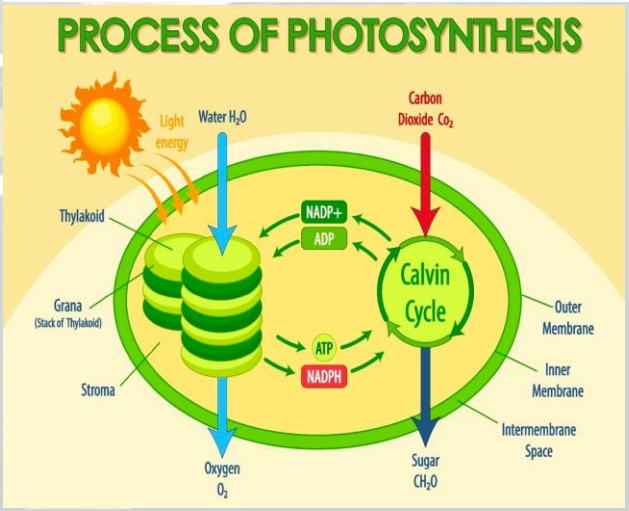
- **Besides the extra time taken on account of the longer route, the developments could make imports costlier and call for better inventory management.**
- **the Red Sea crisis could come in the way of any plans to reduce pump prices of petrol and diesel.**
- **Additional war risk premiums in the Red Sea have been partially contributing to the freight rate increases for the relevant routes, but this surcharge is significantly lower than the costs linked to rerouting via the Cape of Good Hope.**

The Hindu

Photosynthesis







- **The oldest evidence of photosynthetic structures reported to date has been identified inside a collection of 1.75billion year old microfossils, a paper published in the journal Nature reveals.**
- **The discovery helps to shed light on the evolution of oxygenic photosynthesis.**

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- Oxygenic photosynthesis, in which sunlight catalyses the conversion of water and carbon dioxide into glucose and oxygen, is unique to cyanobacteria and related organelles within eukaryotes.
- Cyanobacteria had an important role in the evolution of early life and were active during the Great Oxidation
- **What is a great Oxidation event??**
- The accumulated oxygen started escaping into the atmosphere, where it reacted with methane. As more oxygen escaped, methane was eventually displaced, and oxygen became a major component of the atmosphere.
- This event, known as the "Great Oxidation Event," occurred sometime between 2.4 – 2.1 billion years ago direct evidence of fossilised photosynthetic structures from Navifusa majensis.
- The microstructures are thylakoids; membrane bound structures found inside the chloroplasts of plants and some modern cyanobacteria.
- 
- N. majensis is presumed to be a cyanobacterium.
- The discovery of thylakoids in a specimen of this age suggests that photosynthesis may have evolved at some point before 1.75 billion years ago.
- It does not, however, solve the mystery of whether photosynthesis evolved before or after the Great Oxidation Event.
- Thylakoids represent direct ultrastructural evidence for oxygenic photosynthesis metabolism.
- Thylakoid membranes are dense, mostly galactolipid, protein containing bilayers in which photosynthesis occurs in photosynthetic organisms. "
- The Hindu

Environmental enteric dysfunction (EED)

- Scientists have discovered promising treatment strategies for a gut condition that commonly afflicts malnourished children in developing countries, according to a new study involving mice and data from 115 children in Zambia.
- By identifying key signatures of environmental enteric dysfunction (EED), their study suggests that a high

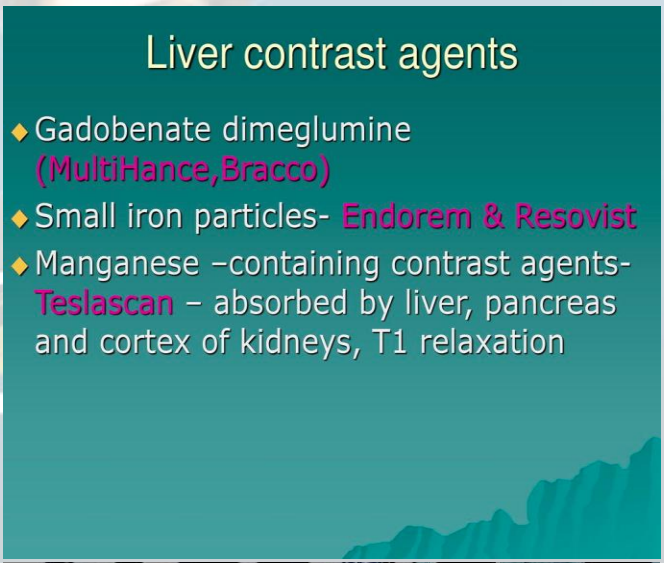
protein diet, supplementation of a coenzyme, or a bile acid sequestrant (or a combination thereof) could reverse the disorder's damaging effects on the intestines.

- **Environmental enteric dysfunction (EED)** refers to an incompletely defined syndrome of inflammation, reduced absorptive capacity, and reduced barrier function in the small intestine. It is widespread among children and adults in low- and middle-income countries.

The Hindu

MRI-CONTRAST AGENT

- A team of researchers has designed a 'living contrast' agent for MRI of the brain, allowing them to detect episodes of mild traumatic brain injury more effectively in a large animal model.
- Their imaging agent is based on micro patches that capture immune cells that tend to infiltrate the brain after traumatic brain injury and could provide a powerful diagnostic tool for clinical monitoring and therapeutic research.
- Nearly 6090% of mild traumatic brain injury cases currently go undiagnosed.
  - What are contrast agents?
- Air and carbon dioxide gas are common examples of negative contrast agents used in radiology.
- These agents are often used to visualize specific areas, such as the gastrointestinal tract, where the simple presence of gas can provide valuable diagnostic information.



The Hindu

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Long-lived plasma cells (LLPCs)

- By examining the effects of a SARS-CoV2 vaccine in large animals, scientists have developed a pipeline to isolate and study long lived plasma cells that produce antibodies.
- Their technique provides a means to detect these rare cells and could inform studies of the immune system.
- Long-lived plasma cells originate in germinal centres and usually take up residence in the bone marrow.
- There, they secrete antibodies and help protect against pathogens over long periods.
- **Long-lived plasma cells (LLPCs)??**
- Long-lived plasma cells (LLPCs) are a distinct subset of plasma cells that play a crucial role in maintaining humoral memory and long-term immunity.
- Plasma cells, also called plasma B cells or effector B cells, are white blood cells that originate in the lymphoid organs as B cells and secrete large quantities of proteins called antibodies in response to being presented specific substances called antigens.
- They continuously produce and secrete high-affinity antibodies into the bloodstream, conversely to memory B cells, which are quiescent and respond quickly to antigens upon recall
- long-lived plasma cells fulfill the criteria of memory cells as they continuously secrete the antibodies independently of their precursor cells (B cells), T cell help and antigen presence.
- **The Hindu**

L. saxatilis

- The seaside marine snail Littorina saxatilis is the most misidentified creature in the world.
- Although live bearing is the only trait that distinguishes L. saxatilis from its egg-laying relatives, L. saxatilis did not seem to form a single evolutionary group.
- "We were able to identify 50 genomic regions that together seem to determine whether individuals lay eggs or give birth to live young,"
- Littorina saxatilis is commonly known as the Rough Periwinkle.
- It is native to the North Atlantic with a range spanning from the Arctic Ocean to Virginia (in the West Atlantic) and the Iberian Peninsula (in the East Atlantic)

- **The Hindu**

Dietary diversity

- **reduction in "dietary diversity" influences the quality of our diets. Eating food from many different food groups improves nutrition.**
- **But the practice of monoculture – growing one crop or vegetable on large tracts of land – only reduces "agricultural biodiversity".**
- **One alternative, to transport food groups from distant regions, raises costs and carries a heavy environmental penalty.**
- **Wide variety Farmers with small holdings, Shepherds on pastoral lands and tribal populations that practice agroforestry are major contributors to nutritional variety in our country**
- **The indigenous people of Northeast India practiced a form of agriculture, called Jhum, in which about 20 different food crops would be grown on the same piece of land.**
- **This form of cultivation is a total antithesis of modern agricultural practices but offers plenty of diversity in their diets. Sadly, this form of cultivation is losing ground.**

The Hindu

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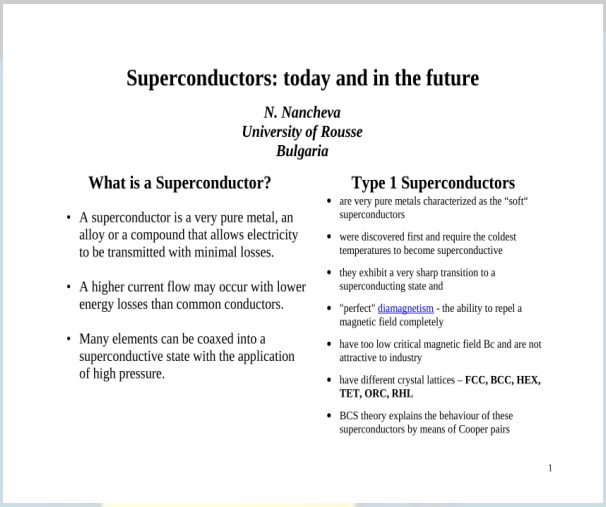
Superconductivity & Meissner effect



Superconductors: today and in the future

N. Nancheva
University of Rousse
Bulgaria

What is a Superconductor?

- A superconductor is a very pure metal, an alloy or a compound that allows electricity to be transmitted with minimal losses.
- A higher current flow may occur with lower energy losses than common conductors.
- Many elements can be coaxed into a superconductive state with the application of high pressure.

Type 1 Superconductors

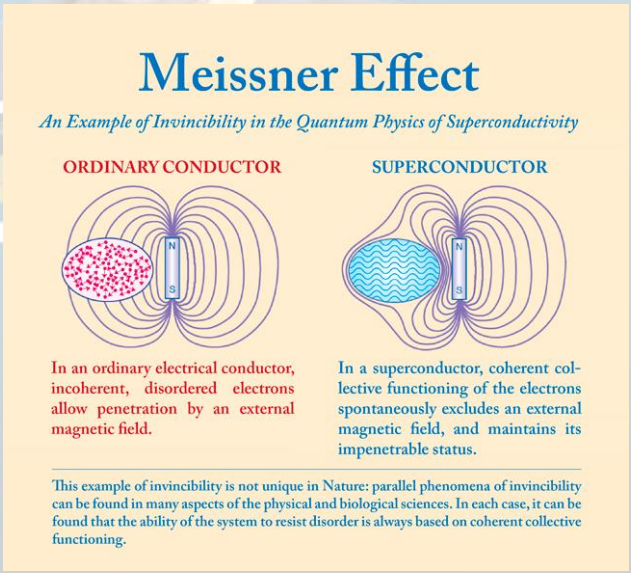
- are very pure metals characterized as the "soft" superconductors
- were discovered first and require the coldest temperatures to become superconductive
- they exhibit a very sharp transition to a superconducting state and
- "perfect" diamagnetism - the ability to repel a magnetic field completely
- have too low critical magnetic field Bc and are not attractive to industry
- have different crystal lattices – **FCC, BCC, HEX, TET, ORC, RHL**
- BCS theory explains the behaviour of these superconductors by means of Cooper pairs

1

- **A group of scientists affiliated with research institutes in China and Japan have reported finding a sign of superconductivity in a material that was at the centre of a controversy last year over similar claims.**

What is the Meissner effect?

- **The sign in question is called the Meissner effect.**
- **It is one of a few 'effects' certain materials exhibit when they're able to conduct electric currents without any resistance i.e. when they become superconductors.**
- **The researchers have reported in their paper that they observed the Meissner effect in a compound called copper substituted lead apatite.**
- **Scientists know many types of materials that become superconducting in different conditions metals, metallic compounds, ceramics, hydrides, etc.**
- **The Meissner effect is the expulsion of a magnetic field from a superconductor during its transition to the superconducting state when it is cooled below the critical temperature.**
- **This expulsion will repel a nearby magnet**



Meissner Effect

An Example of Invincibility in the Quantum Physics of Superconductivity

ORDINARY CONDUCTOR

SUPERCONDUCTOR

In an ordinary electrical conductor, incoherent, disordered electrons allow penetration by an external magnetic field.

In a superconductor, coherent collective functioning of the electrons spontaneously excludes an external magnetic field, and maintains its impenetrable status.

This example of invincibility is not unique in Nature: parallel phenomena of invincibility can be found in many aspects of the physical and biological sciences. In each case, it can be found that the ability of the system to resist disorder is always based on coherent collective functioning.

- **They all have one thing in common: they become superconducting either when they're cooled to extremely low temperatures or when they're subjected to extremely high pressures.**
- **Many scientists are looking for a material that becomes superconducting at room temperature and pressure (RTP).**

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- Aside from scientific curiosity, such a material would have applications worth several billion dollars.
- It could be used to make wires that transport electricity with zero loss; such transmission losses are the largest source of electric energy loss in the world today.
- The material will also have uses in medical diagnostics, computing, power generation, advanced electronic circuits, and many other fields.
- For example, the water absorbing properties of modern diapers were first tested with particle accelerators, which use superconducting magnets to work.

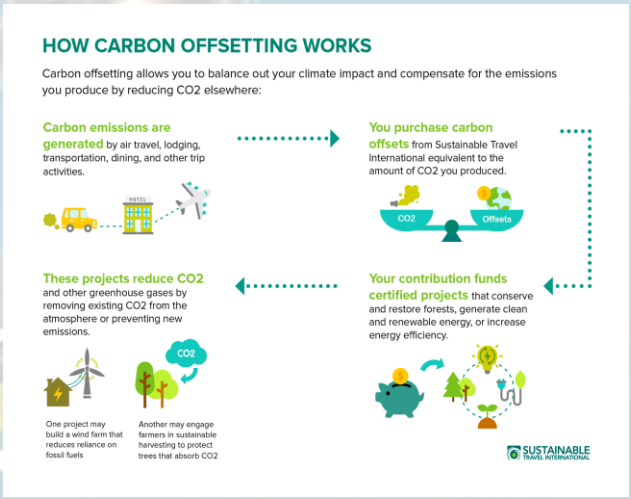
The Hindu

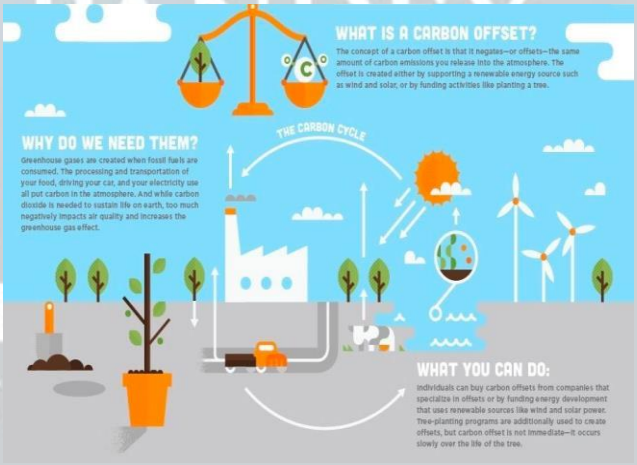
South Korean researcher

- Another set focused on a material called LK99 that, a South Korean research group claimed, was an RTP superconductor.
- Independent studies soon found that when LK99 was prepared the way the South Korean group had indicated (albeit not clearly), it didn't become a superconductor.
- Instead, it acquired an impurity whose presence the group hadn't accounted for, and which distorted measurements of the material's heat capacity and magnetism in a way an actual superconductor would have, misleading the scientists.

The Hindu

Carbon offsetting





Mulya Pravah

Mulya Pravah, which was notified in 2019. It seeks to inculcate human values and professional ethics in higher education institutions.

The stated intention is to build value-based institutions by orienting individuals and institutions towards developing a deep respect for fundamental duties and constitutional values and bonding with the country.

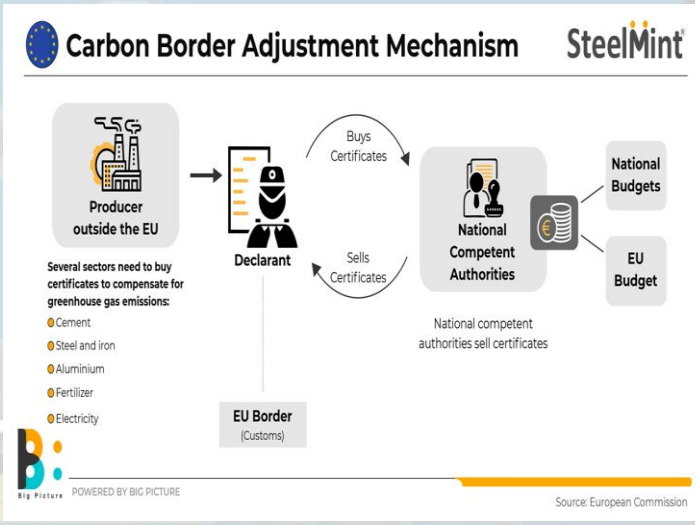
- The trigger is the findings of a survey of human resource managers which highlight unethical practices in various organizations.
- The most prominent of these are "favoritism in hiring, training, pay, and promotion; sexual harassment; gender discrimination in promotion; inconsistent view on discipline; lack of confidentiality; gender differentiation in compensation; nonperformance factors overlooked in appraisals; arrangements with vendors for personal gain; and gender discrimination during recruitment and hiring"

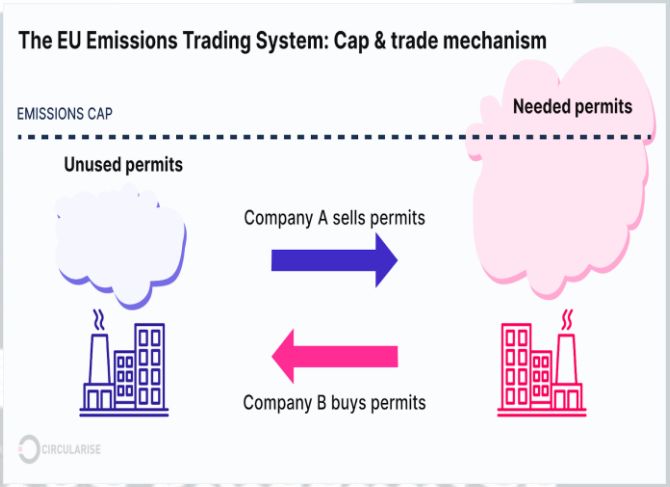
Emphasis on transparency

- Mulya Pravah 2.0 underscores the need for utmost transparency in administration and highlights that decision-making in higher education institutions must be solely guided by institutional and public interest, and not be vitiated by biases.
- Higher education institutions must, in fact, be mandated to voluntarily disclose all critical information and subject themselves to public scrutiny.

- The Hindu

- Carbon emission





- European Union (EU)'s Carbon Border Adjustment Mechanism (CBAM).
- The policy, which intends to tax carbon intensive products coming into the EU from 2026, is divided into two phases, with the first phase

(transitional phase) kicking in from October 1, 2023.

- There has been constant exchange between the EU and India on the implications of the CBAM.

What is CBAM?

The EU contended, while providing context for the CBAM, that it intends to achieve the target of a 55% reduction in greenhouse gas (GHG) emissions by 2030, compared to 1990 levels, under the European Green Deal.

- The CBAM is part of the package planned to achieve this.
- Second, there is a threat to EU products being replaced by carbon - intensive imports from other countries such as India or China.
- The EU argues that the higher standard of environmental compliance in its domestic industries will reduce their competitiveness.
- Thus, it intends to impose an import duty on carbon intensive industries from non EU countries to meet both these objectives.
- The CBAM is intended to work like the EU's Emission Trading System (ETS), which sets a cap on the amount of GHG emissions permitted.
- Under the EUETS, companies covered by the scheme have to 'buy' allowances corresponding to their GHG emissions.
- Financial incentives are provided to them to cut emissions.
- But energy intensive industries receive free allowances to ensure their competitiveness.
- This is also a way of preventing carbon leakage, wherein carbon intensive production by EU based producers could move to non EU countries with lax environmental regulations.
- The CBAM has been pitched to replace this allocation of EUETS allowances.
- The CBAM's transitional phase will last until December 2025.
- In this stage, all EU manufacturers and importers of energy intensive industries will need to report the GHG emissions embedded in their imports without any financial obligations.
- From January 1, 2026, the CBAM will enter the definitive phase wherein, upon declaration of the emissions embedded in imports, the importers will be required to surrender annually the corresponding number of CBAM certificates

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- India has just started working on its own carbon trading mechanism.
- In December 2022, it amended the Energy Conservation Act, 2001, to introduce the Carbon Credit Trading System (CCTS).
- This is proposed to combat climate change by incentivizing actions for emission reductions leading to increased investments in clean energy by the private sector.
- The Ministry of Power is still working on the specifics to operationalize the CCTS, including carbon valuation.

The Hindu

Lunar economy & ULA

- The first American spacecraft to attempt to land on the Moon in more than half a century is poised to blast off early Monday but this time, private industry is leading the charge.
- A brand new rocket, United Launch Alliance's Vulcan Centaur, lifted off from Cape Canaveral Space Force Station in Florida for its maiden voyage, carrying Astrobotic's Peregrine Lunar Lander
- Vulcan Centaur is a two-stage-to-orbit, heavy-lift launch vehicle developed by United Launch Alliance (ULA).
- It is principally designed to meet launch demands for the U.S. government's National Security Space Launch (NSSL) program for use by the United States Space Force and U.S. intelligence agencies for national security satellite launches.
- It will replace both of ULA's existing launchers (Atlas V and Delta IV Heavy) in this role, as these launchers are retiring. Vulcan Centaur will also be used for commercial launches, including an order for 38 launches from Kuiper Systems.

TERMS

- **A two-stage-to-orbit (TSTO)** or two-stage rocket launch vehicle is a spacecraft in which two distinct stages provide propulsion consecutively in order to achieve orbital velocity.
- **A heavy-lift launch vehicle** is an orbital launch vehicle capable of generating a large amount of lift to reach its intended orbit. Heavy-lift launch vehicles generally are capable of lifting payloads between 20,000 to 50,000 kg (44,000 to 110,000 lb) (by NASA classification) or between 20,000 to 100,000 kilograms (44,000 to 220,000 lb) (by Russian classification) into low Earth orbit (LEO).

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- As of 2023, operational heavy-lift launch vehicles include the Long March 5, the Proton-M, and the Delta IV Heavy.
- United Launch Alliance, LLC, commonly referred to as ULA, is an American aerospace manufacturer, defense contractor, and launch service provider that manufactures and operates rocket vehicles that launch spacecraft into orbits around Earth and other bodies in the Solar System. ULA also designed and built the Interim Cryogenic Propulsion Stage for the Space Launch System (SLS).

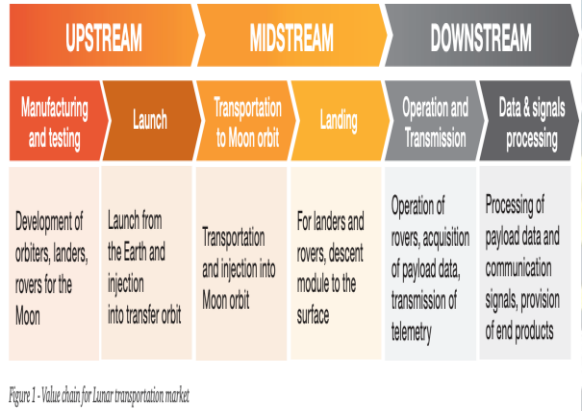

Figure 1 - Value chain for Lunar transportation market

- Significant steps were moved by the private sector into the wider space exploration domain (in lunar exploration, in Space Resources Utilization, or in the commercial exploitation of Low Earth Orbit)
- In 2015, NASA partnered with GM to develop a faster, more dexterous, and more technologically advanced robot, Robonaut 2
- In 2016, PTS partnered with Audi to help build and launch a 3D printed rover.
- In 2019, JAXA and Toyota announced their collaboration on international space exploration.

Mining Sector

- Remote-operating systems to minimize the danger in hazardous environments on Earth or in space.
- Mining technology and drills can be used to extract space resources.
- Technology transfer between the space sector and the O&G industry mainly for: robotics, advanced sensors, AI.

Construction Sector

- The construction industry is expected to support the development of modern techniques that would enable building lunar habitats and structures in space while simultaneously facilitating the terrestrial industry in advancing 3D printing (additive manufacturing) capabilities

Energy Sector

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- **OxEon Energy worked with the Colorado School of Mines to integrate an electrolysis technology to process ice and separate the hydrogen and oxygen on the Moon.**
- **The molecules could then be cooled to produce fuel for cislunar transport.**
- **Robotics Sector**

  The energy industry and the robotics industry will also play vital roles in investing and developing lunar exploratory activities.

  The Hindu

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Honeyguide bird

- African honeyguide birds understand and respond to the culturally distinct signals made by local human honey hunters, suggesting cultural coevolution between species.
- These successful calls have been maintained in these groups for generations.
- Systems in which humans successfully cooperate with wild animals are rare.
- One such involves the greater honeyguide, a small African bird known to lead humans to wild bees' nests

- Honeyguides (family Indicatoridae) are near passerine birds in the order Piciformes.
- They are also known as indicator birds, or honey birds,
- These birds are best known for their interaction with humans. Honeyguides are noted and named for one or two species that will deliberately lead humans (but, contrary to popular claims, not honey badgers) directly to bee colonies, so that they can feast on the grubs and beeswax that are left behind.
- Near passerines and higher land-bird assemblage are terms of traditional, pre-cladistic taxonomy that have often been given to tree-dwelling birds or those most often believed to be related to the true passerines.
- The Hindu

Annual tree ring

- Annual tree ring growth records from more than 122 species of trees show that trees growing in wetter forests are more sensitive to increasing drought.
- The findings suggest that land management and policy focused solely on drought effects in drier regions overestimates the resilience of forests in wetter regions.

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- Dendrochronology (or tree-ring dating) is the scientific method of dating tree rings (also called growth rings) to the exact year they were formed in a tree

- Research suggests that forests will continue to shift from carbon sinks to sources as the effects of climate change increase. So there is a need to predict which forests are vulnerable to a hotter future.

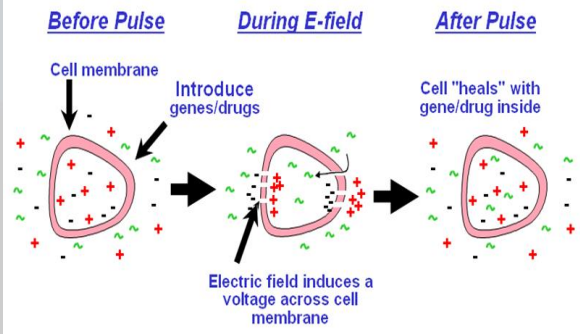
The Hindu

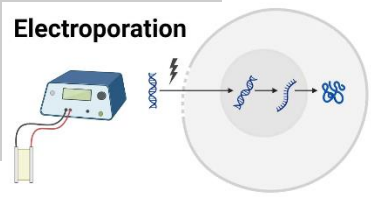
Teosinte

- Teosinte, any of four species of tall, stout grasses in the genus *Zea* of the family Poaceae.
- Teosintes are native to Mexico, Guatemala, Honduras, and Nicaragua. Domesticated corn, or maize
- Teosinte expands outward. It's an Omni-directional force starting from a pin point and then outward like an exploding star. This makes it impossible to define by a small sample

Electroporation

- Electroporation designates the use of short high-voltage pulses to overcome the barrier of the cell membrane.
- By applying an external electric field, which just surpasses the capacitance of the cell membrane, transient and reversible breakdown of the membrane can be induced





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Green turtle

- Rising global temperatures could lead to an increase in the nesting range of green turtles in the Mediterranean Sea, as per a study in Scientific Reports.
- Under the worst case climate scenario, the nesting range could increase by over 60% points, spreading west from the current area to include much of the North African, Italian, and Greek coastlines.
- Human caused climate change has caused sea surface temperatures to increase globally, with severe impacts on some marine life.
- Sea turtles are potentially particularly susceptible, as the sex of their offspring is dependent on incubation temperature

About Green turtle

- The green turtle is one of the largest Sea turtles and the only herbivore among the different species. Green turtles are in fact named for the greenish color of their cartilage and fat, not their shells.
- In the Eastern Pacific, a group of green turtles that have darker shells are called black turtles by the local community. Green turtles are found mainly in tropical and subtropical waters.
- Like other sea turtles, they migrate long distances between feeding grounds and the beaches from where they hatched. Classified as endangered, green turtles are threatened by overharvesting of their eggs, hunting of adults, being caught in fishing gear and loss of nesting beach sites.
- The Hindu

Michaung intensification and MJO

- On December 4, the cyclonic storm intensified into a supercyclonic storm. Tropical cyclones are 'engines' that use a warm sea surface as 'fuel'.
- As air moves over a warm sea, it also warms and accumulates moisture, and begins to ascend.
- In the process, it becomes cooler, which condenses the vapour and forms clouds. Condensation releases heat, which makes the air lighter and causes it to ascend further.
- As it does, the surrounding air moves in underneath, creating the surface winds associated with cyclones.
- This (simplified) process is the reason climate change has been conducive to cyclone intensification.

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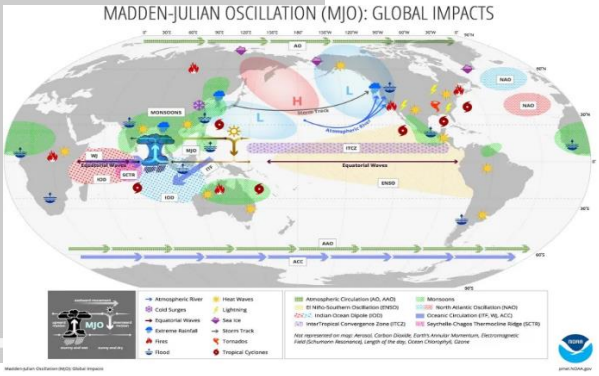
- Large water bodies absorb most of the heat of global warming.
- The intensification is also greater if the cyclone spends more time over water before landfall, as Cyclone Michaung did off the Tamil Nadu coast.

Why does intensification matter?

- Cyclones draw heat from the sea and move it to the upper atmosphere, where winds carry it to the earth's poles.
- An intensifying cyclone will do this more powerfully. A study published in May 2020 found that tropical cyclones with wind speeds upward of 185 km/hr had become 15% more likely since 1979.
- Cyclone Michaung's own intensification was also assisted by the MaddenJulian oscillation (MJO), among other factors
- The MJO consists of a 'pair' of weather anomalies that move eastward around the world once every one to two months.
- The leading side imposes dry weather while the trailing side imposes wet (rainy) weather. The advisory said that on December 3, the MJO near Cyclone Michaung maintained favourable conditions for rain formation.
- Cyclone intensification complicates forecast models and allows storms to make landfall with more energy, move further inland, survive longer, and bring their on ground devastation to previously 'inaccessible' areas.

ALL ABOUT MJO (MaddenJulian oscillation (MJO))

- Imagine ENSO as a person riding a *stationary* exercise bike in the middle of a stage all day long. His unchanging location is associated with the persistent changes in tropical rainfall and winds that we have previously described as being linked to ENSO.
- Now imagine another bike rider entering the stage on the left and pedaling slowly across the stage, passing the stationary bike (ENSO), and exiting the stage at the right.
- This bike rider we will call the MJO and he/she may cross the stage from left to right several times during the show.



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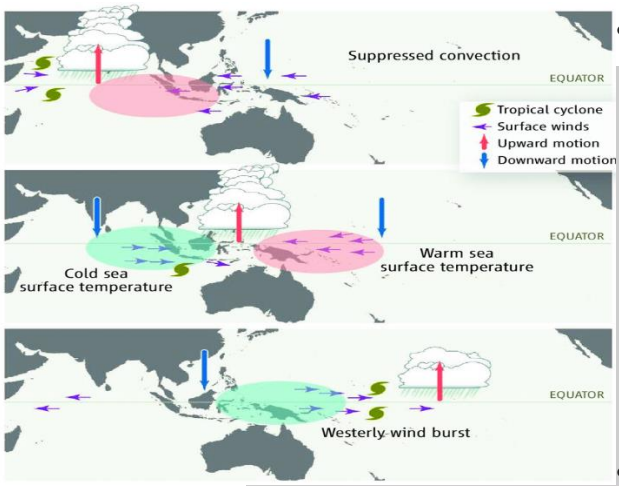
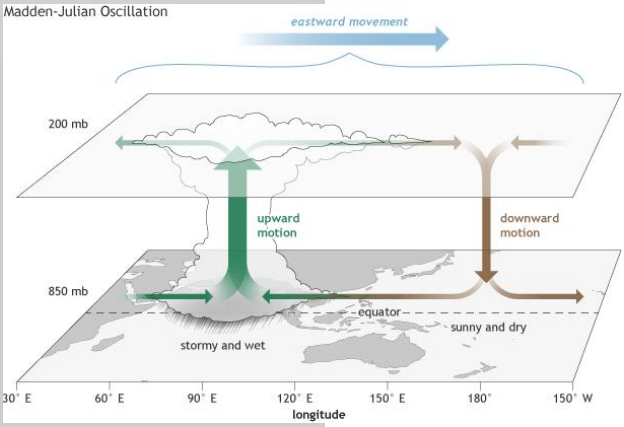


- **So, unlike ENSO, which is stationary, the MJO is an *eastward moving* disturbance of clouds, rainfall, winds, and pressure that traverses the planet in the tropics and returns to its initial starting point in 30 to 60 days, on average.**
- **This atmospheric disturbance is distinct from ENSO, which once established, is associated with persistent features that last several seasons or longer over the Pacific Ocean basin.**
- **There can be multiple MJO events within a season, and so the MJO is best described as *intraseasonal* tropical climate variability (i.e. varies on a week-to-week basis).**
- **The MJO was first discovered in the early 1970s by Dr. Roland Madden and Dr. Paul Julian when they were studying tropical wind and pressure patterns.**
- **The MJO consists of two parts, or phases: one is the enhanced rainfall (or convective) phase and the other is the suppressed rainfall phase. Strong MJO activity often dissects the planet into halves: one half within the enhanced convective phase and the other half in the suppressed convective phase.**
- **These two phases produce opposite changes in clouds and rainfall and this entire dipole (i.e., having two main opposing centers of action) propagates eastward.**
- **In the enhanced convective phase, winds at the surface converge, and air is pushed up throughout the atmosphere. At the top of the atmosphere, the winds reverse (i.e., diverge).**
- **Such rising air motion in the atmosphere tends to increase condensation and rainfall**



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PMJANMAN

- The Tribal Affairs Ministry told the Rajya Sabha that the population of Particularly Vulnerable Tribal Groups (PVTGs) was not in decline, citing information provided by the Office of the Registrar General and Census Commissioner of India (ORGI)

Who are the PVTGs?

- Initially known as Primitive Tribal Groups, the PVTGs are defined by the government as tribal communities that show either a declining or stagnant population, use of pre-agrarian technology, economic backwardness, low literacy etc.
- They are found to be living in some of the remotest and most inaccessible areas in the country.
- There are 75 such communities which are spread over 18 States and Union Territories, according to government figures.

What does the PMJANMAN aim to do?

- The Cabinet recently approved the ₹24,000 crore Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan after the Prime Minister announced the Particularly Vulnerable Tribal Groups Development Mission early this year that would take basic facilities likes roads, power, homes, mobile connectivity, etc. to the most backward among the Scheduled Tribes, the PVTGs.
- The first announcement of this package came early this year during the Budget Session, when Finance Minister Nirmala Sitharaman announced that a PMPVTG Development Mission would be launched, for which the Government was planning a ₹15,000 crore expenditure, to be spent over a period of three years.
- The allocation cleared by the Union Cabinet on November 29 for this package stood at ₹24,104 crores out of which the central share would be ₹15,336 crores and the share for the respective State governments would stand at ₹8,768 crores.
- The Hindu

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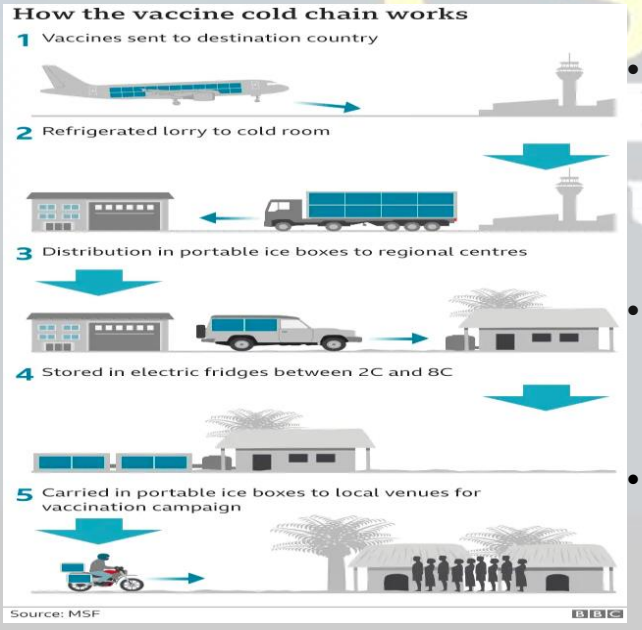
Warm vaccine

Why in the news??

- A heat-tolerant vaccine developed by the Indian Institute of Science (IISc.) researchers is said to be effective against all current strains of SARS CoV 2 besides having the potential to be quickly adapted for future variants as well.
- The 'warm' vaccine developed by the Bengaluru-based Mynvax laboratories, a company incubated at the Indian Institute of Science Bangalore, is unique among existing vaccines in that it can be stored at 37 degrees Celsius for four weeks and at 100 degrees Celsius for up to 90 minutes



- Nearly all vaccines need to be transported and distributed between 2C and 8C in the so-called cold chain.
- And most of the Covid-19 vaccines under development, according to the World Health Organisation (WHO), will need to be refrigerated at temperatures well below 0, the freezing point of water.
- "warm" or a heat-stable vaccine, they claim, can be stored at 100C for 90 minutes, at 70C for about 16 hours, and at 37C for more than a month and more.
- Only three offering protection against meningitis, human papillomavirus (HPV), and cholera - are licensed and approved by WHO for use at temperatures up to 40C.
- These vaccines can be deployed quickly in hard- to-reach communities, and reduce pressures on healthcare workers.
- The Hindu

Warmest year

- Last year was the planet's hottest on record by a substantial margin and likely the world's warmest in the last

1,00,000 years, the European Union's Copernicus Climate Change Service (C3S) said on January 9. Scientists had widely expected the milestone after climate records were repeatedly broken

- The world has not breached that target which refers to an average global surface temperature of 1.5 degrees over decades but C3S said the fact that temperatures had exceeded the level on nearly half of the days of 2023 set "a dire precedent".
- Despite the proliferation of governments' and companies' climate targets, CO2 emissions remain stubbornly high.
- The world's CO2 emissions from burning coal, oil and gas hit record levels in 2023.
- Last year, the concentration of CO2 in the atmosphere rose to the highest recorded, of 419 parts per million, C3S said.
- It was also the first year in which every day was more than 1C hotter than pre-industrial times.
- Alongside human caused climate change, temperatures were boosted by the El Niño weather phenomenon, which warms the surface waters in the eastern Pacific Ocean and contributes to higher global temperatures, in 2023.
- Each fraction of temperature increase exacerbates extreme and destructive weather disaster.
- The Hindu

Cosmic rays

- Cosmic rays are streams of energetic particles and clusters of particles coming from outer space and the sun.
- They include protons and alpha particles (nuclei of helium atoms). Only low-intensity cosmic rays reach the earth's surface.
- Their energy is mostly lost in the atmosphere itself, as they smash into atoms of the atmospheric gases and produce a shower of other particles.
- Otherwise life wouldn't have been possible on the earth.

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- From the 1930s, studies of cosmic rays led scientists to discover many then unknown subatomic particles

How much energy?

- Data collected by the Telescope Array Project indicated the Amaterasu cosmic ray had an energy of 240 exa electronvolt (EeV).
- The electronvolt (eV) is a unit of energy, like joules, used to measure the energy of subatomic particles.
- The energy of 1 eV is approximately 1.6 × 1019 joules. One joule is the energy required to light a one-watt bulb for one second.
- The light particles in sunlight have an energy of about 1.63.1 eV, for example. When one deuterium nucleus and one tritium nucleus undergo fusion, they release one helium atom, one neutron, and 17.6 million eV of energy.
- The mass energy of a single Higgs boson particle, which is considered 'heavy', is 125.1 billion eV.
- Cosmic rays typically range in energy from about one billion eV to about 100 billion billion eV.
- The Amaterasu cosmic ray had an energy of 240 EeV or 240 billion billion eV. This is extremely high.

What do cosmic ray energies tell us?

- Ultra high energy cosmic rays (UHECRs) are subatomic particles from extragalactic sources with energies greater than 1 EeV.
- Scientists have observed UHECRs more energetic than 100 EeV.
- But typically, cosmic rays with more energy than around 60 EeV don't 'survive' beyond a certain distance in space.

Where did Amaterasu come from?

- An amazing feature of the Amaterasu particle is that if you look along the direction it came, towards its point of origin, there is nothing to be seen – meaning it appears to have come from an empty part of the universe

How can Amaterasu help?

- Cosmic rays can be divided into two types: those originating from beyond our solar system, called galactic cosmic rays (GCR), and high energy particles emitted by the sun, called

solar cosmic rays, that are mainly protons.

- Solar cosmic rays originate primarily in solar flares. In modernity, the particles in these rays have come to be called solar energetic particles.
- By tracking these cosmic rays, scientists have found that the mass ratio of helium to hydrogen nuclei that is, the ratio of the total masses of hydrogen and helium present is about 28:100, meaning there are about 28 grams of alpha particles for every 100 grams of protons in cosmic rays.

The Hindu

Remission policy

The story so far:

- The Supreme Court on January 8 set aside the remission of 11 convicts sentenced to life imprisonment for the gang rape of Bilkis Bano and the murder of her family, during the 2002 communal riots in Gujarat.
- The remission order was passed by the Gujarat government in August 2022.

What are clemency powers?

- Articles 72 and 161 of the Constitution provide powers to the President and Governor respectively to grant pardon, commutation, remission, respite, or reprieve to a convict.
- These are sovereign powers vested in the heads of the Union and State executive to be exercised on the advice of the council of ministers.
- Apart from this, the appropriate State government under Section 432 of the Criminal Procedure Code, 1973 (CrPC) may remit the whole or part of the punishment to which a convict has been sentenced.
- In the case of life imprisonment convicts, this remission can be done only after a period of 14 years in jail as per Section 433A of the CrPC.

Why Fog in north India?

What is fog?

A fog is a collection of small droplets of water produced when evaporated water has cooled down and condensed.

"Fog is nothing but a thick cloud, but very close to the earth's surface. For a thick fog to form, temperatures should be lower, and abundant moisture should be available near the surface."

Fog materializes whenever there is a temperature disparity between the ground and the air.

- **This happens frequently during Indian winters fog is created when the temperature drops at night and in the early morning, aerosols present in the atmosphere condense.**
- **High humidity, combined with an ample presence of water vapor or moisture, encourages foggy conditions.**
- **The process by which it cools plays a pivotal role in the formation of fog. One primary mechanism contributing to fog formation is called infrared cooling.**
- **It typically occurs when the weather is transitioning from summer to winter.**
- **In the summer, the ground absorbs radiation from the sun, becomes warmer, and moistens the air passing over it.**
- **When cooler weather kicks in, this mass of warm, moist air comes in contact with processes that cool it.**
- **The 'collision' prompts the water vapor in the air to condense rapidly, giving rise to fog.**
- **Another type of fog, known as radiation fog, is prevalent and occurs when an unseasonably warm day with high humidity is followed by rapidly dropping temperatures.**
- **The specific type of fog, its duration, and its effects are contingent on various environmental conditions.**

Why is northern India prone to fogging?

- **"The entire Indo Gangetic plains are prone to formation of fog during winter season, as all the conditions low temperatures, low wind speed, moisture availability and plenty of aerosols are present in this region,"**
- **"Moisture incursion into this region can happen once a Western Disturbance a precipational pattern that brings rain to north India during**

winter months moves across northern parts.

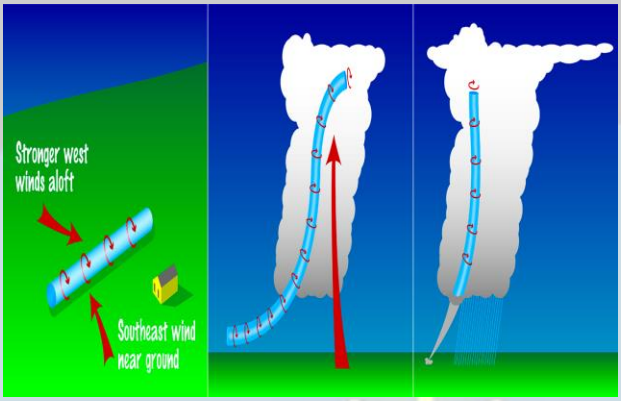
- Sometimes, moisture incursion can happen from the Arabian Sea also.

The Hindu

Tornadoes Formation

- Severe weather battered the U.S., spinning off tornadoes and reportedly killing three people in the South as high winds and blizzards buffeted the North causing a power blackout
- Tornado - A violently rotating column of air touching the ground, usually attached to the base of a thunderstorm.
- Tornadoes are nature's most violent storms.
- Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds.
- Winds of a tornado may reach 300 miles per hour
- Tornado - A violently rotating column of air touching the ground, usually attached to the base of a thunderstorm. Tornadoes are nature's most violent storms.
- Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds.
- Winds of a tornado may reach 300 miles per hour.
- A tornado forms from a large thunderstorm.
- Inside thunderclouds, warm, humid air rises, while cool air falls--along with rain or hail.
- These conditions can cause spinning air currents inside the cloud.
- Although the spinning currents start out horizontal, they can turn vertical and drop down cloud-becoming a tornado.

Conditions are ripe for tornadoes when the air becomes very unstable, with winds at different altitudes blowing in different directions or at different speeds a condition called wind shear. The first result is a large thunderstorm.



- Inside the huge thundercloud, warm and humid air is rising, while cool air is falling, along with rain or hail.
- All these conditions can result in rolling, spinning air currents inside the cloud.
- Although this spinning column of air starts horizontal, it can easily go vertical and drop down out of the cloud.
- When it touches the ground, it's a tornado.

The Hindu

AI and the global economy

- False and misleading information supercharged with cutting-edge artificial intelligence that threatens to erode democracy and polarize society is the top immediate risk to the global economy, the World Economic Forum
- In its latest Global Risks Report, the organization also said an array of environmental risks pose the biggest threats in the longer term.
- The report listed misinformation and disinformation as the most severe risk over the next two years, highlighting how rapid advances in technology also are creating new problems or making existing ones worse.
- The authors worry that the boom in generative AI chat-bots like ChatGPT means that creating sophisticated synthetic content that can be used to manipulate groups of people won't be limited any longer to those with specialized skills
- "Societies could become further polarized" as people find it harder to verify facts, she said.
- The rise of AI brings a host of other risks, she said. It can empower "malicious actors" by making it easier to carry out cyberattacks, such as by automating phishing attempts or creating advanced malware.

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The Hindu

SAURABH PANDEY

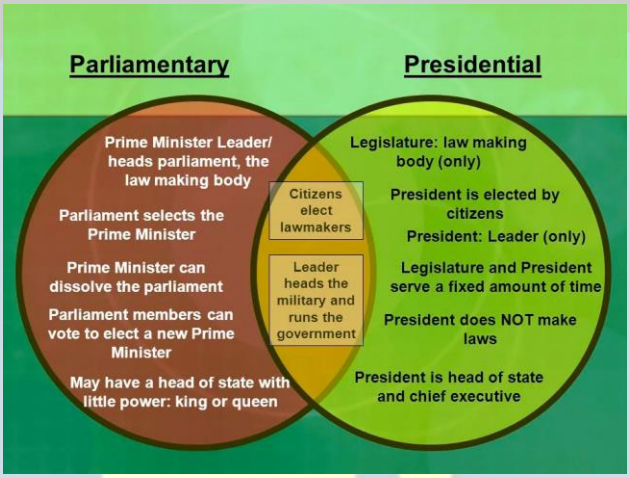
CSE

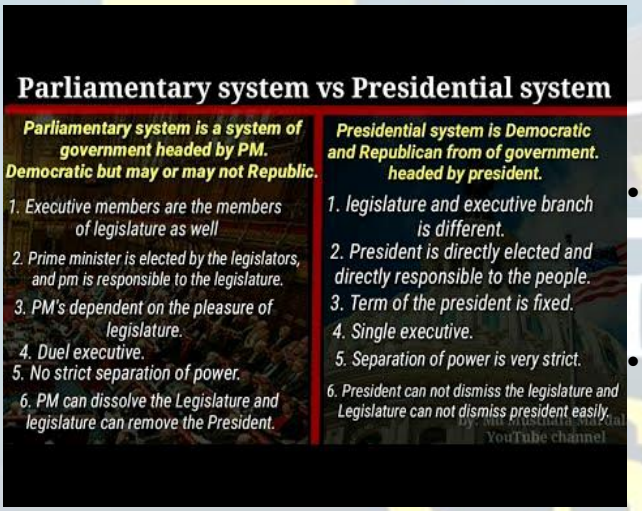
(CIVIL SERVICES EXAMINATION)

FROM BASICS TO UPSC BRILLIANCE

Current Affairs 12th January 2024 by Saurabh Pandey

Presidential vs parliamentary system





Parliamentary	*Presidential*
(1) In Parliamentary form of government the parliament or central legislatures is supreme.	(1) In Presidential form of government the President is real executive and he is the most powerful official of the country.
(2) Parliamentary systems of the government is based on the principles of collective leadership. The Council of ministers, having Prime Minister as its head is responsible to the Parliament.	(2) President is the head of the state. Generally he or she is elected directly therefore he is not responsible to the Congress or the Parliament in general.
(3) Head of the government is usually known as Prime Minister.	(3) President is also the head of the government.
(4) The Prime Minister is the leader of the majority party (or of the group of the several political parties).	(4) The President is generally directly elected by the people.
(5) He is accountable to the legislature.	(5) He is not accountable to legislature.
(6) In a monarchy constitutional democracy the monarch may be head of the state. Example the Monarch of Britain. He is a ceremonial executive.	
(7) In a Parliamentary Republic form of Parliamentary government the President is nominal executive. For instance Indias is a Parliamentary Republic. President in India is a ceremonial executive.	

India - Maldives relation

What led to the 'India out' campaign during Solih's administration?

- **The Maldives is a key maritime neighbours of India in the Indian Ocean Region (IOR).**
- **The country's location holds significant strategic importance to India, especially amid China's growing engagements in the region.**
- **Although Maldives India ties have been mostly cordial over the years, there was a noticeable tilt towards China during the presidency of Progressive Party of Maldives (PPM) leader Abdulla Yameen from 2013 to 2018.**

It was under Mr. Yameen that China included the Maldives as a part of its Belt and Road Initiative (BRI).

- Bilateral ties improved when Ibrahim Mohamed Solih of the Maldivian Democratic Party (MDP) took over the reins from Mr. Yameen in 2018.
- Aiming to reset ties with "one of its closest bilateral partners," Mr. Solih adopted an 'India first' foreign policy to establish a closer relationship with India in the areas of defence, security and economics.
- The growing proximity between New Delhi and Male and high level military exchanges sparked concern in certain quarters, leading to an 'India out' campaign spearheaded by the Opposition.
- The critics of the Solih administration alleged that the government was compromising the sovereignty of the island nation and "allowing Indian boots on the ground."
- The Opposition sharpened its attack after the government signed the Uthuru Thila Falhu (UTF) deal with India in 2021 to jointly develop the National Defence Force Coast Guard Harbour.
- The anti- India campaign emerged as the main poll plank in the 2023 presidential race under the leadership of former proChina Maldivian President Yameen.
- The first signs of a shift in foreign policy emerged when the new Maldivian President skipped India and instead travelled to Turkiye in November on his first official visit.
- The Ankara trip marked a departure from a long tradition of Maldivian heads visiting New Delhi first.

Why did the decision to revoke the survey pact with India cause a stir in political circles?

- The Muizzu government caused a stir in political and strategic circles with its decision to revoke a key 2019 agreement with India for conducting surveys in Maldivian waters.
- The Memorandum of Understanding (MoU) for hydrographic surveying, signed during PM Modi's state visit to the islands when President Ibrahim Solih was in power, backed the commitment of the two countries to maintain close cooperation in defence and maritime security.
- Critics of the Solih government, however, had claimed that it harmed national security.

The Hindu

Tableau selection

- The Defence Ministry has finalised a rotational plan which will ensure that all States and Union Territories get a

chance to display their tableaux at the Republic Day parade within a three year cycle.

- This year, tableaux of 16 States/Union Territories (UT) were selected for the January 26 parade following an established process but the Opposition ruled Delhi, Punjab, Karnataka and West Bengal that were not qualified cried foul.
- Only around 15 or 16 tableaux from States/UTs are selected each year, and, obviously, all cannot be accommodated.
- Those States that have not been selected for the parade this year were invited to showcase their tableaux at the Bharat Parv from January 23 to 31 at the Red Fort.
- The new plan, that has been agreed to by 28 States, is aimed at giving everyone an equitable chance at participation.
- The Defence Ministry already has an elaborate screening mechanism for participants in the parade.
- A committee of distinguished persons drawn from various fields including Padma awardees was set up this year too that screened proposals from States and organisations.
- The Ministry of Culture had empanelled 30 agencies for design and fabrication of tableaux through an open selection process and States/UTs were advised to engage these agencies following appropriate procedure.
- While the marching contingents and military platforms at the parade showcase the nation's military might, the tableaux and the performances hold a lens to the country's cultural splendor and diversity.
- In the backdrop of controversies year after year, the new proposal of a rotational opportunity for each State/UT offers a fairer, more transparent mechanism.

How are tableaux selected?

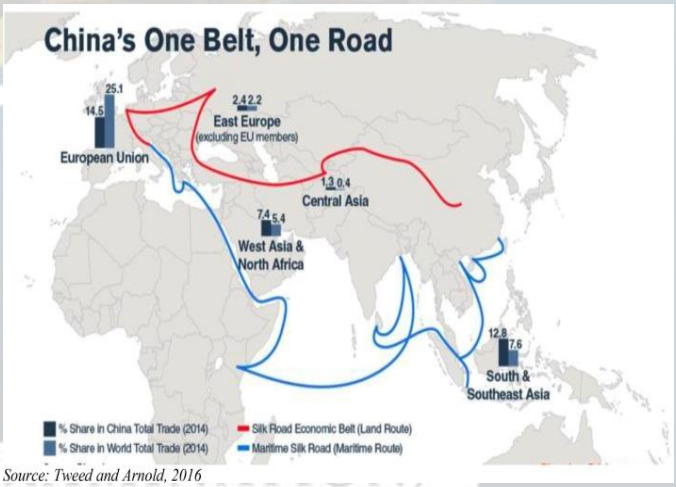
- Republic Day celebrates India's adoption of the Constitution and transition to a democratic republic.
- The parade, led by the President in New Delhi, showcases military strength and cultural heritage, featuring tableaux from States, Union Territories, Ministries, and departments.
- The Ministry of Defence oversees parade coordination and preparations.
- This process includes the selection and shortlisting of tableaux.

Who makes the selection?

- **The Ministry follows a standardized procedure for Republic Day parade tableau selection, inviting submissions months in advance based on a specified theme.**
- **Proposals undergo expert evaluation, including a basic assessment and a presentation of three dimensional models.**
- **Factors like visual appeal, theme alignment, and local resource use contribute to final selections.**
- **A State can pitch multiple proposals to the committee, but only one is chosen for the final parade.**
- **The Defence Ministry emphasizes time constraints for the limited number of tableaux.**
- **The Hindu**

China-Maldives agreements-BRI, Global security initiative

- **Two countries signed 20 key agreements, including one on tourism cooperation, and elevated their bilateral ties to a comprehensive strategic cooperative partnership.**
- **The two heads of state announced the elevation of bilateral ties to a Comprehensive Strategic Cooperative Partnership. .20 key agreements were signed today between the Government of the Maldives and the Government of China**
- **The agreements signed included one tourism cooperation, disaster risk reduction, blue economy, strengthening investment in the digital economy and the Belt and Road Initiative.**
- **China will also provide grant assistance to the Maldives, but the amount was not disclosed.**



Source: Tweed and Arnold, 2016

China's major global initiatives

Program	Date proposed	Objectives/progress
Global Security Initiative	April 2022	Aims to safeguard peace and provide a China-led solution to international security challenges
Global Development Initiative	Sept. 2021	Seeks to help developing countries eradicate poverty, improve public health and reduce other inequalities; more than 50 countries and international organizations have expressed support
Belt and Road Initiative	Sept./Oct. 2013	Backing infrastructure projects across 149 participating countries such as Cambodia, Pakistan, Laos, Thailand

Source: Nikkei Asia research

Current Affairs 12th January 2024 by Saurabh Pandey

The Hindu

Orion space Gravity 1

- **Orien Space's Gravity1, which is the most powerful rocket developed by a Chinese private company, takes off from a ship off the coast of Haiyang near Shandong province.**

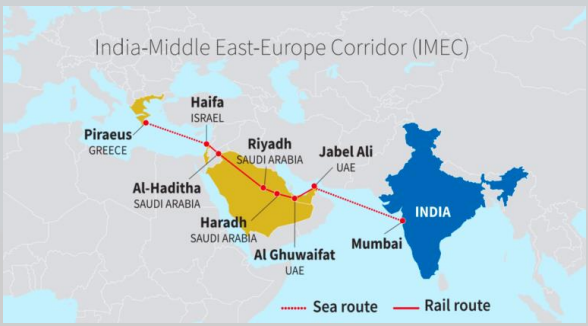
The Hindu

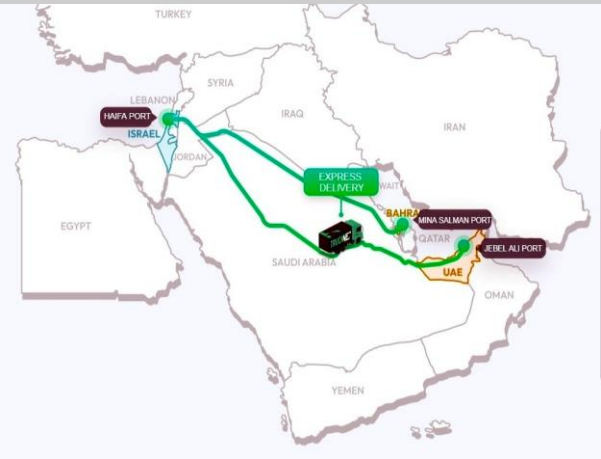
Krčedinska Ada

- **Island of Krčedin or Krčedinska Ada is a river island in Serbia. It is a river island, located on the left bank of the Danube. This island is located opposite the settlement of Krcedin, after which it got its name.**
- **It is an important part of the Special Nature Reserve "Koviljsko-Petrovaradinski rit".**

The Hindu

Alternative route to red sea





- **While shippers face delays in sending cargo to Europe and vice versa due to the Red Sea crisis, Israeli logistics startup Trucknet has a solution move cargo by road between Dubai and the Adanirun Haifa port in Israel.**
- **Cargo will move through Saudi Arabia and Jordan to reach Haifa port and proceed to Europe by sea.**
- **Though the startup cannot match the high volume that is moved by sea, it has a solution to move emergency goods such as medicines. This means cargo from Mumbai or Mundra can be sent to Jebel Ali, from where it could be sent by road to Haifa, and then via ships to reach ports in Europe or the U.S.**
- **The Hindu**

Cleanest city award 2023

- **This year the cleanest city award showcased joint winners. Port city Surat bagged the top honours, alongside Indore, who had conquered the top spot alone for 6 consecutive years.**
- **In the category of cities with a population of less than 1 lakh, Sasvad, Patan and Lonavala secured the top three spots. Mhow Cantonment Board in Madhya Pradesh was adjudged the Cleanest Cantonment Board.**
- **Varanasi and Prayagraj won the top two awards amongst the Cleanest Ganga Towns. Maharashtra, Madhya Pradesh and Chhattisgarh won the top three awards for Best Performing State.**
- **Chandigarh walked away with the award for the Best Safaimitra Surakshit Sheher. 110 awards were bestowed during the ceremony.**
- **"The theme for the year 2023 "Waste to Wealth" is an important topic to ponder upon.**
- **The G20 Leaders' Delhi Declaration has committed to "enhance environmentally sound waste management and substantially reduce waste generation by 2030 and highlight the importance of zero waste initiatives.**

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SWACHH SURVEKSHAN AWARDS 2023

All India Clean City Rank 1	Indore & Surat
All India Clean City Rank 3	Navi Mumbai
All India Clean City Rank 1 (Population < 1 Lakh)	Sasvad
All India Clean City Rank 2 (Population < 1 Lakh)	Patan
All India Clean City Rank 3 (Population < 1 Lakh)	Lonavala
Cleanest Cantonment Board	Mhow Cantonment Board
Best SafaiMitra Surakshit Sheher	Chandigarh
Cleanest Ganga Town Rank 1	Varanasi
Cleanest Ganga Town Rank 2	Prayagraj

The Hindu

Revised rules under Schedule M

- **The Ministry of Health and Family Welfare late last week notified revised rules under Schedule M of the Drugs and Cosmetics Rules, 1945.**
- **The revision aims to ensure that the pharma sector recommits to the manufacture of safe, effective, and high-quality drugs in compliance with international quality standards, thus benefiting both patients and industry.**
- **This is a response to the backlash India has been receiving over reports of substandard medicine exports.**
- **Last year, the country felt intense global scrutiny after the World Health Organization (WHO) issued an alert about cough syrups being contaminated with diethylene glycol and ethylene glycol.**
- **These are considered toxic to humans and can prove fatal.**
- **The contamination was allegedly found in samples taken from a batch of cough syrup made by QP Pharma hem Ltd, based in Punjab. QP Pharma hem Ltd's manufacturing licence was suspended after cough syrup, linked to child deaths in Gambia and Uzbekistan, were found to be contaminated.**
- **Other cases of alleged contamination have also been reported from cough syrups made in India.**
- **The latest revision includes five new categories of drugs pharmaceutical products containing hazardous substances such as sex hormones, steroids (anabolic and androgenic), cytotoxic substances, biological products, and radiopharmaceuticals.**
- **It also has additional sections including the introduction of a pharmaceutical quality system (PQS), quality risk management (QRM), product quality review (PQR), qualification and validation of equipment, and a computerised storage system for all drug products.**
- **According to the notification, the manufacturer must assume responsibility for quality of pharmaceutical products to ensure that they are fit for use, comply with**

requirements of the licence, and do not place patients at risk due to inadequate safety, quality or efficacy.

- **Additionally, companies must market a finished product only after getting "satisfactory results" from tests of the ingredients and retain enough of the samples of intermediate and final products to allow repeated testing or verification of a batch.**
- **The linkage between manufacturing and product quality and the interdependence has been established.**
- **Also, observations from ongoing risk based inspections further emphasise the need for a relook at current Good Manufacturing Practices (GMP) regulations and quality management systems being followed by pharmaceutical manufacturers."**
- **Based on the above factors and to keep pace with fast changing manufacturing and quality domain, there was a need to revisit and revise the principles and concept of GMP mentioned in current Schedule M.**
- **The Hindu**

Thirty Meter Telescope (TMT) project

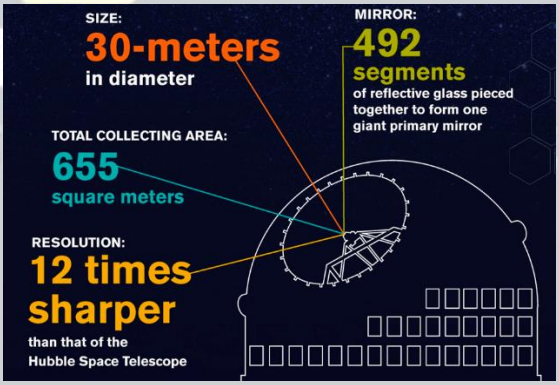
- In a signal of renewed enthusiasm for a global scientific project, an official delegation from the Department of Science and Technology visited Mauna Kea, an inactive volcano on the island of Hawaii in the U.S., to discuss "challenges" to the Thirty Meter Telescope (TMT) project, a press release said.
- The TMT has been conceived as a 30-meter diameter primary mirror optical and infrared telescope that will enable observations into deep space.
- It is proposed as a joint collaboration involving institutions in the U.S., Japan, China, Canada, and India. Indian participation in the project was approved by the Union Cabinet in 2014.
- India expects to be a major contributor to the project and will provide hardware worth $200 million. Mauna Kea hosts multiple telescopes.

Maunakea

- Maunakea is a truly unique place.
- The clarity and stability of the atmosphere above Maunakea allows incredibly detailed visual observations of the night sky. It is one of the best places on earth for TMT to capture the precise data needed to test fundamental theories of physics and detect the faint signatures of life on far-off worlds.

The Thirty Meter Telescope (TMT)

- The Thirty Meter Telescope (TMT) is a planned extremely large telescope (ELT) that has become controversial due to its location on Mauna Kea, on the island of Hawai'i.
- The TMT would become the largest visible-light telescope on Mauna Kea.



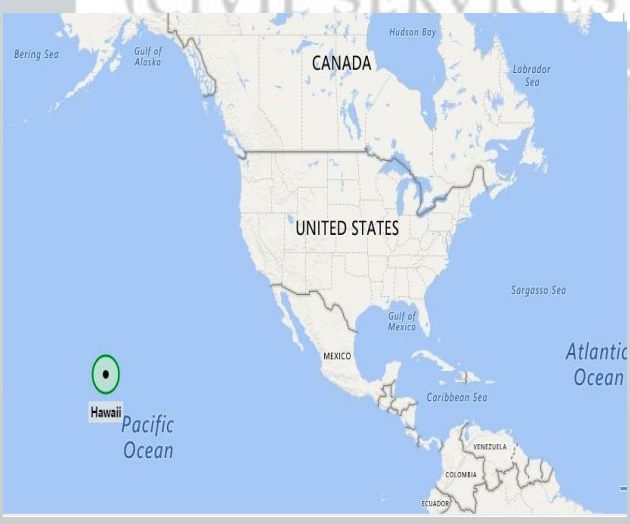
TMT's Science and Technology

TMT is an extraordinary international scientific endeavor that will

revolutionize our understanding of the universe and our place within it. Its unprecedented design will feature unique capabilities for the exploration of black holes, dark matter, and the possibility of life outside the solar system.

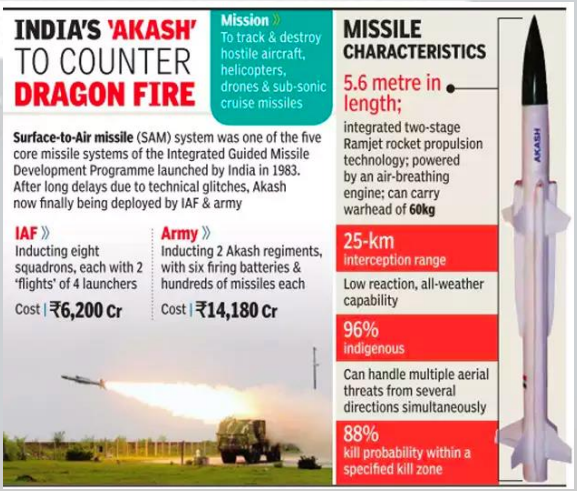
TMT will explore some of the most important questions facing astronomers:

- **What is the nature and composition of the universe?**
- **When did the first galaxies form and how did they evolve?**
- **What is the relationship between black holes and galaxies?**
- **How do stars and planets form?**
- **What is the nature of extrasolar planets?**
- **Is there life elsewhere in the universe?**



Aakash missile

- **The Defence Research and Development Organisation (DRDO) conducted a successful flight test of the new generation Akash surface-to-air missile (SAM) from the Integrated Test Range (ITR), Chandipur, off the coast of Odisha, on Friday.**
- **"The flight test was conducted against a high-speed unmanned aerial target at very low altitude.**
- **The target was successfully intercepted by the weapon system and destroyed.**



Police reform

- The three-day conference in Jaipur (in the first week of January) of police officers (Director General of Police level) from across India.
- police have still to earn the trust and confidence of a majority of the populace.
- The 'New Delhi conceived and managed' Indian Police Service (IPS) is perceived to be 'a permanent irritant' to some States who look upon the IPS as unreliable intruders over whom they have no control.
- we have more educated policemen in the lower echelons
- Knowledge and integrity will have to go together alongside genuine empathy for the common man if the image of India's police force has to improve.
- It is unfortunate that the structure of the hierarchy works against spending quality time with the constabulary.
- Why cannot DGPs and their immediate subordinates spend an hour a day to teaching their ranks how to expand their frontiers of knowledge a
- how to insulate our policemen from political caprice dominates all debates on the police?
- This knotty problem is intertwined with the democratic system of government.
- It is an art to politely say 'no' to a downright illegal demand made by grassroots politicians. Not many can do it with tact.

The Hindu

Optical 8 satellite

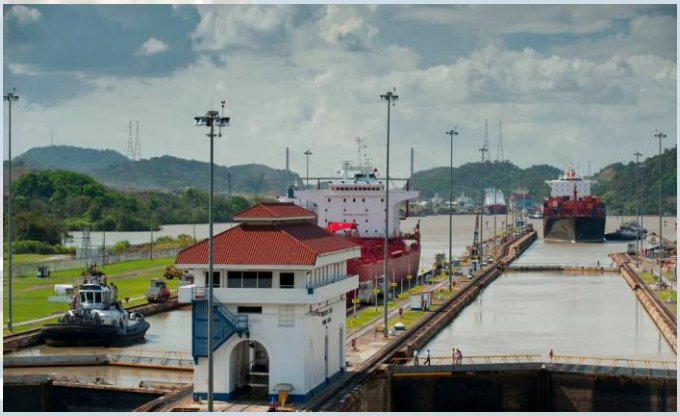
- Japan successfully launched a rocket carrying a government intelligence gathering satellite on Friday on a mission to watch movements at military sites in North Korea and to improve responses to natural disasters.
- The H2A rocket, launched by Mitsubishi Heavy Industries Ltd., lifted off from the Tanegashima Space Center in southwestern Japan, carrying the optical satellite as part of Tokyo's reconnaissance effort to rapidly build up its military capability.
- Optical 8 satellite can capture detailed images, though its capability is limited in severe weather.
- Japan began the satellite program after a North Korean missile flew over Japan in 1998.
- Japan aims at setting up a network of 10 satellites, including those carrying radars that can operate at night or in

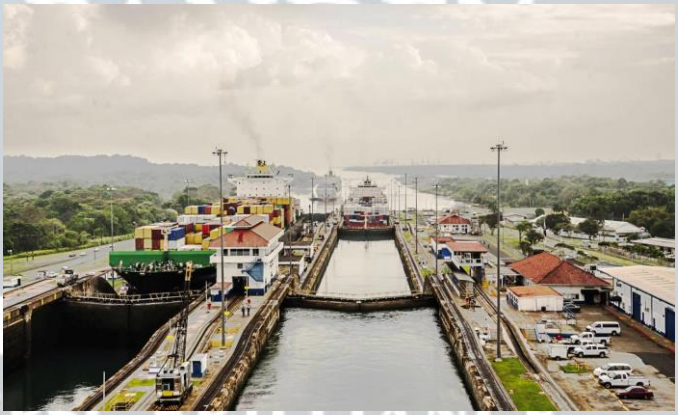
severe weather, to spot and provide early warning for possible missile launches.

The Hindu

Panama Canal

- **With the Red Sea crisis paralyzing the global shipping industry, there is more trouble for the sector due to the severe shortage of water in the Panama Canal.**
- **The artificial 82 kilometer waterway connects the Atlantic Ocean with the Pacific Ocean.**





- **The Canal's locks at each end lift ships up to Gatun Lake, an artificial freshwater lake 26 meter above the sea level created by damming the Chagres River and Lake Alajuela to reduce the amount of excavation work required for the canal, and then lower the ships at the other end.**

- An average of 20,00,00,000 liter of fresh water is used during the single passage of a ship.
- based on the current and projected water levels in Gatun Lake, the Panama Canal Authority had to make reductions to the amount and weight of vessels that can pass through the canal.
- The Panama Canal cuts across the Isthmus of Panama and is a key conduit for international maritime trade.

All about Atal setu

- Atal Setu is the longest bridge and also the longest sea bridge in the country.
- The prime minister's vision is to improve the 'ease of mobility' of citizens by strengthening urban transport infrastructure and connectivity. In line with this vision, Mumbai Transharbour Link (MTHL), now named 'Atal Bihari Vajpayee Sewri-Nhava Sheva Atal Setu' has been built.
- It is a 21.8-km long six-lane bridge having 16.5 km length over the sea and about 5.5 km on the land.
- It will provide faster connectivity to Mumbai International Airport and Navi Mumbai International Airport. It will also reduce the travel time from Mumbai to Pune, Goa, and South India. It will also improve connectivity between Mumbai Port and Jawaharlal Nehru Port.
- The lights used in Atal Setu do not disturb the aquatic environment and its construction involved several technologies that were used for the first time in India
- River circulation rings have also been used to minimize sound and vibrations to safeguard marine life.
- One of the most important features of this bridge is its environmental sustainability.
- The Bombay Natural History Society, an organization that works for the environment, has also given a certificate of appreciation to this landmark.

Technology used

- Reverse circulation rigs: These specialized rigs help in reducing sound and vibrations, hence protecting marine life around the bridge.
- Eco-friendly lighting: The bridge's lighting. lights that are designed to be non-disruptive to the aquatic to the aquatic environment

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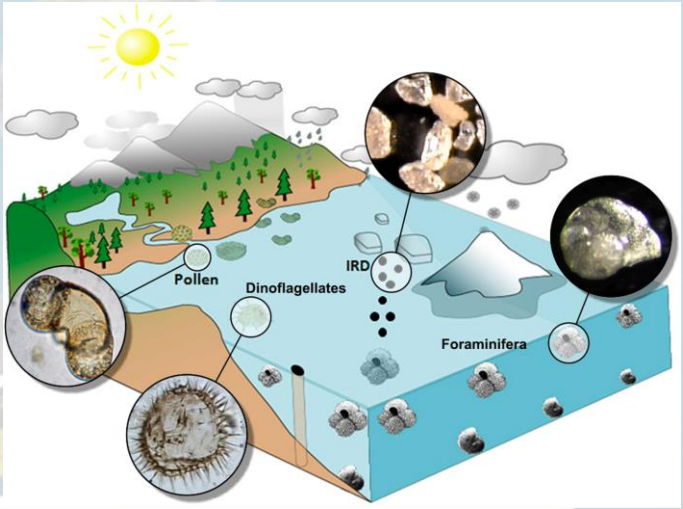
Current Affairs 14th January 2024 by Saurabh Pandey

Pollen dating & Gigantopithecus blacki

- The extinction of the largest known primate, a giant ape from China, resulted from its struggle to adapt to environmental changes, as per a paper published in Nature.
- These findings fill a key gap in our understanding of why this species failed to survive where other, similar primates persisted.
- Gigantopithecus blacki was a species of great ape found in China between 2 million and 330 thousand years ago, after which the species became extinct.

What is pollen dating?

- Pollen dating is done by comparing the pollen zones in different rock layers or strata, comparing older, deeper layers to newer ones on top.
- The pollen zone is the particular time frame where specific species of plants release more pollen into the air than others.
- Using this, archeologists can determine climate changes, deforestation, or changes in the use of land hundreds of years ago such as the association between European settlement in North America and an increase in the amount of ragweed pollen found.
- Specific locations can even be determined as the origins for many rare or uncommon pollens.
- Pollen can come in a variety of distinct shapes and sizes depending on the plant it is coming from.
- These microscopic grains are incredibly sturdy with outer shells made from sporopollenin, an incredibly inert substance.



The Hindu

Biodiversity hotspots and trees extinction

- A comprehensive analysis of tree species' conservation statuses across Atlantic Forest trees reveals high extinction risks.
- According to the study, roughly two-thirds of the 4,950 tree species living in this biodiversity hotspot are threatened with extinction.
- This includes 82% of endemic species, which have quite limited geographic ranges.
- The researchers suggest that the conservation status of tropical forests may be worse than previously believed.

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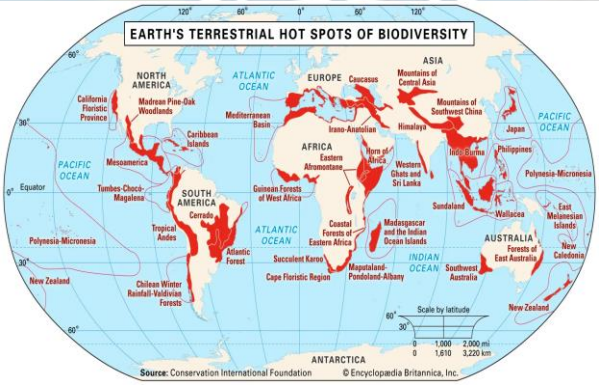
Biodiversity Hotspot

- Biodiversity hotspots are places on Earth that are both biologically rich and deeply threatened.

To qualify as a biodiversity hotspot, a region must meet two strict criteria:

- It must have at least 1,500 vascular plants as endemics which is to say, it must have a high percentage of plant life found nowhere else on the planet.
- A hotspot, in other words, is irreplaceable. It must have 30% or less of its original natural vegetation. In other words, it must be threatened.



The Hindu

Arctic seal survival

- Arctic seals have evolved many adaptations to cope with their frosty environment.
- Researchers report that these structures help the seals retain heat and moisture as they breathe in and out.
- The seals' ability to warm and moisten air during inhalation and to reduce heat and moisture loss during exhalation.
- In cold, dry environments, animals lose heat and moisture just by breathing. Most mammals and birds have complex bones called maxilla turbinate's inside their nasal cavities that help to minimise this risk.
- These porous, bony shelves are covered with a vascularized layer of mucosal tissues that humidify inhaled air, which is important for lung function and reduces the amount of heat and moisture lost during exhalation.

The Hindu

All about ICJ

What gives ICJ jurisdiction?

- The ICJ is the principal judicial organ of the United Nations. The statute that created it makes it clear that only states may be parties in cases before the Court.
- Both South Africa and Israel are signatories to the Genocide Convention of 1948, which has now been invoked by South Africa.
- Provisional measures are interim rulings of the ICJ aimed at preventing

either party from doing irreparable harm to the main case.

- Proceedings instituted before the ICJ usually take years to disposal.

What is the Genocide Convention?

- The Genocide Convention, 1948, was the first human rights treaty to be adopted by the UN General Assembly.
- It primarily arose form a commitment to 'never again' allow mass killing of people such as the Holocaust.
- South Africa's case is based upon Article II which says genocide means acts such as killing members of a national, racial, ethnic, or religious group; causing serious bodily and mental harm to the members of the group; and deliberately inflicting on the group conditions of life calculated to bring about its physical destruction in whole or in part.
- It has also accused Israel of causing hunger, dehydration, and starvation in Gaza by impeding sufficient humanitarian assistance, cutting off water, food, fuel, and electricity, and failing to provide shelter or sanitation to Palestinians in Gaza, including its 1.9 million internally displaced people.
- South Africa put the death toll at 23,000, 70% of them being women and children.

The Hindu

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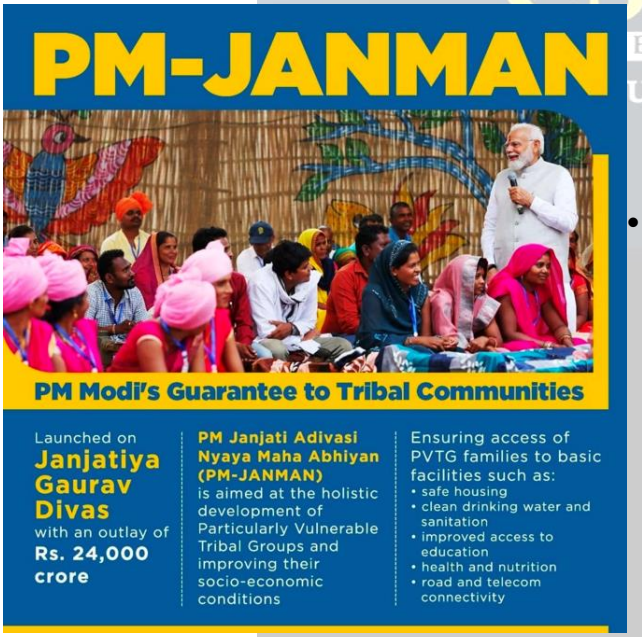
Bhogali Bihu

- Magh Bihu also called Bhogali Bihu or Maghar Domahi is a harvest festival celebrated in Assam, North-East India, which marks the end of harvesting season in the month of Magh (January–February).
- A bonfire (Meji) is lit for the ceremonial conclusion and prayer to the God of Fire. The festival is a regional variance of Makar Sankranti.
- The first day of Magh Bihu is known as Uruka or the Bihu Eve. On this day, women folk get ready for the next day with food items.
- The Hindu

PM – JANMAN



- According to the 2011 census, India has a Scheduled Tribe (ST) population of 10.45 crore, with 75 communities across 18 states and the Union Territory of Andaman and Nicobar Islands identified as Particularly Vulnerable Tribal Groups (PVTGs). These PVTGs continue to grapple with vulnerabilities in social, economic, and educational domains.
- In the Budget Speech for 2023-24, it was announced that a Pradhan Mantri PVTGs Development Mission will be launched to enhance the socio-economic conditions of Particularly Vulnerable Tribal Groups. This initiative aims to provide essential amenities such as secure housing, clean drinking water, sanitation, improved access to education, health, and nutrition, as well as enhanced road and telecom

connectivity, and sustainable livelihood opportunities to PVTGs households and habitats.

- An allocation of Rs. 15,000 crores has been earmarked for the next three years under the Development Action Plan for the Scheduled Tribes (DAPST) to implement this mission.
- This campaign is an effort aimed at saturating PVTGs families with individual entitlements and habitations with basic facilities, by making these tribal communities awake of their entitlements. During the campaign period, Aadhar Card, Community Certificate and Jan Dhan Accounts will be provided as these are basic requirements for other schemes such as issue of Ayushman Card, PM Kisan Samman Nidhi, Kisan Credit Card etc.
- This initiative will ensure to cover every PVTG household that has remained unreached because of distance, lack of road, and digital connectivity and will provide facilities at their doorstep. Places like Haat Bazar, CSC, Gram Panchayat, Anganwadi, Multipurpose Centre, Vandhan Vikas Kendras, and Krishi Vigyan Kendras will be used to organize these events.
- The Hindu

Modern computers and qubits

- Modern computers use semiconductor transistors to build circuits that function as bits.
- A semiconductor chip hosts more than 100 million transistors on 1 sq. mm. Imagine how small an individual transistor is and how close it is to adjacent transistors.
- As transistors become smaller, they become more susceptible to quantum effects. A fundamental limitation of conventional computing architecture is that each bit can exist in only one of the two states, 0 or 1.
- But according to quantum physics, a qubit can also be in a superposition of its two states at the same time
- To perform one calculation that requires 16 different inputs, a classical computer requires a total of four bits and sixteen computations.
- But with four qubits in superposition, a quantum computer could generate answers corresponding to all 16 inputs in a single computation.

Gate in computing

- A bit is the smallest piece of information storage (it is a portmanteau of binary digit).

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- Often, a large number of bits is required to convey meaningful information.
- With the advent of modern semiconductor technology, we routinely speak of household computers having a few terabytes (8 trillion bits) of information storage.
- One terabyte can store 500 hours of high definition video content. In a computer, a bit is a physical system with two easily discernible configurations, or states e.g. high and low voltage.
- These physical bits are useful to represent and process expressions that involve 0s and 1s: for instance, low voltage can represent 0 and high voltage can represent 1. A gate is a circuit that changes the states of bits in a predictable way.
- The speed at which these gates work determines how fast a computer functions.
- The quantum gate Modern computers use semiconductor transistors to build circuits that function as bits.
- A semiconductor chip hosts more than 100 million transistors on 1 sq. mm.
- Imagine how small an individual transistor is and how close it is to adjacent transistors.
- As transistors become smaller, they become more susceptible to quantum effects.
- Moore's law, announced in 1965, states that computing power increases tenfold every five years.
- This law no longer holds as we have already slowed to a twofold increase every five years.
- But this doesn't have to mean we are nearing the end of computing development: the quantum revolution is coming.
- The most basic unit of a quantum computer is a quantum bit, or qubit.
- Like in a conventional computer, it is a physical object that has two states.
- A quantum gate is a physical process or circuit that changes the state of a qubit or a collection of qubits.
- In the quantum computing context, if particles or superconducting qubits are the physical qubits, the gate is often an electromagnetic pulse.

What gates do??

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- In quantum computers, quantum gates act on qubits to process information.
- According to quantum physics, a qubit can also be in a superposition of its two states at the same time.
- The Hindu

Global surgery

What is global surgery?

- Global surgery focuses on equitable access to emergency and essential surgery.
- While it predominantly focuses on low and middle-income countries (LMICs), it also prioritizes access disparities and under-served populations in high-income countries (HICs).
- These "surgeries" include essential and emergency surgeries such as surgery, obstetrics, trauma, and anaesthesia (SOTA).
- Despite small differences, there is largely a consensus across multiple international groups on about thirty procedures that fall under the umbrella of emergency and essential surgery.

The Hindu

Regulating online gaming

With a staggering 692 million Internet users, India has the world's second-largest Internet user base and ranks eighth globally in terms of time spent on mobile apps.

- The average daily mobile app usage has surged to 4.9 hours, a 32% increase since 2019.
- Notably, a significant 82% of usage is dedicated to media and entertainment with social media accounting for roughly half of this engagement.
- While this trend has generated significant benefits to people, it has also created new concerns.
- For instance, the Internet has been inundated with AI generated deep fake videos of celebrities.
- These technologically advanced simulations have blurred the lines between what's real and what's not.

The online gaming

- The online gaming industry in India is predominantly a homegrown startup ecosystem growing at 27% CAGR.
- It is widely estimated that AI and online gaming can add up to $300 billion to India's GDP by 2026-27.

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- The meteoric rise of online gaming has brought with it an array of concerns such as addiction, mental illness, suicides, financial frauds, privacy, and data security concerns.
- Money laundering and national security concerns are other realities.
- The situation is further exacerbated by the growth of illegal offshore gambling and betting markets wherein the volume of digital transactions provides fertile ground for financial malpractices.
- In July 2023, the Parliamentary Standing Committee on Finance, of which I am a member, identified four major trends in cybercrime.
- Notably, one includes the use of international online betting sites for purposes such as money laundering.
- No mechanism exists for individuals to differentiate between legitimate gaming platforms and illegal gambling/betting sites.
- In addition, in the absence of a specialised regulatory authority, enforcement is lacking. As a result, the number of illegal operators is multiplying by the day.
- The inherent cross-border nature of the Internet makes enforcing such a ban almost impossible, leading to the unintended consequence of legitimate, regulated platforms being replaced by unregulated and potentially harmful ones.
- In this context, the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021 marked a commendable step towards oversight.
- According to the International Monetary Fund, a combination of high taxes and a weak, discretionary approach to regulatory enforcement creates the most fertile ground for the proliferation of a shadow economy an environment in which the Indian online gaming industry is operating.
- Therefore, establishing a strict regulatory framework is an urgent need, not just for protecting our digital nagriks and national interests, but also to ensure responsible growth of the online gaming sector.
- The Hindu

Anti-defection and speaker

- In Rajendra Singh Rana vs Swami Prasad Maurya (2007), the Court had said that when a member or a group of members of the ruling party joins hands with the Opposition party and meets the Governor along with the Members of the Opposition and try to form an alternative government,

they can be said to have voluntarily given up the membership of their original party. Originally, under the Tenth Schedule, a legislator could avoid disqualification on two grounds.

- First, a split in his political party occurs wherein one-third of the legislators form a faction and break with that party.
- Second, the legislator's party merges with another party and not less than two-thirds of them agree to the merger and walk out of the original party. In both these cases the outgoing legislators could claim exemption from disqualification.
- But the split provision in paragraph 3 of the Tenth Schedule was omitted through the 91st Constitution Amendment in 2003 ostensibly because of the frequent abuse of this provision by ingenious legislators.
- Now only the merger provision in paragraph 4 remains which can protect defectors provided the conditions stipulated in paragraph 4 are met, the main condition being the merger of the defectors party with another party. It is an extremely difficult condition to fulfill, yet this condition is also being circumvented now in a number of cases.
- The Hindu

Mount Marapi

- Mount Marapi, an active volcano located in the Padang Highlands of western Sumatra, Indonesia.
- The mountain is part of the Ring of Fire a long, horseshoe-shaped, seismically active belt that rings the Pacific Ocean.
- The highest peak among several volcanoes in the highlands, Mount Marapi rises to 9,485 feet (2,891 meters) above sea level.
- Its summit contains the Bancah caldera which has a diameter of 0.9 mile (1.4 km) and is characterized by a series of overlapping craters.
- Mount Marapi is often confused with a similar active volcano called Mount Merapi, which is located near the center of the island of Java, Indonesia..

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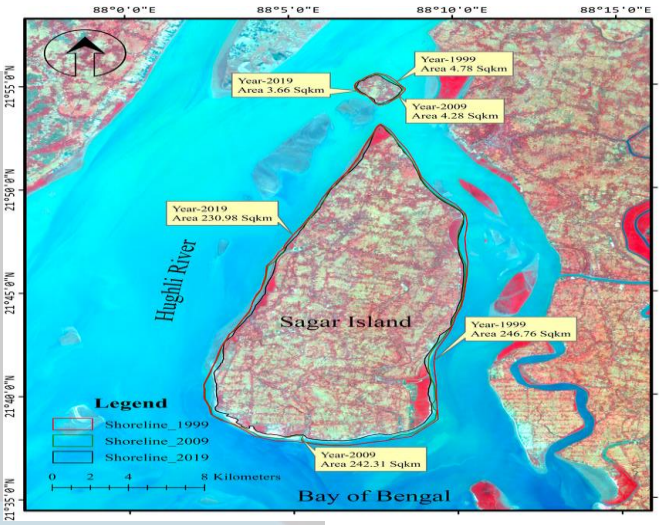
The Hindu



Sagar island

- **Rising sea level and erosion of the beach in front of the Kapil Muni temple on Sagar Island are turning out to be a damper on the Ganga Sagar Mela as the West Bengal government is desperately seeking a "national fair" status for the annual religious congregation.**

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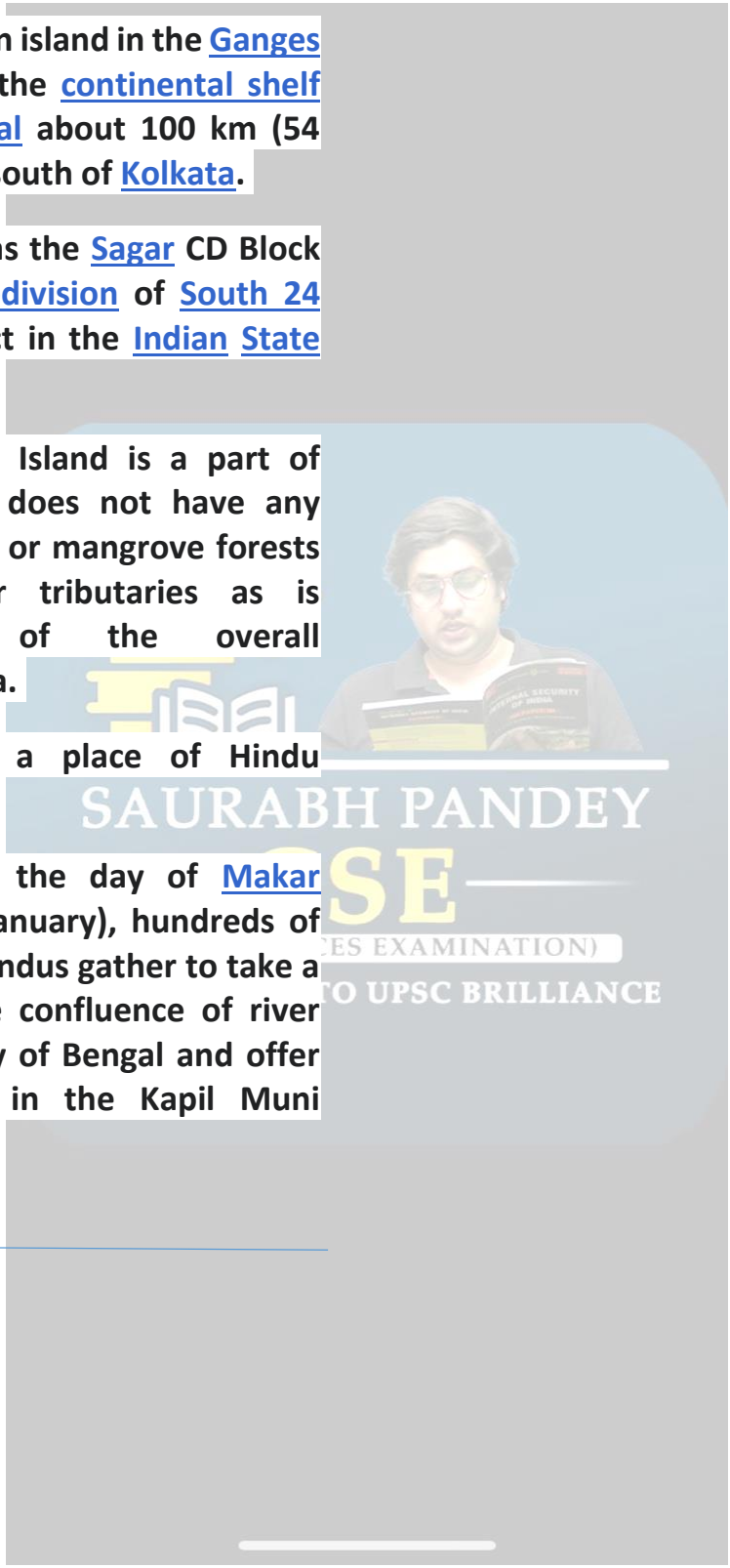
Sagar Island

- Sagar Island is an island in the Ganges delta, lying on the continental shelf of Bay of Bengal about 100 km (54 nautical miles) south of Kolkata.
- This island forms the Sagar CD Block in Kakdwip subdivision of South 24 Parganas district in the Indian State of West Bengal.
- Although Sagar Island is a part of Sundarbans, it does not have any tiger habitation or mangrove forests or small river tributaries as is characteristic of the overall Sundarban delta.
- This island is a place of Hindu pilgrimage.
- Every year on the day of Makar Sankranti (14 January), hundreds of thousands of Hindus gather to take a holy dip at the confluence of river Ganges and Bay of Bengal and offer prayers (*puja*) in the Kapil Muni Temple.



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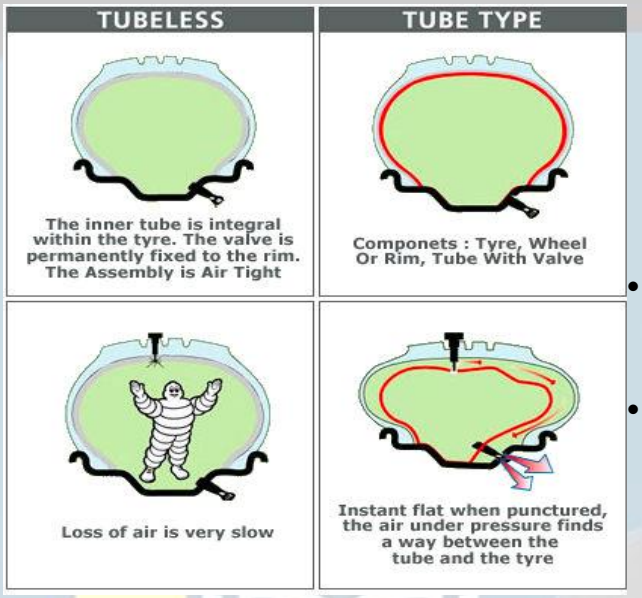
Tubeless tyre



- **Tubeless tyres are not popular in India for two reasons.**
- **First, rusting of rims, which leads to air leaks, is a perennial problem in a tropical climate.**
- **Second, fitment of such tyres needs special tools and presses and so they cannot be repaired in roadside shops.**
- **In conventional tubed tyres, the load is carried by a volume of air held inside a tube, which is closeted to the inside of the rim at the bottom and to a tyre over the remaining area. In tubeless tyres, the tyre itself holds the air.**
- **Outwardly, a tubeless tyre resembles a tubed tyre.**
- **The inside of a tubeless tyre has an airtight lining extending beneath the bead the part of the tyre that anchors it to the rim when inflated.**
- **In order to provide perfect sealing, a special coat of rubber is provided to the inside wall of the tyre which is fitted to the rim using rubber seals. The special bead seating (on the rim) also prevents air leaks.**
- **There is no need for a flap and so a valve is fitted to the rim itself for inflating or deflating the tyre.**

The Hindu

Mount Marapi

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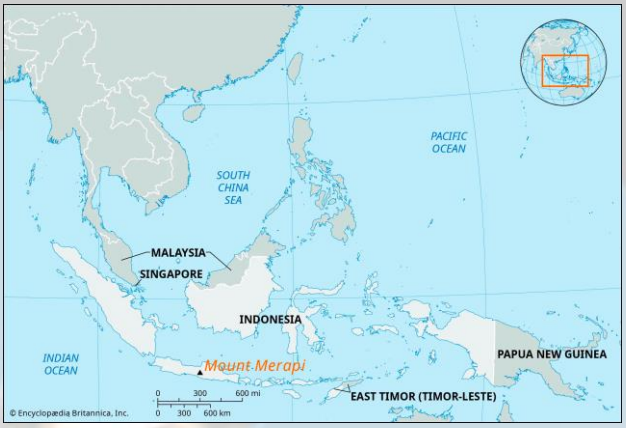
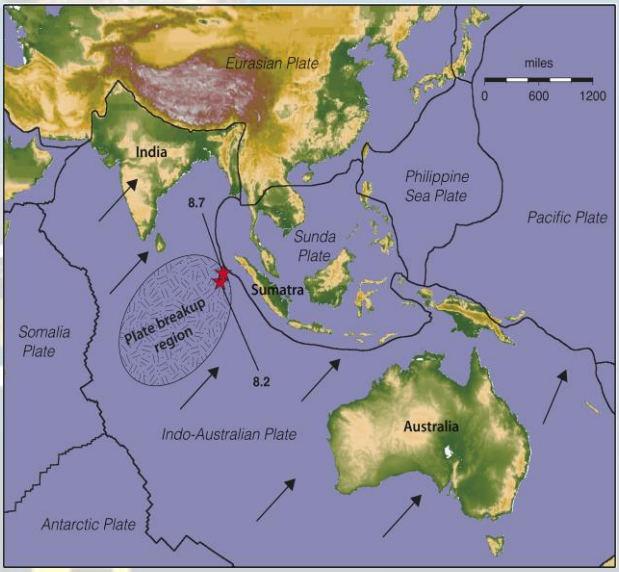
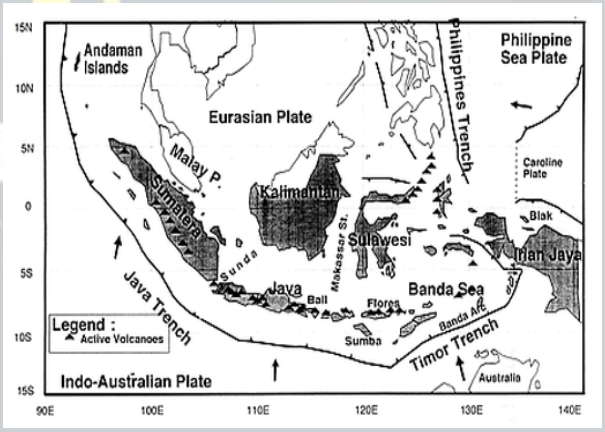
- **The Marapi, or Mount Marapi, is a complex volcano in West Sumatra, Indonesia, and is the most active volcano in Sumatra.**







- **India's relationship with the Maldives, built over time, is a comprehensive one.**

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- While the Maldives needs India, it is true that India needs the Maldives equally.
- The Maldives is India's key maritime neighbour in the Indian Ocean Region.
- It has also consistently taken pro-India positions in the Organisation of Islamic Cooperation.
- China and the Maldives also elevated their bilateral ties to a 'comprehensive strategic cooperative partnership'.
- In addition, Chinese President Xi Jinping said that China "respects and supports the Maldives in exploring a development path suited to its national conditions".
- According to the vocabulary of Chinese diplomacy, this means that China wants the Maldives to emerge out of India's shadows.

Wolf warrior diplomacy??

- Wolf warrior diplomacy is a style of coercive diplomacy adopted by Chinese diplomats during the Xi Jinping administration.
- The term was coined from the title of the Chinese action film *Wolf Warrior 2*.
- Wolf warrior diplomacy, China informed the world how its political system was better at handling the pandemic than the West.
- Wolf warrior diplomats in China often defend China's interests against what they perceive as hostility from abroad.
- Thereby, they resort to the rhetoric of authoritarianism as being more efficient than other systems and better at delivering the public good.

- The Hindu
- 10th schedule and anti-defection law

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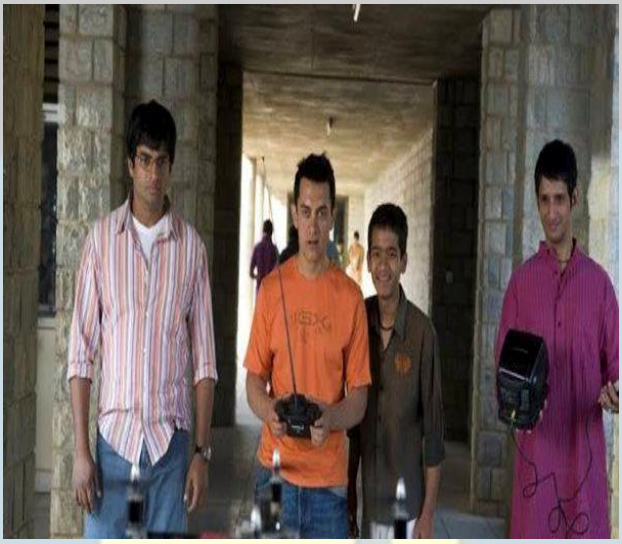

Why was the Tenth Schedule made?

- **The defections of legislators during the 1960s and 70s from their parent parties created political instability in many States, bringing down elected governments.**
- **Therefore, to ensure the stability of elected governments, the 52nd constitutional amendment introduced the 'antidefection' law through the Tenth Schedule in 1985.**
- **This Schedule provides that a member of a House of Parliament or State legislature who voluntarily gives up the membership of their political party or votes against the instructions of their party in a House are liable for disqualification from said House.**
- **This instruction with respect to voting is issued by the 'whip' of a party. A 'whip' is a member of the 'legislature party' in a House who is appointed as such by the respective 'political party'.**
- **The 'political party' is the entire organization of a party including the legislators, while the 'legislature party' is only the members of a political party in a House of Parliament or State legislature.**
- **The Tenth Schedule originally provided for two exceptions that would not render the members liable for disqualification.**

- First, one-third of the members of the 'legislature party' split to form a separate group (para 3).
- Second, a merger of their 'political party' with another party that is approved by two-thirds of members of its 'legislature party' (para 4).
- However, considering the need to strengthen the 'anti defection' law, para 3 was omitted in 2003.

What are the issues involved?

- With the deletion of para 3, there have been instances of two third members of a legislature party 'practically' defecting but claiming to be the original political party to escape disqualification.
- There have also been instances where more than two-thirds of members of a State 'legislature party' of a national political party merged themselves with another political party to escape disqualification.

What are the reforms needed?

- The Supreme Court in Sadiq Ali versus Election Commission of India (1971), laid down the three test formula for determining which faction is to be recognized as the original political party by the Election Commission.
- These are aims and objects of the party; its affairs as per the party's constitution that reflect inner party democracy; and majority in the legislative and organisation wings.
- The first test is subject to competing claims by rival groups. But it is lack of inner party democracy that results in most of these defections.
- The Hindu

PVR and Competition commission

Current Affairs 17th January 2024 by Saurabh Pandey

The story so far:

- Having found "no discernible competition concern," the Competition Commission of India (CCI) rejected a complaint alleging that multiplex chain PVR had abused its dominant market position.
- Yogesh Partap Singh, a film director, had accused the multiplex chain of according preferential treatment to films from large production houses over those by independent filmmakers.

What was PVR's response?

- PVR denied the allegations.
- It said that the allegations were not backed by evidence.
- Further, the chain argued that the purpose of the complaint was to "pressurize" it to exhibit his film, in the absence of any legal obligation to do so.
- PVR clarified that it has no special tie ups or recurring/long-term arrangements.

What does the CCI's order say?

- After examining the submissions of the multiplex chain, CCI concluded that there existed no perceptible concern about competition.
- Its order held that the commercial wisdom of the exhibitors is largely driven by consumer demand.
- Unless harm to competition was apparent, any intervention on its part would only lead to "undesirable consequences," it noted. T.

About Competition commission

- The Competition Act, 2002 was passed by the Parliament in the year 2002, to which the President accorded assent in January 2003.
- It was subsequently amended by the Competition (Amendment) Act, 2007.
- In accordance with the provisions of the Amendment Act, the Competition Commission of India and the Competition Appellate Tribunal have been established.
- The Competition Commission of India is now fully functional with a Chairperson and six members.

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- The provisions of the Competition Act relating to anti-competitive agreements and abuse of dominant position were notified on May 20, 2009.
- The Competition Commission of India ('Commission') has been established to enforce the competition law under the Act.
- The Commission consists of a Chairperson and not more than 6 Members appointed by the Central Government.
- It is the statutory duty of the Commission to eliminate practices having adverse effect on competition, promote and sustain competition, protect the interests of consumers and ensure freedom of trade carried on by other participants, in markets in India as provided in the Preamble as well as Section 18 of the Act.
- The Hindu

Ice berg

A cruise ship sails at the Gerlache Strait -which separates the Palmer Archipelago from the Antarctic Peninsula. AFP

- Gerlache Strait or de Gerlache Strait or Détroit de la Belgica is a channel/strait separating the Palmer Archipelago from the Antarctic Peninsula.
- Four tectonic blocks are identifiable in the Gerlache Strait area, bounded by two systems of Tertiary strike-slip faults.
- The longitudinal faults include the SW-NE trending Neumayer Fault that extends from Peltier Channel across Wiencke Island, and then onwards most likely as the Gerlache Fault.
- The SW-NE trending Fournier Fault parallels the Gerlache Fault and divides Anvers Island.
- The transverse faults trend E-W and SE-NW across Wiencke Island and Brabant Island, and include the Schollaert Channel faults.

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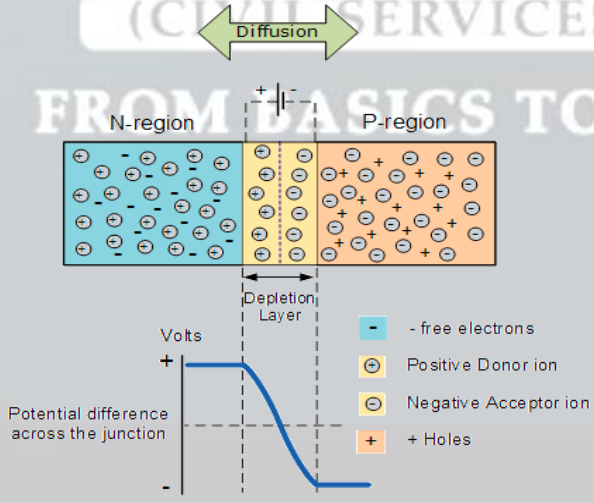
- The Danco Coast Block extends from Cape Willems to Wilhelmina Bay.
- The Brabant Island Block encompasses the southern portion of that island. The Neumayer Channel Block is bound by the Neumayer Fault and the Fournier Fault.
- The Anvers-Melchior Islands Block includes northwest Anvers Island and its offshore islands Melchior Islands.

The Hindu

PN Junction and working of LED

- The 21st century will be lit by LED lamps."
- The occasion was the awarding of the Nobel Prize for physics for that year, for an achievement that paved the way for light emitting diodes (LEDs), to succeed incandescent bulbs and fluorescent lamps, as the world's light source of choice.



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What are diodes?

- A diode is an electronic component about 5 mm wide. It has two points of contact, or terminals, called its anode and cathode.
- A diode's primary purpose is to allow current to flow in only one direction. It achieves this using a pn junction.
- A pn junction is made of two materials laid next to each other.
- One material is a ptype material: its primary charge carriers are holes.
- The other is an n type material: its primary charge carriers are electrons. Electrons: they are 'places' inside atoms that carry negative charge.
- A hole denotes a 'place' in an atom or a group of atoms where there could be an electron but isn't.
- Thus, a hole is an electron placeholder but without the electron, so it has a positive charge.
- A p-n junction is an interface where the surface of a ptype material and the surface of an n type material meet.
- At this interface, electrons can pass easily from the n type material to the p type material but can't go the other way.

What is an LED?

- An LED is a diode that emits light.
- Inside the diode's pn junction, the electrons have more energy than the holes.
- When an electron meets and occupies a hole, it releases energy into its surroundings.
- If the frequency of this energy is in the visible part of the electromagnetic spectrum, the diode will be seen to emit light.
- The overall phenomenon is called electroluminescence.
- The energy of a wave is proportional to its frequency.
- So making sure the light emitted by an LED is visible light is a matter of making sure the electron hole recombination releases a certain amount of energy, not more and not less.

What is the band gap?

- Particles like electrons can only have specific energy values.
- They can occupy only particular energy levels.
- When a group of electrons comes together in a system they're required to follow some rules.

- One of them is that no two electrons can occupy the same energy level at the same time.
- These electrons generally prefer to have lower energy, and thus prefer to occupy the lowest available energy level.
- If that level is taken, they occupy the next available level. Sometimes they can acquire more energy, tear free from their atoms, and flow around the material.
- In these circumstances, we say the material is an electrical conductor.
- When the electrons don't have enough energy to flow around, the material is an insulator.
- Electrons can acquire such extra energy when an electric field is applied to the material.
- The field will accelerate the electrons and energise them, and the electrons will be 'kicked' from lower to higher energy levels.
- It's the reason why electrons in these materials can't conduct an electric current unless they receive a minimum amount of energy the energy required to jump across this gap.
- This gap is called the band gap.
- In LEDs, the energy emitted when an electron and a hole recombine is the energy of the band gap.
- By carefully choosing the materials that make up the p-layer and the n-layer, researchers can engineer the composite pn junction to have a band gap that corresponds to visible light.

What colours can an LED produce?

- Since LEDs can produce all three primary colours red, green, and blue different LEDs can be combined on a display board to produce a large variety of colours.
- The reason: scientists had identified a compound, gallium nitride, that was electroluminescent and whose band gap could yield blue light.

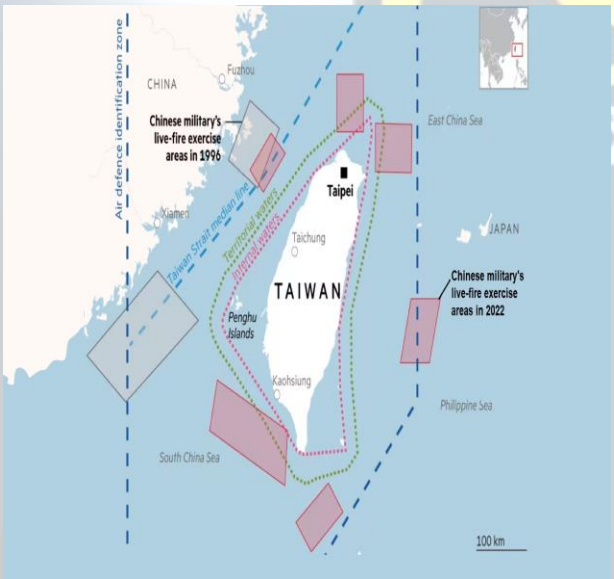
What are the advantages of LEDs?

- According to Moore's law, specified by American engineer Gordon Moore in the 1970s, the number of transistors on a chip would double every two years.
- Similarly, improvements to LEDs since 1970 have followed Haitz's law.
- Named for scientist Roland Haitz, it states that for a given frequency of light, the cost per unit of light of an LED will drop 10x and the amount of light it produces will increase 20x every decade.

- **But even before Haitz's law, researchers prized LEDs because they were more efficient than incandescent bulbs and fluorescent lamps.**
- **Per watt of power consumed, LEDs can produce up to 300 lumen (amount of visible light emitted per second) versus incandescent bulbs' 16 lumen and fluorescent lamps' 70 lumen.**
- **Together with their greater durability and light contrast, LEDs' advantages translated to higher cost savings and less material waste.**
- **LEDs have several applications in industry, consumer electronics, and household appliances: from smartphones to TV screens, signboards to 'feeding' plants light in greenhouses, barcode scanners to monitoring air quality.**

China –Taiwan

- **On January 13, Taiwan concluded its democratic elections.**
- **Lai Chingte of the Democratic Progressive Party (DPP), who was the Vice President under Tsai Ing-wen, whom China has called the "troublemaker", is the newly elected President of Taiwan.**



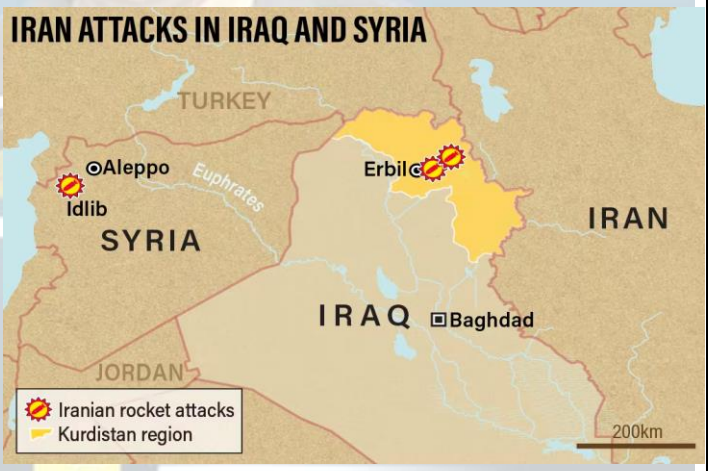
What is the status of China-Taiwan ties?

- **One of the main reasons for China's assertiveness is the refusal of Ms. Tsai to accept the '1992 consensus'.**
- **The 1992 consensus acknowledges that there is 'one China'. It was agreed upon between the Kuomintang (KMT, pro statusquo party) and the Communist Party of China (CPC).**
- **However, Ms. Tsai has publicly said that this consensus goes against the 'Taiwanese consensus'.**
- **There has also been a rise in 'Taiwanisation', where the younger generation of Taiwan do not feel any historical affinity with China.**
- **This generation recognises itself as Taiwanese and have grown up in a democratic political environment and do not feel any bond with the historical narratives of a united China.**
- **All these developments have intensified aggressiveness towards Taiwan under Chinese President Xi Jinping.**
- **Rejuvenation of the Chinese nation and reunification of Taiwan are two very prominent and essential goals for Mr. Xi.**
- **China had consistently made comments and indicated its**

displeasure of the DPP, given its pro independence stance.

The Hindu

Iran attack Pakistan



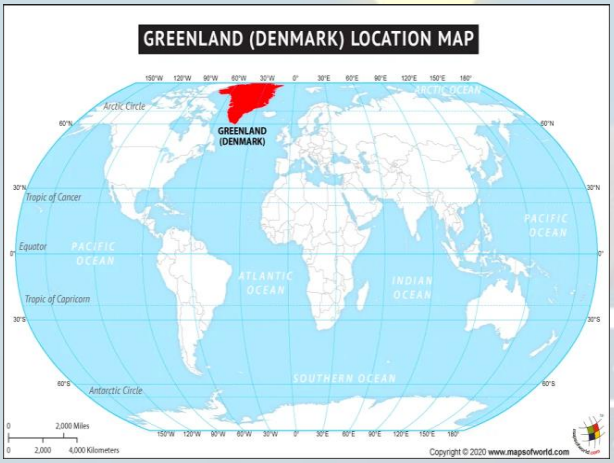
- on December 15, 2023, a police station in Rask in Iran's Sistan Baluchestan province, roughly 60 km from the Pakistani border, came under attack.
- At least 11 Iranian security personnel were killed in the attack, which was claimed by the Jaish al Adl (the Army of Justice).
- On January 3, 2024, a memorial event for Gen. Qassem Soleimani, the Quds Force commander who was assassinated by the U.S. in January 2020, in Kerman in southeastern Iran was hit by twin blasts, killing at least 94 people.
- The Islamic State Khorasan, the Afghanistan-based branch of the Islamic State terrorist group, claimed responsibility for the attack.
- All these attacks took place after the Gaza war between Israel and Hamas broke out on October 7, and Iran-backed militias in the region started attacking U.S. and Israeli troops as well as commercial vessels.
- Iran's retaliation On January 1516, Iran claimed to have carried out retaliatory strikes against "the perpetrators" of all these attacks.
- First, it launched missiles and kamikaze drones into Erbil, the capital of Iraq's Kurdistan.
- The IRGC claimed that its attacks destroyed "an espionage center" of Mossad, Israel's external security agency.
- **Analysis**
- The crisis is spreading like wildfire across the region, with profound implications for Iran's security, both internal and external.
- By carrying out multiple strikes in three geographies, Iran seems to be flexing its military muscles.
- It wants to send a message, to both the Sunni militants and its conventional rivals that it would not hesitate to take military action against targets that it deems hostile if its security red lines are breached, even at the risk of a wider war.
- Iran also seeks to assure its people that the government can act assertively to ensure the security of the Islamic Republic and that the killing of its commanders would be avenged.
- Iran may also be thinking that Israel is stuck in Gaza and the U.S. is preoccupied with the Houthis.
- This gives Tehran some space to make relatively bolder military moves.
- But what's to be seen is whether the attacks would help Iran improve its internal and external security or

these would further worsen the security crisis in a region, which is already in a ring of fire.

- **The Hindu**

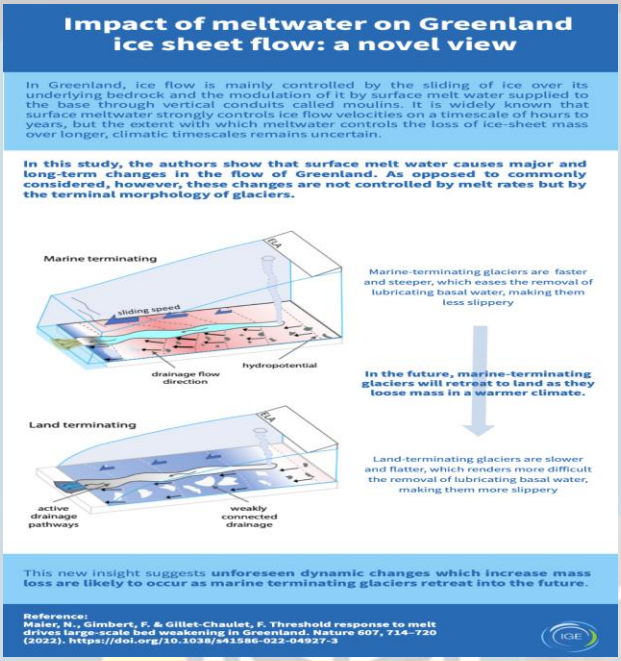
Greenland ice melting

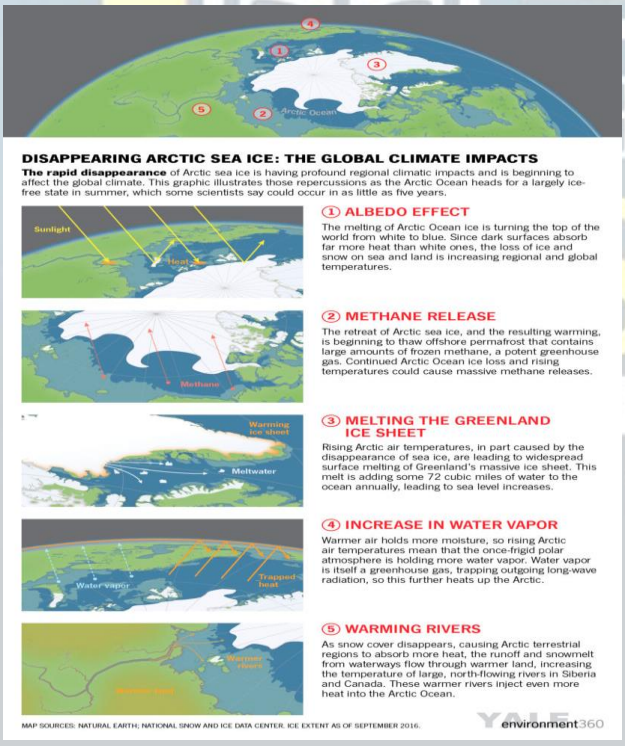
- **Climate change has caused Greenland's ice sheet to lose 20% more ice than previously thought, according to research published.**



- **Previous studies have found that about 5,000 gigatons of ice has been lost from the surface of the Greenland ice sheet in the past two decades, a major contributor to rising sea levels.**
- **They found that over 1,000 gigatons (1 gigaton is equivalent to 1 billion tons), or 20%, of ice around the edges of Greenland had been lost over the past four decades and not been accounted for.**
- **"The Greenland ice sheet has lost appreciably more ice in recent decades than previously thought.**
- **Researchers found that the Greenland glaciers most susceptible to seasonal changes that expand in winter and retreating in summer are also the ones most sensitive to the impact of global warming and experienced the most significant retreat since 1985.**
- **The melting of Greenland's vast ice sheet the world's second-largest after Antarctica is estimated to have**

contributed more than 20% to observed sea level rise since 2002.





The Hindu

Disruption of trade in Red Sea

- **Trade disruptions a worry- The situation in the Red Sea is growing in complexity.**
- **While the impact on stability is immense, the impact on trade is a growing concern.**
- **What is of greater concern is the modern weaponry being used and the inability of nations, both allies and strategic partners, to work together as a team, despite the substantial presence of maritime forces.**
- **This also raises questions about the claim of a high degree of interoperability after years of joint defence exercises.**
- **The delayed international response had provided the pirates with time to adapt to modern technologies and adopt tactics such as hijacking ships and using them as motherships.**
- **This has facilitated mid-ocean attacks, which in turn has increased the 'High Risk Area', with attendant multiple impacts on maritime trade such as rerouting and insurance costs.**
- **Tepid response from allies Operation Prosperity Guardian launched by the U.S. which was intended to operate under the Combined Maritime Force's (CMF)**

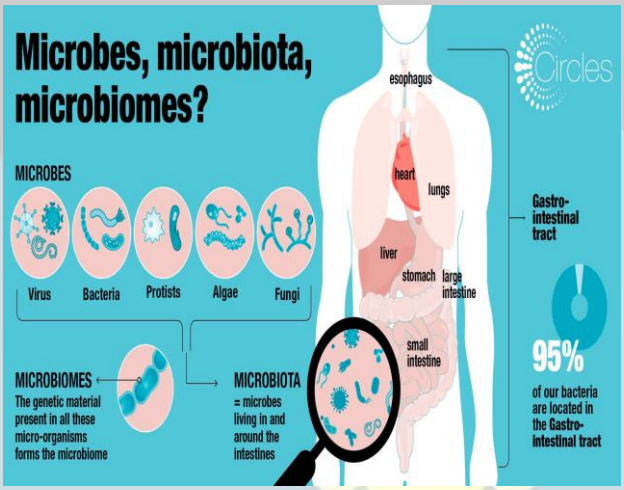
Combined Task Force 153 has seen a lackluster response from allies and strategic partners.

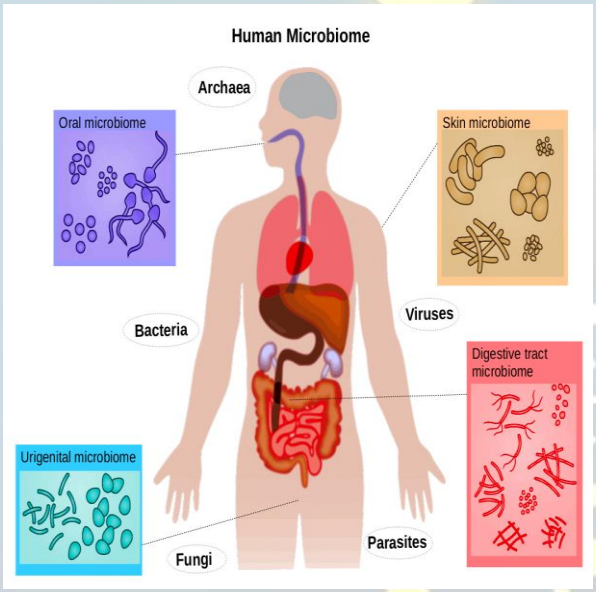
- **Out of the nine nations mentioned initially as part of the operation, three North Atlantic Treaty Organization (NATO) allies of the U.S., i.e., France, Italy, and Spain, declined to be part of the operation, and are operating independently.**
- **Bahrain, which houses the U.S. Fifth Fleet headquarters, is the only West Asian nation to be a part of the operation.**
- **Saudi Arabia has not joined the operation, perhaps to avoid negative impacts on the Saudiled negotiations on ending the ongoing war in Yemen, and the recent endeavours to improve relations with Iran.**
- **Another major reason could be to avoid being seen as supporting Israel, an aspect which perhaps has also limited the United Arab Emirates from joining the operation.**
- **India, which joined the CMF as an associate partner in 2022 and was upgraded to full member in November 2023, is also operating independently.**
- **This could be due to India-Iran relations despite the stoppage of oil imports based on U.S. insistence.**
- **Even the U.S.'s allies, Japan and Australia, are yet to join the operation.**

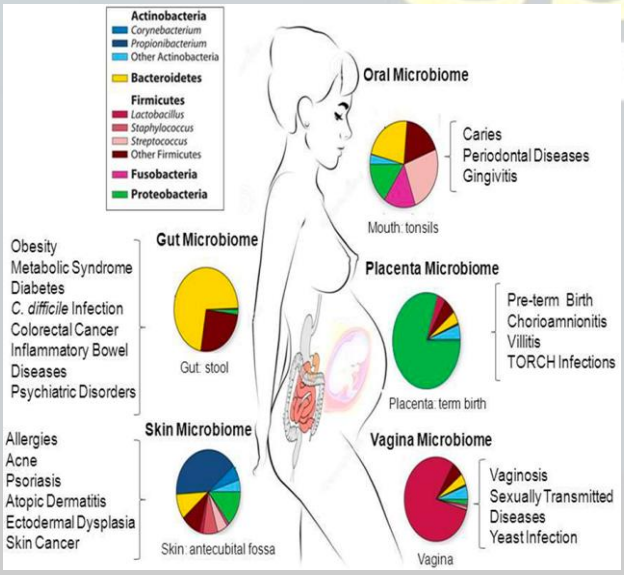
The Hindu

Microbiome role in the human body

- **The human microbiome is a community of trillions of microorganisms that reside in our body, especially in the digestive tract.**
- **It is a dynamic community that plays a pivotal role in regulating our health and diseases.**
- **These microbes influence various aspects of our well-being, including the way we digest food, absorb nutrients, metabolize key metabolites, develop immunity, and maintain good mental health.**
- **This is why scientists have been immensely interested in understanding the intricate relationship between the human genome and the body's microbial inhabitants.**







Role of Microbiome

The strong association of the ABO locus in the human genome and the gene cluster associated with the metabolism of Nacetylgalactosamine in specific microorganisms like in Faecalibacterium prausnitzii and Collinsella aerofaciens, which scientists have studied extensively in the context of cardiovascular risk suggests that the association of ABO and risk for cardiovascular disorders could in part be modulated through the microbiome.

	Group A	Group B	Group AB	Group O
Red blood cell type	A	B	AB	O
Antibodies in plasma	Anti-B	Anti-A	None	Anti-A and Anti-B
Antigens in red blood cell	A antigen	B antigen	A and B antigens	None

- **The development of colorectal cancer could be mediated by a molecule called trans 3 indoleacrylic acid (IDA).**
- **That is, administering IDA or implanting the microbe Peptostreptococcus anaerobius in the gut of mice caused them to develop colorectal cancer.**

- **Evidence is also mounting that the human microbiome can be associated with how neurons 'talk' to each other. Gut microbes produce vitamin B12**
- **The vitamin could influence neuronal signalling by influencing the availability of free choline, a molecule neurons use to make a neurotransmitter called acetylcholine.**
- **The yellow color of urine comes from a pigment called urobilinogen.**
- **Urobilinogen is produced in the body when the body metabolises bilirubin.**
- **And bilirubin is produced when the body metabolises haemoglobin in the blood.**
- **This is why a high level of bilirubin seen in the yellowing of the eyes is associated with jaundice.**
- **Using biochemical analyses and comparative genomics, they identified a bacterial enzyme, called bilirubin reductase (BilR), to be responsible for reducing bilirubin to urobilinogen, a pivotal step in this process that has so far remained out of sight.**
- **Through genome sequencing, the researchers observed that microorganisms belonging to the species Firmicutes predominantly encode the gene that teaches cells to make BilR.**

The Hindu

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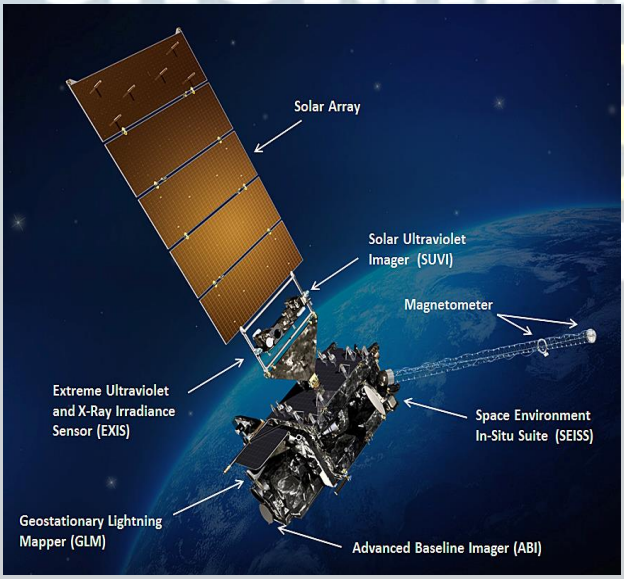
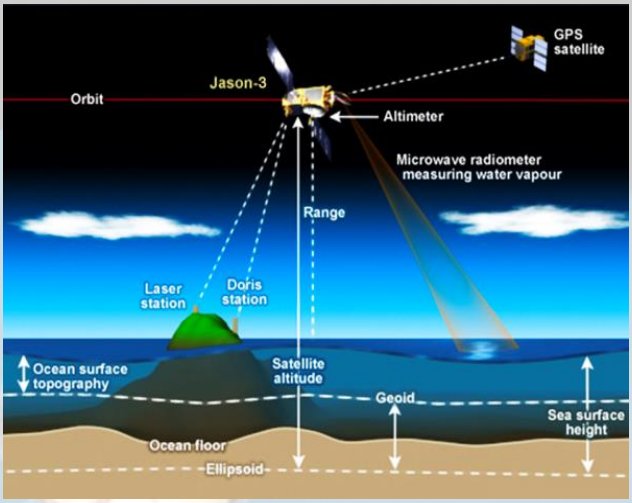
How does satellite track weather?

- The IMD has accompanied weather alerts with maps from the INSAT 3D satellite, and sometimes from the INSAT 3DR satellite.

How does one read the maps? What do the colors represent?

- At the bottom right of a map from 2021 (map 1) is a clue 'Night Microphysics'.
- According to a paper published by IMD scientists in February 2019, the INSAT 3D satellite has a red-green-blue, or RGB, imager whose images' colors are determined by two factors: solar reflectance and brightness temperature.





- Solar reflectance is a ratio of the amount of solar energy reflected by a surface and the amount of solar energy incident on it.
- Brightness temperature has to do with the relationship between the temperature of an object and the corresponding brightness of its surface.
- The INSAT 3D's 'day microphysics' data component studies solar reflectance at three wavelengths: 0.5 micrometers (visible radiation), 1.6 micrometers (shortwave infrared radiation) and 10.8 micrometers (thermal infrared radiation).
- The strength of the 0.5-micrometer visible signal determines the amount of green color; the strength of the 1.6-micrometer shortwave infrared signal, the amount of red color; and the strength of the 10.8-micrometer thermal infrared signal, the amount of blue color.

- This way, the INSAT 3D computer determines the color of each point of the image.

How does the satellite track snow?

- According to the paper, "the major applications of this color scheme are an analysis of different cloud types, initial stages of convection, maturing stages of a thunderstorm, identification of snow area, and the detection of fires."
- While the solar reflectance of snow and that of clouds is similar in the visible part of the spectrum, snow strongly absorbs radiation of wavelength 1.6 micrometer, that is the shortwave infrared.
- As a result, when the satellite tracks snow, the red component of the colour scheme becomes very weak.

How are the colours determined?

- The satellite's 'night microphysics' component is a little more involved.
- Here, two colours are determined not by a single signal but by the strength of the difference between two signals.
- The computer determines the amount of red colour according to the difference between two thermal infrared signals 12 micrometer and 10 micrometer.
- The amount of green colour varies according to the difference between a thermal infrared and a middle infrared signal 10.8 micrometer and 3.9 micrometers.
- The amount of blue color is not a difference but is determined by the strength of a thermal infrared.
- By combining day and night microphysics data, atmospheric scientists can elucidate the presence of moisture droplets of different shapes and temperature differences over time, and in turn track the formation, evolution, and depletion of cyclones and other weather events.
- For example, taking advantage of the fact that INSAT 3D can produce images based on signals of multiple wavelengths,

How do the satellites collect weather data?

- Both INSAT 3D and INSAT 3DR use radiometers to make their spectral measurements.
- A radiometer is a device that measures various useful properties of radiation, typically by taking advantage of radiation's interaction with matter, for example in the form of temperature or electrical activity.

- Both satellites also carry atmospheric sounders.
- These are devices that measure temperature and humidity and study water vapor as a function of their heights from the ground.

What weather satellites does India have?

- According to the INSAT 3DR brochure, its radiometer is an upgraded version of the very high-resolution radiometer (VHRR) that the Kalpana 1 and INSAT 3A satellites used (launched in 2002 and 2003, respectively.
- For meteorological observation, INSAT 3A carries a three channel Very High Resolution Radiometer (VHRR) with 2 km resolution in the visible band and 8 km resolution in thermal infrared and water vapour bands."
- The Kalpana 1 and INSATs 3A, 3D, and 3DR satellites aided India's weather monitoring and warning services with the best technology available in the country at the time, and with each new satellite being a better equipped version of the previous one.
- The INSAT 3D and 3DR satellites are currently active in geostationary orbits around the earth, at inclinations of 82 degrees and 74 degrees' east longitudes respectively.

The Hindu

HPV

- 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.Depending on the site affected, increase the risk of cancer of the cervix, vulva, vagina, penis, anus, mouth, tonsils, or throat.
- Nearly all cervical cancer is due to HPV, and two strains HPV16 and HPV18 account for 70% of all cases.
- HPV vaccines can prevent the most common types of infection.
- To be most effective, inoculation should occur before the onset of sexual activity, and are therefore recommended between the ages of 9–13 years.

The Hindu

Electric propulsion system

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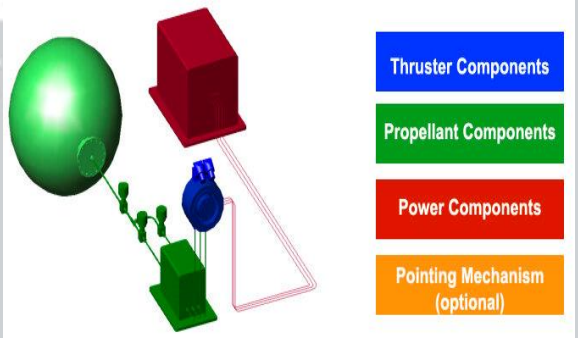
- Electric Propulsion, when compared with chemical propulsion, is not limited in energy, but is only limited by the available electrical power onboard the spacecraft.
- Therefore, EP is suitable for low-thrust (micro and milli-newton levels) long-duration applications on board spacecraft.
- The propellant used in EP systems varies with the type of thruster and can be a rare gas (i.e. xenon or argon), a liquid metal or, in some cases, a conventional propellant.

Electric Propulsion System components

An Electric Propulsion System is composed by four different building blocks:

- The thruster components,
- The propellant components or fluidic management system,
- The power components, which includes the PPU,
- The pointing mechanisms (optional)



Electric Propulsion applications and type of thrusters

The different applications which currently make or may make use of Electric Propulsion Systems in the future, are:

- LEO (e.g. Earth Observation, Earth Science, constellations)
- MEO (e.g. Navigation)
- GEO (e.g. Telecommunications)
- Space Transportation (e.g. launcher kick stages, space tugs)
- Space Science, Interplanetary, and Space exploration.

The Hindu

Steadfast Defender 2024

- The Steadfast Defender 2024 exercise, which will be held from next week to May, will involve about 90,000 troops from NATO-member states and Sweden.
- *"Steadfast Defender 2024 will demonstrate NATO's ability to rapidly deploy forces from North America,"*
- The last exercises of a similar scale were the Reforger drills during the Cold War in 1988 with 125,000 participants and the Trident Juncture ones in 2018 with 50,000 participants.

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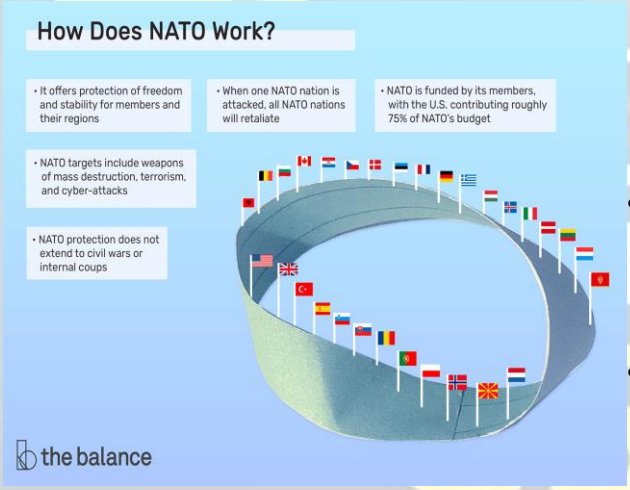

The Hindu

Chancay port and china

- Once-sleepy fishing town of Chancay, 80km north of Lima
- The town is about to become host to one of the largest Deepwater ports in Latin America. Construction and operation will be carried out entirely by private companies
- The project is so huge it has the potential to upend maritime traffic all along the Pacific coast of South America, displacing it from Chile, Ecuador and Colombia
- Cosco Shipping, a Chinese state-backed shipping and logistics company, has a 60 per cent stake in the port, with the remainder in the hands of Volcano, a Peruvian mining company
- "The intention of the port is to pull South American countries towards Peru as a focal point [for trade to Asia], taking advantage of our strategic location
- Cargo will be able to reach China from Peru in 10 days, rather than 45 at present.
- And Brazil is also expected to be a beneficiary of the port, which will provide quicker access to Asian markets for the country's exports.
- The $3.5 billion deep water port, set to start operations late this year, will provide China with a direct gateway to the resource rich region.
- Over the last ten years, Beijing has unseated the U.S. as the largest trade partner for South America, devouring its soy, corn and copper.

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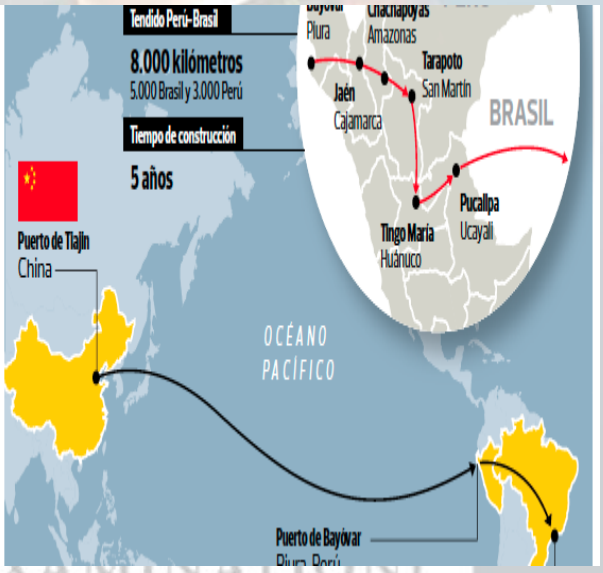

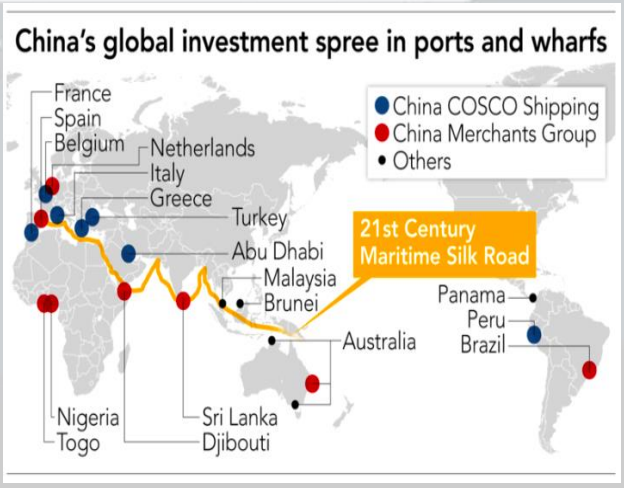

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Yanomami and gold mining

- The Yanomami are the largest relatively isolated tribe in South America.
- They live in the rainforests and mountains of northern Brazil and southern Venezuela.
- The Yanomami Indigenous group are again facing a severe humanitarian crisis blamed on illegal gold miners,
- Like most tribes on the continent, they probably migrated across the Bering Straits between Asia and America some 15,000 years ago, making their way slowly down to South America. Today their total population stands at around 38,000.
- At over 9.6 million hectares, the Yanomami territory in Brazil is twice the size of Switzerland. In Venezuela, the Yanomami live in the 8.2-million-hectare Alto Orinoco Casiquiare Biosphere Reserve. Together, these areas form the largest forested Indigenous territory in the world.
- The Hindu

India science management

- India's low overall expenditure on research and development (around 0.7% of GDP, compared to 3.5% for the United States and 2.4% for China) is but one aspect constraining its scientific outcomes.
- In 2022, the Indian Space Research Organisation stood a distant eighth on launch numbers, with foreign startups racing ahead on key technologies such as reusable rockets. Likewise, the lead in nuclear energy has been frittered away, being latecomers to small modular reactors; thorium ambitions remain unrealized.
- On critical science and technology themes such as genomics, robotics, and artificial intelligence, the situation is even more alarming.
- The direction and organization of science is inconsistent, even unfit, for the vital role that science must play going ahead. India's science is dominated by the public sector.
- Generic irritants associated with governmental bureaucracy, such as tardiness in approving crucial time-dependent funding, or equitable decision-making across different funding levels, are known problems.

Challenges

- The basic assumption behind the outsized role played by scientists in Indian science administration is that a good scientist will also be a good science administrator.
- The lack of comprehensive training in selecting which particular metrics are appropriate under what circumstances leads to absurdities such as an entire project getting derailed due to a single invoice or acquisition
- The fact that there is no system of all India transfers of both scientists and science administrators only magnifies institutional capture and factionalism.
- Poverty forced the country to concentrate high end equipment in a handful of institutions, primarily the Indian Institutes of Technology in the 1960s.
- Since only these institutions had exclusive access to certain equipment, a system of gatekeepers emerged.
- These gatekeepers slowly began to capture positions, government patronage, and institutional power on the back of their monopoly over critical equipment.

Step

- Even the U.S., with labs being embedded in the university ecosystem and run by scientists,

selects scientists for administrative roles quite early on in their careers.

- Such selected science administrators, by and large, only carry out administrative tasks thereon and are groomed for the task, with very few of them ever going back to active science.

The Hindu

OpenAI and challenges

- The New York Times (NYT) sued OpenAI and Microsoft for copyright infringement.
- The IT industry was shaken recently by the brief ousting and swift reinstatement of OpenAI's outspoken chief executive officer, Sam Altman, but the fierce conflict between the providers of information used to train Artificial Intelligence systems and the operators went unaddressed.
- The NYT claimed that these companies use information from multiple sources to develop AI products.
- OpenAI argues that since using copyrighted content to train GenAI models "serves a new 'transformative' purpose", their actions should be permitted under "fair use"
- An epic battle pits push-button information generated by AI against labor-intensive human newsgathering.
- From a legal perspective, it is a classic case of established law lagging behind new technology.
- The victory of Big Tech might deter human content producers.
- However, if The NYT prevails, GenAI companies might be required to compensate content producers for their use, which would significantly increase the cost of GenAI models.

The Hindu

Indian meteorological department

India Meteorological Department

It was established in 1875.

It is the National Meteorological Service of the country and the principal government agency in all matters relating to meteorology and allied subjects.

- To take meteorological observations and to provide current and forecast meteorological information for optimum operation of weather-sensitive activities like agriculture, irrigation, shipping, aviation, offshore oil explorations, etc.
- To warn against severe weather phenomena like tropical cyclones, northwestern, dust storms, heavy rains and snow, cold and heat waves,

etc., which cause destruction of life and property.

- To provide meteorological statistics required for agriculture, water resource management, industries, oil exploration and other nation-building activities.
- To conduct and promote research in meteorology and allied disciplines.

Analysis

- the India Meteorological Department (IMD), entered the 150th year of its existence.
- While at present, it analyses the entire spectrum of climate and weather, from cyclones to fog, it was conceived, in colonial times, to probe the mysteries of the southwest monsoon.
- The British administration, concerned about revenues, was intimately aware of the influence of the monsoon on harvests and thus extremely invested in determining whether past observations of wind, rain, and sunshine could be used to predict future torrents and droughts.
- In the years since then, the IMD has collected gargantuan stores of meteorological data that underlie its forecasts of the monsoon.
- One such analysis of this data by researchers at the Council on Energy, Environment and Water (CEEW) examines monsoon trends at the sub divisional (tehsil) level, from 19822022.
- This finds that monsoon rainfall is increasing in more than half, or 55%, of India's roughly 4,400 tehsils.
- About 11% of them saw decreasing rainfall.
- In those tehsils, about 68% experienced reduced rainfall in all four monsoon months, while 87% showed a decline during the June and July crucial for the sowing of Kharif crops.
- The southwest monsoon accounts for nearly 76% of India's annual rainfall, with about 11% from the northeast monsoon.
- That India's monsoons are increasingly prone to long, dry spells and punctuated by torrential wet spells is well documented though how much of it can be explained by natural variability and how much from global warming is an active area of research.
- While revenue extraction guided colonial interest in weather at the regional levels, such analyses have a new, contemporary relevance.
- This is to make region-specific plans to improve climate resilience and

channel necessary funds and resources.

- Prioritizing regional and sub-district forecasts over national ones, would be a commendable step forward by the government.

The Hindu

SLIM

- The Smart Lander for Investigating Moon (SLIM) is a Japanese Aerospace Exploration Agency (JAXA) mission designed to demonstrate accurate lunar landing techniques by a small explorer, with the objective of acceleration of the study of the Moon and planets using lighter exploration systems.
- SLIM is a small-scale exploration lander designed for pinpoint landings on the Moon's surface, reduction in the size and weight of equipment used in Moon landings, and investigation into the Moon's origins.
- It will also test technology fundamental to exploration in low-gravity environments, an important requirement for future scientific investigation of the solar system.
- The techniques demonstrated by this mission will pave the way for future lunar sample return missions. SLIM launched on 6 September 2023 and landed on the Moon on 19 January 2024 (

SLIM Mission Objectives

- Following are the SLIM mission objectives thereby JAXA endeavors to contribute to future missions to explore the moon and other planets;
- Demonstration of the accurate lunar landing techniques embodied in a small explorer
- Acceleration of the study of the moon and other planets using the lighter exploration system
- Future solar science exploration will demand the level of navigation accuracy that JAXA is in the quest for through the SLIM mission.

The Hindu

Spacecraft and Subsystems

- SLIM is an irregularly shaped cuboid 2.4 meters in height, 2.7 meters across, and 1.7 meters deep, with a dry mass of 190 kg and a fully loaded mass of 710 kg.
- The body is built around the propellant tank as the structural element. Power is provided by thin-film solar cells and lithium-ion batteries.
- SLIM will carry a landing radar for the final descent and a multiband camera for mineralogical exploration of the surface, as well as a small laser retroreflector array. The landing system uses a crushable

aluminum foam base to absorb impact.

- **Opioids and nonsteroidal anti-inflammatory drugs (NSAID)**
- **The sensation of pain, while universal, can also be influenced by culture.**
- **Though there is progress in understanding new pathways on how pain is processed at a biochemical level in the body, the current class of painkillers that consist of opioids and nonsteroidal anti-inflammatory drugs (NSAID) will remain the mainstay of treatment for a long time, said David Julius, biochemist, molecular physiologist and co -recipient of the 2021 Nobel Prize in Physiology.**
- **Opioids and non-steroidal anti-inflammatory drugs (NSAIDs) are the commonest drugs used to treat pain.**
- **Opioids mimic the actions of endogenous opioid peptides by interacting with mu, delta or kappa opioid receptors.**
- **The opioid receptors are coupled to G1 proteins and the actions of the opioids are mainly inhibitory.**

The Hindu

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Antibody-dependent enhancement (ADE)

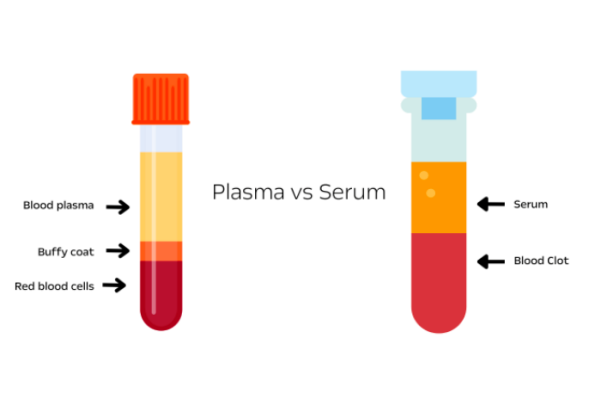
- Antiviral antibodies constitute an important component of the host immune response against viral infections and serve to neutralize and reduce the infectivity of the virus.
- However, these antibodies, intended to protect the host, may sometimes prove beneficial to the virus, by facilitating viral entry and replication in the target cell.
- This phenomenon, known as antibody-dependent enhancement (ADE) of infection, is a result of the interaction of virus–antibody immune complexes with Fcγ and/or complement receptors on certain types of host cells and promotes viral entry into the host cells.

SERUM PROTEIN

- Analysis of blood samples from patients with Long Covid a debilitating condition with unknown causes has revealed serum protein changes as the likely culprit.
- The findings highlight potential biomarkers for Long Covid diagnosis and could yield insights into treating the condition.

SERUM PROTEIN

- Serum is the fluid and solvent component of blood which does not play a role in clotting. It may be defined as blood plasma without the clotting factors, or as blood with all cells and clotting factors removed
- Serum proteins are classified as albumin or globulins. Albumin is the most abundant protein in the serum.
- It carries many small molecules. It is also important for keeping fluid from leaking out from the blood vessels into the tissues.
- Serum total protein, also known as total protein, is a clinical chemistry parameter representing the concentration of protein in serum. The serum contains many proteins including serum albumin, a variety of globulins, and many others.

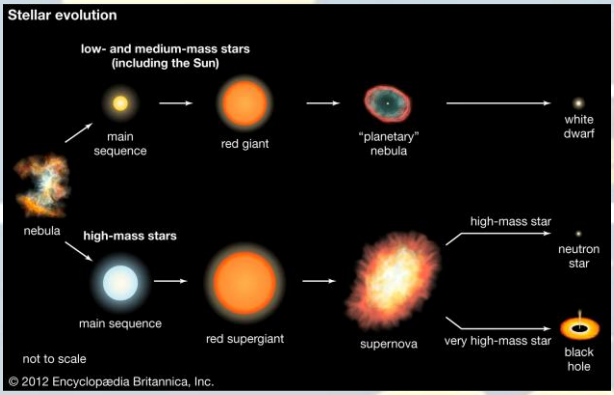


Evolution of stars

- Researchers who used a telescope in South Africa report discovery of an object in the Milky Way that could

either be the most massive mass between 2.09 and 2.71 solar masses neutron star ever observed, or the least massive black hole.

- There is a substantial gap between the masses of the heaviest measured neutron star and the lightest measured black hole the most massive neutron stars generally range between 2.2 to 2.5 solar masses, while black holes of less than 5 solar masses are rare.



Simian human immunodeficiency virus

- Three different antibodies have been isolated and tested, which can each shield large animals from infections with simian-human immunodeficiency virus (SHIV), a chimera of SIV and HIV.
- The antibodies directed against the HIV fusion peptide provided almost complete protection against challenges with SHIV, adding further evidence that the fusion peptide can be targeted with neutralizing antibodies for HIV.
- The simian immunodeficiency viruses (SIVs) are a genetically diverse group of viruses that naturally infect a wide range of African nonhuman primates and are the source of the human immunodeficiency viruses (HIV-1 and HIV-2).
- The Hindu

Urbanization and climate change

- More than half of the world's population now resides in the cities and are thus vulnerable to urban climate change such as increased heat stress and extremes.
- Globally, cities contribute to more than 80% of the global GDP and 75% of all greenhouse gases/carbon emissions.
- Thus, they are both contributors to climate change and also potential agents for tackling it.
- However, their representation in Nationally Determined Contributions (NDCs) and National Adaptation Plans is inadequate.
- Nevertheless, in recent times, the inclusion of the 11th sustainable development goal (SDG) exclusively focusing on cities and the formation of groups like the U20 under the G20

umbrella have acknowledged the need for city level action plans.

- The ministerial meeting on urbanisation and climate change at COP 28 stressed the importance and role of cities in achieving climate change mitigation and adaptation targets.
- These initiatives show the importance attached to cities and their role in global affairs including climate change mitigation and adaptation.
- Bhubaneswar, a tier II city in the eastern State of Odisha, is rapidly urbanizing in recent times.

IMPACT

- It was quantified that almost 60% of the overall warming observed over the city is due to local activities/changes.
- In addition to the warming due to climate change, there is additional warming due to the trapping of heat by the concrete and asphalt materials used to build the city.
- The decreased evapotranspiration due to the replacement of natural surfaces with artificial impervious surfaces is also contributing to the observed warming.
- Reduction in the wind speeds by about 0.2 meters per second, in the eastern fringes of the city, limiting dispersion of heat.
- Microclimate plays a significant role in shaping winter urban surface temperatures, highlighting the complex interplay between urbanization and climate.
- Urban planning to mitigate or adapt to these changes require systematic scientific explorations

Steps needed

- Different mitigation strategies like cool roofs, highly reflective pavements, and blue green infrastructure (water bodies and green spaces).
- Building climate resilient smart cities is important to ensure the health, safety, and comfort of the ever-increasing urban population.

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Gambusia

- **The western mosquitofish (*Gambusia affinis*) is a North American freshwater fish, also known commonly, if ambiguously, as simply mosquitofish or by its generic name, *Gambusia*, or by the common name gambezi.**
- **Its sister species, the eastern mosquitofish (*Gambusia holbrooki*) is also referred to by these names..**
- **The eastern mosquitofish is native to the eastern and southern United States from Florida to Pennsylvania and inland to Alabama and Tennessee, while the western mosquitofish has a larger distribution throughout the United States.**
- **The name "mosquitofish" was given because the fish eats mosquito larvae, and has been used more than any other fishes for the biological control of mosquitoes.**
- **Gambusia typically eat zooplankton, beetles, mayflies, caddisflies, mites, and other invertebrates; mosquito larvae make up only a small portion of their diet.**
- **Mosquitofish were introduced directly into ecosystems in many parts of the world as a biocontrol to lower mosquito populations which in turn negatively affected many other species in each distinct bioregion.**

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- Mosquitofish in Australia are classified as a noxious pest and may have exacerbated the mosquito problem in many areas by out-competing native invertebrate predators of mosquito larvae.
- In 1928, Gambusia was first introduced in India during British rule.
- Later, various governmental organizations, such as the ICMR, the National Institute of Malaria Research (NIMR), local municipal corporations, the Fisheries Department, and the Health Department, alongside other private organisations in India, took over as part of their efforts to combat malaria.
- The idea of this scheme was that the newly introduced species would prey on or compete with mosquito larvae, reducing the latter's population.
- Wildlife biologists and conservationists consider mosquitofish to be among the hundred most detrimental invasive alien species.
- Aside from their resilience, these fish also have voracious feeding habits and have demonstrated aggressive behaviour in habitats to which they are introduced.
- In Australia, introduced mosquito fish have led to the local extinction of the red finned blue eye (Scaturiginichthys vermeilipinnis), an endemic fish species. They have also been observed preying on the eggs and larvae of native fish and frogs.
- The World Health Organisation stopped recommending Gambusia as a mosquito control agent in 1982.
- In 2018, the National Biodiversity Authority of the Government of India also designated G.affinis and G. holbrooki as invasive alien species.
- But both government and non-governmental organizations in India have continued to introduce these species for mosquito control.

The Hindu

Mpemba effect

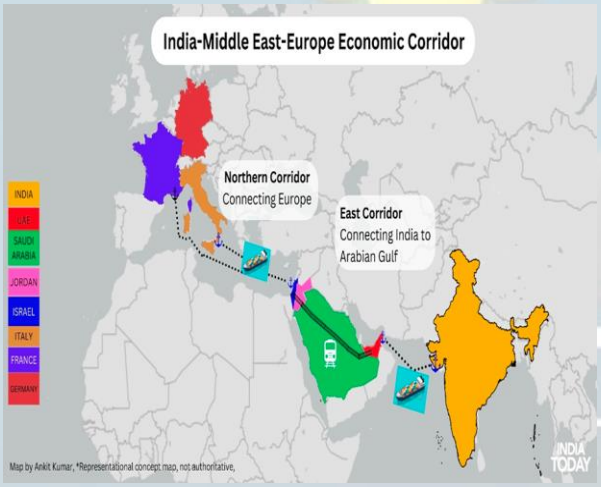
- The Mpemba effect, named after Tanzanian student Erasto Mpemba,

who brought attention to this counterintuitive phenomenon in 1969, makes for curious observation.

- The effect is that hot water can freeze faster than cold water in similar conditions.

The Hindu

IMEC and west Asia geopolitics



The Yemen conflict has seen an alarming erosion in the shipping industry's confidence in the Suez Canal continuing to be the backbone of east west trade.

Critics of IMEC say the Arab Street would simply not allow any major trade link between Saudi Arabia and Israel many years after the Gaza war ends.

Connecting Al Haditha in Saudi to Haifa in Israel is at the core of IMEC but it was always going to be challenging.

Rail projects such as Etihad Rail and the GCC Railway (Gulf Railway), one of whose routes is proposed to terminate at Al Haditha, are already underway in the United Arab Emirates and Saudi Arabia independently, which would dovetail with IMEC that targets ports such as Fujairah and Jebel Ali.

Hydrogen and containerization Besides trade, electricity and digital cables, IMEC is proposed to carry hydrogen pipelines.

As the world moves towards de-carbonization, hydrogen produced from fossil fuel-based processes such as methane reforming will continue to be the transition fuel until electrolysis or other "green" processes become practical.

Hydrogen sourced from fossil fuels would keep Gulf nations in business in the hydrogen economy too with the corridor serving that purpose.

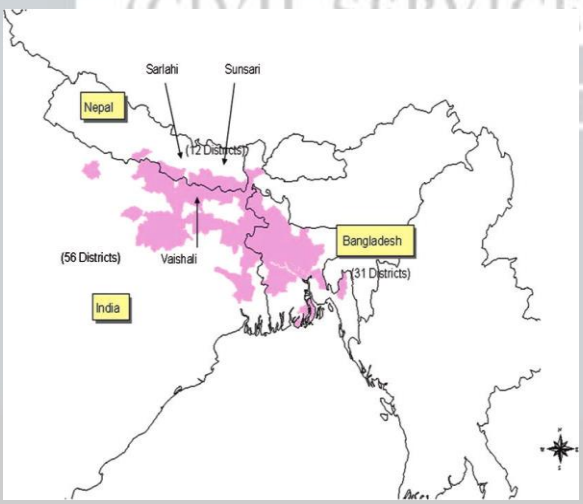
For India, however, the containerization through rail and road in IMEC is a big draw. Containerization radically quickens trade, and reduces port costs.

India's National Logistics Policy, unveiled in 2022, seeks to lower

logistics costs to global levels by 2030.

- Beefing up containerization would be a key pathway towards achieving that goal. In India, some 70% of containers move by road but optimum splits should be 30% road, 30% rail and the rest, coastal and inland shipping.
- The dedicated rail freight corridors that link to two IMEC ports of Mundra and the Jawaharlal Nehru Port Trust (JNPT) will play into IMEC logic.
- But these rail projects skirt southern India, by and large. Containers in the south typically find their way to the Colombo transshipment container terminal via Chennai, Tuticorin/Thoothukudi and so on.
- The Hindu

India and Bangladesh



- There was a rise in anti-India sentiment in the mid1970s over issues ranging from boundary disputes and insurgency to the sharing of water.
- The instability continued for a few decades until Sheikh Hasina came to power in 1996 and scripted a new chapter in bilateral ties with a treaty on the sharing of Ganga waters.
- Since then, India and Bangladesh have built cooperation in trade, energy, infrastructure, connectivity and defence.
- Bilateral trade between India and Bangladesh has grown steadily over the last decade.
- Bangladesh has emerged as India's largest trade partner in South Asia, with bilateral trade reaching $18 billion in 20212022 from $10.8 billion in 202021.
- "Major development partner" of Bangladesh, India is funding several infrastructure and connectivity projects.
- Last year when they inaugurated the Akhaura Agartala rail link that connects Bangladesh and the northeast through Tripura.
- The link has given India access to Chattogram and Mongla ports in

Bangladesh for the movement of cargo.

- It is likely to boost small scale industries and develop Assam and Tripura. In the energy sector, Bangladesh imports nearly 2,000 megawatts of electricity from India.
- The BIMSTEC Master Plan for Transport Connectivity focuses on connecting major transport projects in India, Bangladesh, Myanmar and Thailand, thereby establishing a shipping network.
- India's attention will primarily be directed towards the Matarbari Port, located about 100 km from Tripura, which Bangladesh is building.
- The port will establish a crucial industrial corridor linking Dhaka and the northeast part of India.

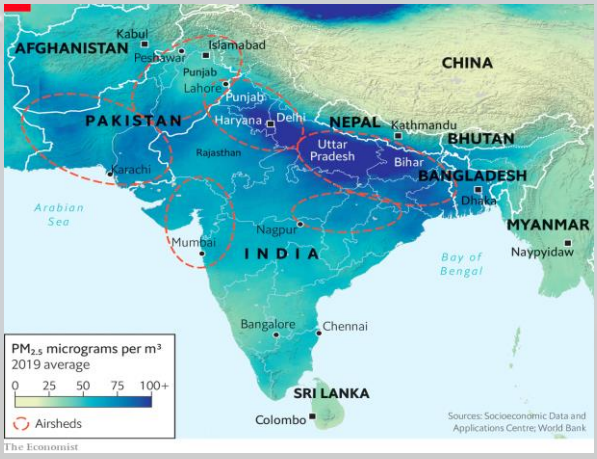
What are the points of tension?

- The looming Teesta dispute will take centre stage in the agenda of the Hasinaled government.
- The issue revolves around the sharing of Teesta's waters, with Bangladesh seeking an equitable distribution. Another contentious matter is the Rohingya issue.
- The Hasina government aims for the peaceful repatriation of Rohingyas to Myanmar, but its talks with the military junta have been unsuccessful so far.
- Cross border terrorism and infiltration are additional threats to internal security.
- The rise of majoritarian forces adds another layer to the complex landscape.

What about global ties?

- The U.S. has been vocal in its criticism of the Awami League government, exerting pressure on Sheikh Hasina over "democratic backsliding".
- Deepening relationship between Bangladesh and China, marked by the substantial Chinese investments in infrastructure in recent years. China built 12 highways, 21 bridges, and 27 power and energy projects in Bangladesh.
- The Hindu

Air pollution and geopolitics



Current Affairs 22nd January 2024 by Saurabh Pandey

- The air smells burnt in Lahore, a city in Pakistan's east that used to be famous for its gardens but has become infamous for its terrible air quality.
- Toxic smog has sickened tens of thousands of people in recent months.
- Lahore is in an air shed, an area where pollutants from industry, transportation and other human activities get trapped because of local weather and topography so they cannot disperse easily.
- Airsheds also contribute to cross border pollution. Under certain wind conditions, 30% of pollution in the Indian Capital New Delhi can come from Pakistan's Punjab province, where Lahore is the capital.
- Regional and international forums offer opportunities for candid discussions about air pollution, even if governments are not working together directly or publicly
- Airshed management needs a regional plan," he said.
- According to the World Bank, a regional airshed management policy would involve countries agreeing to set common air quality targets and measures that everyone can implement, meeting regularly to share their experiences and, if possible, setting common air quality standard

What is Air shed??

- An air shed is generally described as an area where the movement of air, and air pollutants, can be hindered by local geographical features such as mountains, and by weather conditions.
- Delineation of an airshed has three basic steps:
- First, emission quantification to prepare a multi-pollutant emission inventory; second, analysis of meteorological data to evaluate variations and similarities at the local and regional levels; and third, performing air quality modelling to understand the pollution
- Studies by the Pew Research Center and Common Sense Media suggest constant connectivity through messaging apps can lead to increased digital distraction, potentially affecting cognitive abilities and focus among young individuals.
- Research heavily covered in the journal 'Computers in Human Behavior' highlights a potential link between heavy use of messaging apps like WhatsApp and shortened attention spans, which may impact

intellectual engagement and learning. There's also a negative impact on memory.

- **The Hindu**

Cannabis & Antimicrobial resistance

- **Cannabis has the potential to make a dent in India's fight against the escalating threat of antibiotic resistance.**
- **Scientists at CSIR Indian Institute of Integrative Medicine (IIIM), Jammu, have found that phytocannabinoids, a class of compounds found in the cannabis plant, possess some hitherto unexplored antibiotic properties.**
- **Antimicrobial resistance (AMR) is a major health concern worldwide.**
- **It refers to when bacteria, viruses, fungi, and parasites no longer respond to medicines used to treat them.**
- **According to Sanghapal D. Sawant, a senior principal scientist at the CSIR - National Chemical Laboratory (NCL), Pune, bacteria have developed certain sophisticated 'shields' over many decades to resist the effects of antibiotic medications.**
- **These include the formation of biofilms thin sheets of bacterial colonies that are more resistant to antibiotics than when separated and cellular mechanisms called efflux pumps that flush drugs out from cells.**
- **The resulting AMR increases the risk of disease spread, severe illness, and death.**

What is India's AMR burden?

- **According to one estimate, India reported 2.97 lakh deaths in 2019 that could be attributed to AMR and 10.42 lakh others that could be associated with AMR. Reports have also flagged the overuse of antibiotics in India, their misuse in animal husbandry, and poor waste disposal for engendering AMR and potentially rendering India the "AMR capital of the world".**
- **For these reasons, medical researchers are keen to tamp down AMR and find new drugs that fight AMR pathogens.**
- **In the new study, published in the journal ACS Infectious Diseases, IIIM researchers tested the antibacterial properties of tetra hydro cannabidiol (THCBD), a semisynthetic phytocannabinoid, against Staphylococcus aureus, the bacteria responsible for the second most number of deaths due to AMR worldwide.**

Need for 'alternative solutions'

- **Antibiotics are chemical compounds isolated from one microorganism and used to kill another.**

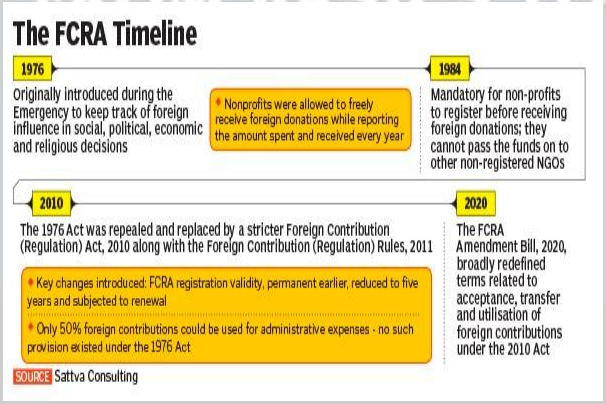
- They have saved millions of lives since their discovery but are falling short against AMR bacteria.
- "S. aureus includes a strain known as MRSA, for methicillin resistant S. aureus, resistant to the last line of antibiotics called methicillin,".
- The study revealed THCBD obtained from cannabis could fight MRSA.

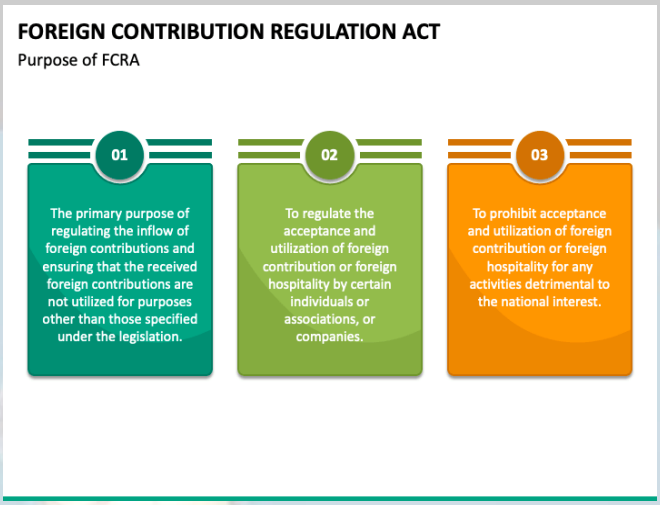
How is THCBD made?

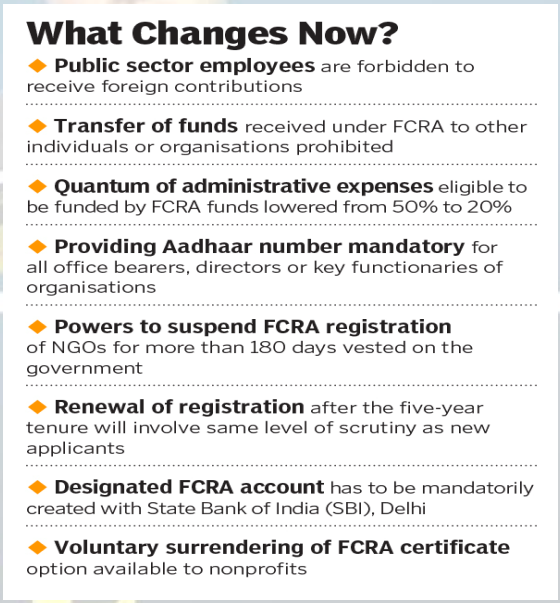
- Cannabinoids are a class of compounds found in the cannabis plant. The researchers extracted cannabidiol from a cannabis plant and made it react with hydrogen, using palladium as a catalyst.
- This process yielded a mixture of molecules with the same composition and order of atoms but different structures. One of them was THCBD.

The Hindu

FCRA







- The Foreign Contribution Regulation Act, 2010 (FCRA) registration of two prominent non-governmental organizations (NGOs) Centre for Policy Research (CPR) and World Vision India (WVI) have been cancelled this month.

Who monitors the process?

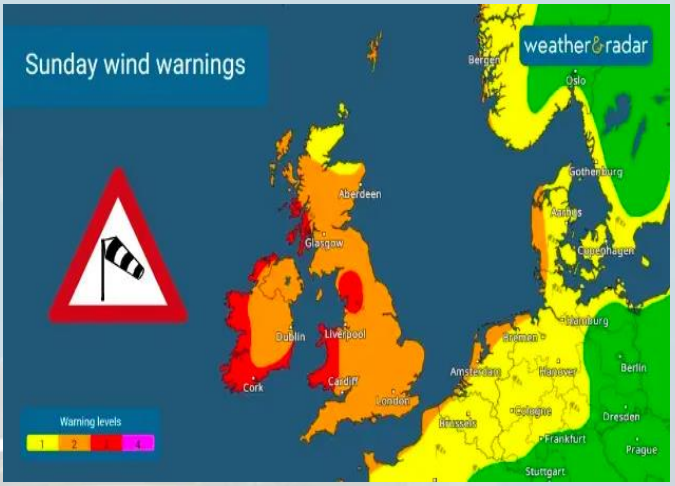
- The Union Ministry of Home Affairs (MHA) monitors the implementation of the FCRA.

Current Affairs 23rd January 2024 by Saurabh Pandey

- **The registration of thousands of NGOs was due for renewal in 2020-2021.**
- **Due to the COVID-19 pandemic and the amendments to the FCRA Act in 2020, many NGOs could not complete the process.**
- **Through the FCRA, the ministry regulates foreign donations to ensure that such funds do not adversely affect the country's internal security.**
- **It is compulsory to register under the Act, first enacted in 1976, if an association, group or NGO intends to receive foreign donations.**
- **The 1976 Act was repealed and replaced with a new legislation in 201. It was further amended in 2020.**
- **The registration is valid for five years, after which the NGO has to apply for a renewal. It is mandatory for all such NGOs to register under the FCRA, initially valid for five years that can be renewed if it complies with all norms.**

Why so many cyclones in UK?

- **Tens of thousands of people across the U.K. and Ireland were without power on Monday after Storm Isha lashed the countries with strong winds and heavy rain, disrupting travel networks.**
- **Gusts of 159 kmph were recorded in northeast England as the whole of the U.K. was subject to weather warnings for its ninth named storm since September.**



Why are storms named?

- **In the UK, a storm is given a name when it has the potential to cause disruption or damage as a result of strong winds, heavy rainfall or snow, leading to amber or red weather warnings being issued.**
- **The UK storm season begins at the end of the summer in September and ends in August the following year.**
- **In Europe there are three storm naming groups, and each September there is a new alphabetical list of names issued for the upcoming storm season.**
- **In Western Europe the list is created by the Met Office in collaboration**

with the Irish and Dutch weather services.

- This coincides with when we expect to experience extreme storms, due to low pressure weather systems that occur in the autumn and winter months.
- Storms can impact many countries at once, and to avoid confusion, the UK adopts a storm name if another European weather service has already named it.

What causes extreme storms in the UK?

- Wind is the movement of air in our atmosphere. Air is forced to move by differences in atmospheric pressure, and the Earth's rotation means that the wind circulates around areas of lower pressure, known as a cyclone. If there is a greater difference in pressure, this causes stronger winds around the cyclone.
- Storms often bring heavy rainfall that may lead to flooding. Storms move moisture around the atmosphere, which forces warm and moist air to rise.
- Wherever the warm, moist air rises, clouds are formed. The formation of clouds also releases energy which can further intensify the storm.
- The UK is renowned for being stormy, but why?
- The jet stream a core of strong winds around 8-11 km above the Earth's surface, blowing from west to east directs weather systems, such as storms, across the Atlantic to the UK.

Will extreme storms become more intense and frequent?

- Links between human-caused global warming and storms should be expected.
- A warming atmosphere is linked with heavier rainfall because the air is able to hold more moisture which leads to clouds containing a greater number of larger raindrops.
- As the climate continues to warm, the effect will increase, and storms with heavy rain are expected to become more common.
- Additionally, the extra release of energy by clouds will likely lead to an increased rate of storms that rapidly intensify and a strengthening of the most extreme storms.
- But while a warmer world is likely making the most extreme storms more intense, the change in the overall number of storms is more uncertain and remains a subject of ongoing scientific research.

Current Affairs 23rd January 2024 by Saurabh Pandey

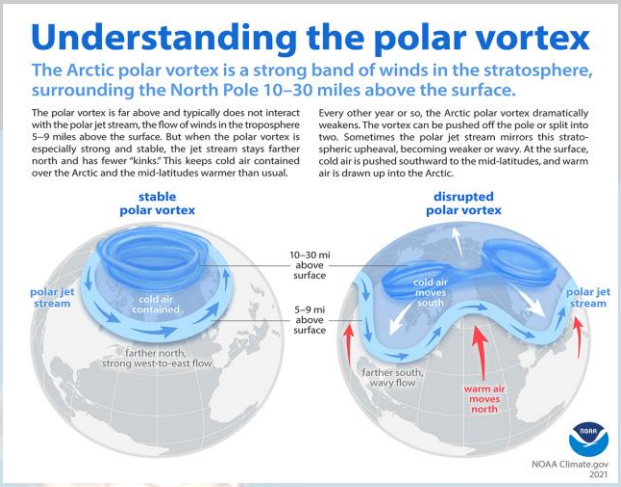
What are sting jets?

- **"Sting jets are narrow jets of air that accelerate as they descend and that can cause extremely strong and damaging surface winds in a relatively small area of the storm, "**
- **"They are called sting jets as they descend from the tip of the hooked cloud that gradually wraps around the area of low pressure at the center of the storm. The presence of a sting jet can make intense storms, with strong surface winds, even more damaging."**

The Hindu

Polar vortex and cold US climate

- **The polar vortex is a low pressure area a wide expanse of swirling cold air that is parked in polar regions.**
- **During winter, the polar vortex at the North Pole expands, sending cold air southward.**
- **This happens fairly regularly and is often associated with outbreaks of cold temperatures in the United States.**



How can the polar vortex cause extremely cold temperatures in the US?

- **Sometimes this low-pressure system, full of arctic air, can weaken and travel from its usual position.**
- **As this system weakens, some of the cold, arctic air can break off and migrate south, bringing plenty of cold air with it.**
- **Areas as far south as Florida may experience arctic weather as a result.**
- **When the low-pressure system is strong and healthy, it keeps the jet stream traveling around Earth in a circular path.**
- **The jet stream is a band of reliably strong wind that plays a key role in keeping colder air north and warmer air south.**

The Hindu

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Tax distribution between states

- **The Finance Commission's important job is to recommend a distribution formula specifying each State's share in the part of the Union tax revenue assigned to States.**
- **Such distribution formulas have a few weighted determinants.**
- **Since the 1st Finance Commission, some States have been arguing that their contributions to the Union tax revenue have been higher than others and, therefore, they rightfully have higher shares in the Union tax revenue.**

Equity, efficiency in tax revenue transfers

- **Two important tasks of the Finance Commissions are (i) to recommend the proportion of the Union tax revenues to be assigned to States and (ii) to recommend the share of each State in the assigned tax revenue.**
- **Till 2000, that is, the 10th Finance Commission, the States' share was restricted only to personal income tax and Union excise duties and after that, all the Central tax revenues were pooled, and States' shares were decided.**
- **With reference to the second task, the Finance Commission devises a distribution formula to arrive at a share for each State, and it is based on the principles of equity and efficiency.**
- **Equity stipulates that the revenue scarce States and States with higher expenditures get larger shares of Union tax revenue than others.**
- **Efficiency is to reward the States that are efficient in collecting revenue and rationalising spending.**
- **The tradeoff between equity and efficiency is normative and remains dynamic in successive Finance Commission recommendations.**
- **States from which large volumes of income tax revenue have been collected argued to consider and assign a higher weight to 'tax collection' as an indicator of tax contribution.**
- **We should note that tax contribution is an efficiency indicator because a State's level of development and economic structure decides its tax contribution.**
- **However, Finance Commissions had assigned only 10% to 20% weight to this efficiency indicator.**
- **Population, a chief indicator of the expenditure needs of the State, was given 80% to 90% weight in the first seven Finance Commissions as far as**

income tax distribution was concerned.

- In the case of distributing revenue from Union excise duties, the entire distribution was based on population or other indicators of expenditure needs such as area, per capita income, the proportion of Scheduled Caste/Scheduled Tribe population, and some indicators of social and physical infrastructure needs.
- Since the 10th Finance Commission, the Commission has recommended a single distribution formula for both income tax and Union excise duties.
- Thus, the Finance Commissions have always favoured assigning more than 75% weight to equity indicators.
- Since 2000, the formula for the distribution of pooled Central tax revenues included tax effort and fiscal discipline as efficiency indicators with a weight of around 15%. Tax effort is broadly defined as the ratio of own revenue of a State to its Gross Domestic Product.
- Fiscal discipline is the proportion of own revenue to the revenue expenditure of a State.
- In the 15th Finance Commission, the distribution formula had tax effort with a weight of 2.5%, and demographic performance, an indicator of efficiency in population control, was given a weight of 12.5%.
- The remaining 85% weight was distributed among equity indicators of per capita income, population as per the 2011 Census instead of the conventional 1971 Census, area, forest cover, etc...
- The two relative contributions, namely GST revenue and petroleum consumption, of States are fair and accurate measures of States' contributions to the national exchequer and a good measure of efficiency.
- There is a persuasive case for the 16th Finance Commission, recently constituted by the Union government, to debate and include these ratios as a measure of efficiency with a weightage of at least 33% in the distribution formula.

The Hindu

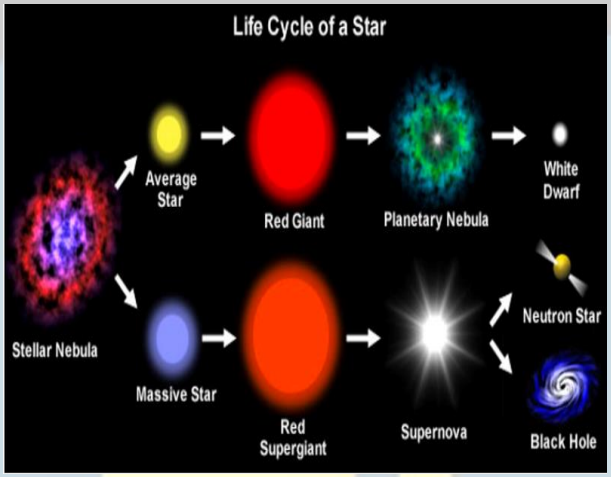
Energy transition and coal

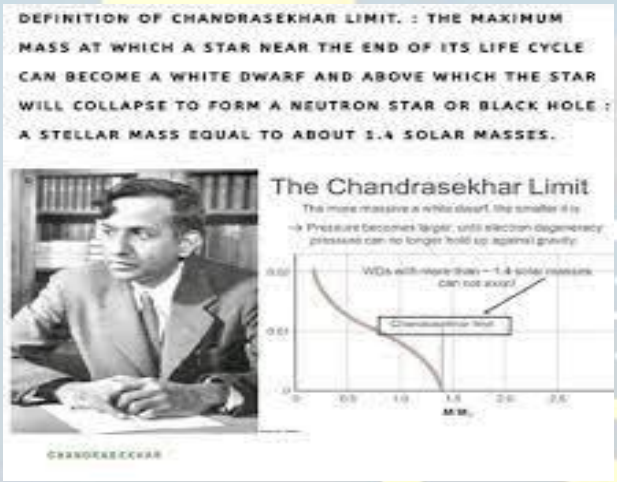
- First, managing thermal plant outages better during peak demand periods.
- In 2023, ~38 GW of coal-based power plants across India witnessed unplanned outages or were not called on to generate power during the top 10% peak demand days.

- **Improved availability and utilization of existing plants can mitigate the need for investments in new(er) thermal assets to meet peak power demand in the medium term.**
- **This will require power utilities to forecast demand better to anticipate outages, plan maintenance and keep plants online during peak days.**
- **Second, increasing the flexibility of the existing coal fleet.**
- **To seamlessly integrate more renewable energy (RE) into the grid, thermal plants that typically produce a steady load of power must learn to follow the vagaries of the wind and the sun.**
- **This can be done by making our existing coal plants more flexible reducing their minimum power load and improving ramp rate capabilities.**
- **Third, incentivizing payment for storage services beyond the supply of energy units.**
- **When RE has to contribute significantly to our demand, energy storage systems will have to support the power grid during hours when renewables are not available.**
- **Fourth, indigenizing supply chains for battery storage and RE technologies.**
- **Being the lifeline of the power system, the coal economy is an important source of domestic value addition, job creation, and furthering India's 'Atmanirbhar' aspirations.**
- **While the attention on the global stage focuses solely on decarbonization, domestic energy security will drive policymaker focus and investments in India.**
- **With falling renewable energy and storage prices, decision makers need a transparent assessment of the long term opportunity costs of locking ourselves into conventional power sources to meet near-term needs.**
- **They must prioritise affordable electricity for all segments of the economy.**

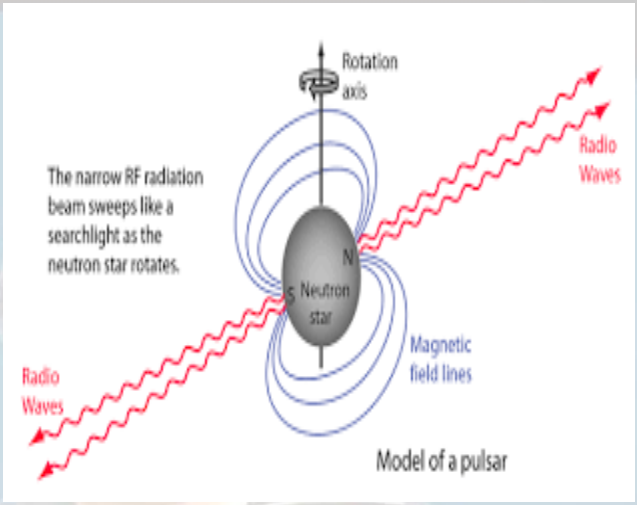
The Hindu

Neutron star and pulsar

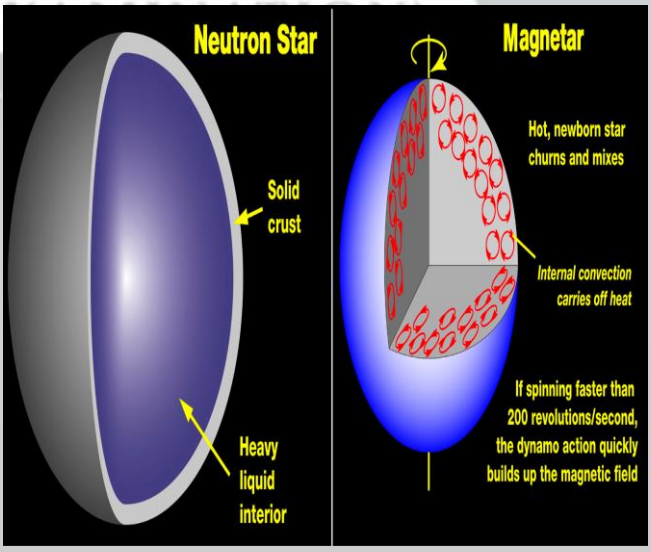




- **When heavy stars die, their cores implode.**
- **If they're heavy enough, they become black holes; but if not, they collapse just enough to form a ball of neutrons, with gravity not being strong enough to overwhelm their outward pressure.**
- **This compact, super-dense object is called a neutron star**
- **Radio signals emitted from near the poles of such a star would form a narrow cone that sweeps past the earth with every rotation.**



- **The fact that the signals came from a very small patch of the sky and that they repeated frequently led scientists to identify pulsars as rotating neutron stars**
- **The rotation of these neutron stars slowed over time; physicists found that the energy 'saved' by reducing the rotation rate was used to accelerate electric charges outside the star, producing the radio signals.**



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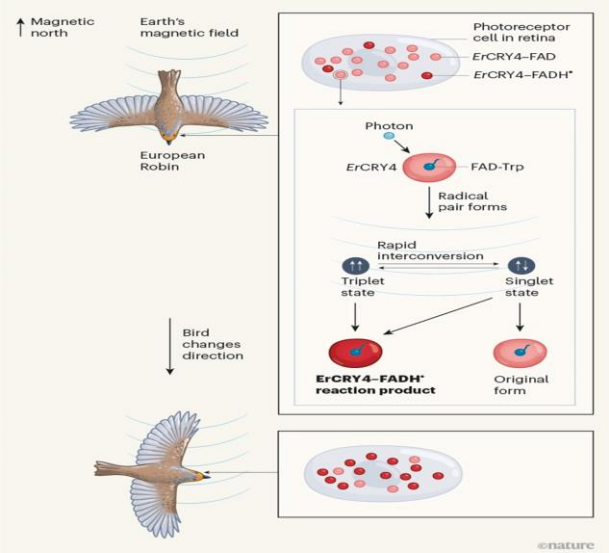
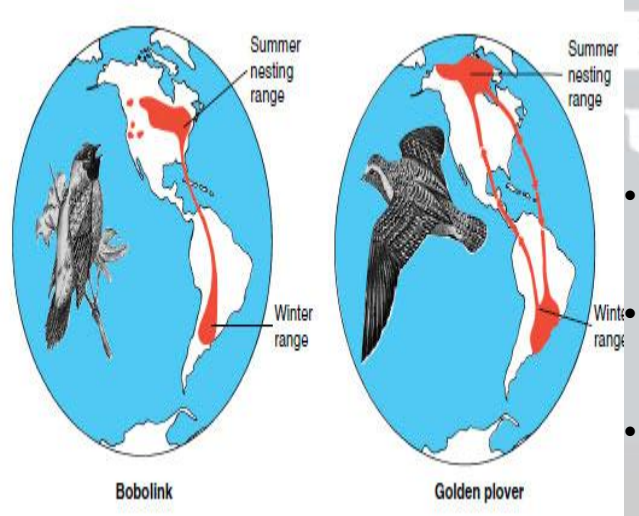
Navigation by birds





- **How do birds find their way home after long journeys?**
- **A1: There are many theories explaining this capability of birds.**
- **According to one of them, the sun's rays and the direction of winds help them navigate.**
- **Birds' extrasensory capabilities assist them in this task and direct them with the help of the earth's magnetic field.**
- **Another theory suggests these winged wonders 'read' and understand star maps well enough to find their way.**
- **A2: Birds have the ability to detect changes in atmospheric pressure, weather, and the earth's magnetic field.**
- **Based on these, they locate specific regions and find their home.**
- **But the most important navigational aid is said to be an internal magnetic compass they are said to possess in their brains.**
- **The compass works in relation to the earth's magnetic field.**
- **The magnetic currents generated here are turned into flight paths.**
- **The Hindu**

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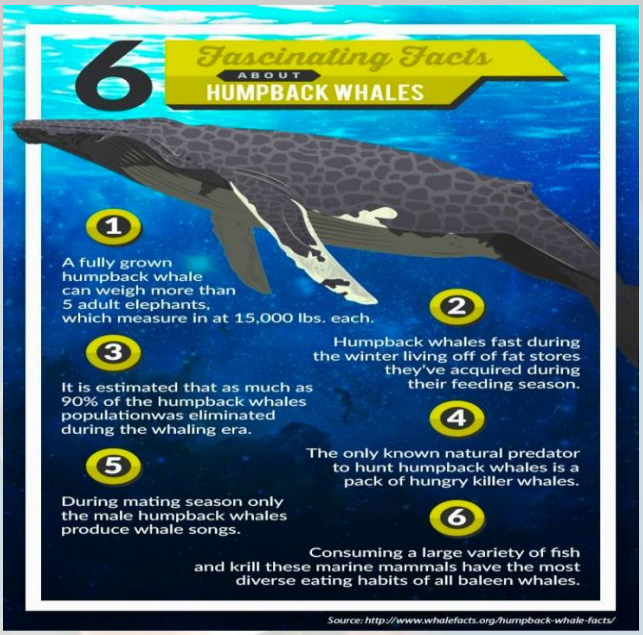
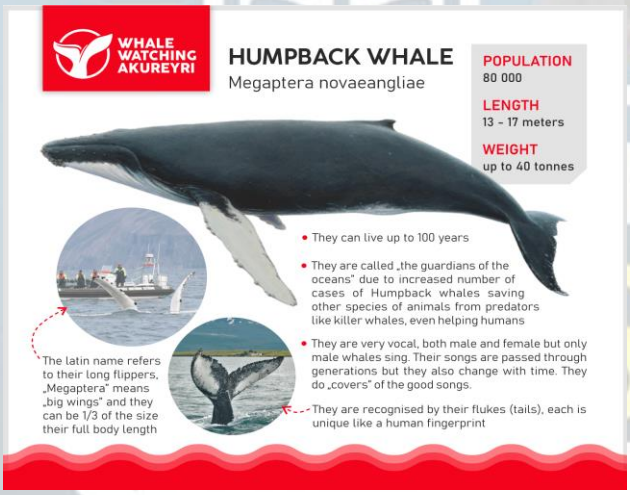
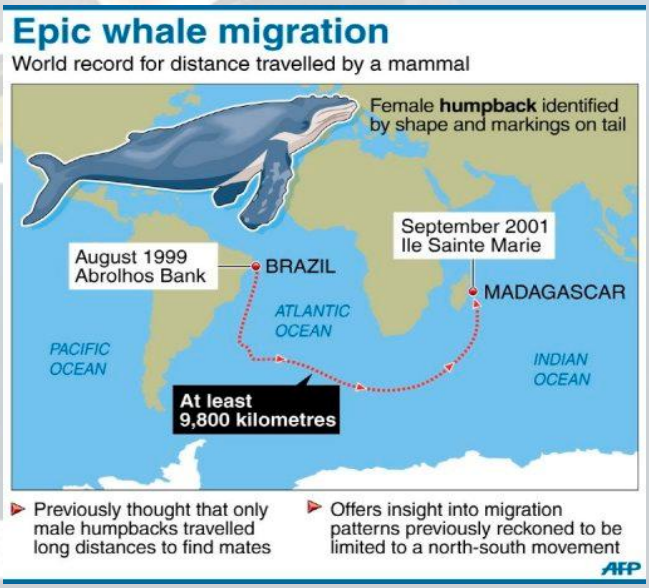
Humpback whale







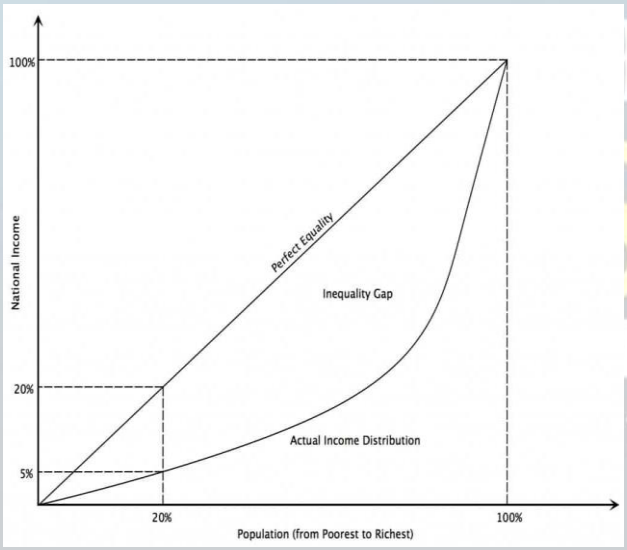
The Hindu

Examining taxpayer data

- **According to a recent report by the State Bank of India (SBI), India has witnessed a significant fall in inequality over the last decade.**
- **Examining taxpayer data, the report claims that the Gini coefficient a**

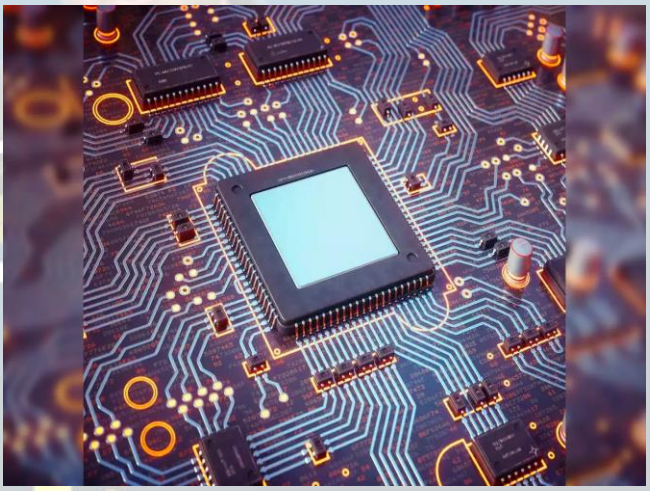
standard measure of inequality that ranges from 0, indicating perfect equality, to 1, indicating perfect inequality has fallen from 0.472 in 201415 to 0.402 in 202223.

- **A fall of almost 15% in the Gini coefficient indicates a significant reduction in inequality.**
- **The fall in the Gini coefficient is more or less empirically established by the SBI report, but this has been accompanied by polarization in incomes.**
- **Such polarization is not seen in taxpayer data since the bottom 10% do not earn enough to be included in the tax net.**



- **The Hindu**

Semiconductor industry



- **Semiconductor Design Linked Incentive (DLI) scheme. There are three goals of India's semiconductor strategy.**
- **The first is to reduce dependence on semiconductor imports, particularly from China, and especially in strategic and emerging sectors, ranging from defence applications to Artificial Intelligence development.**
- **The second is to build supply chain resilience by integrating into the**

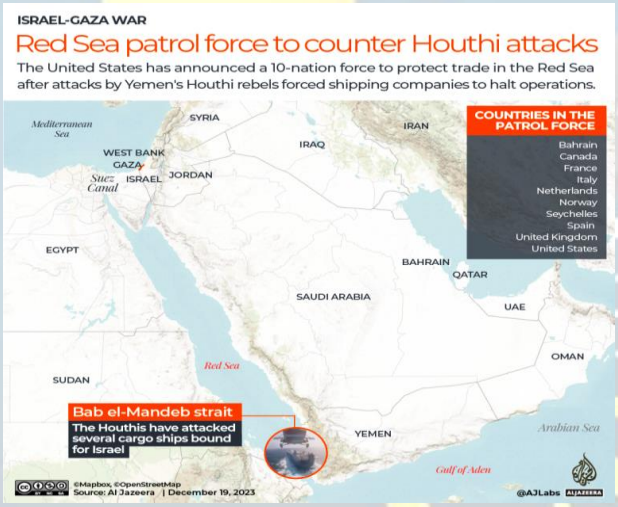
semiconductor global value chain (GVC).

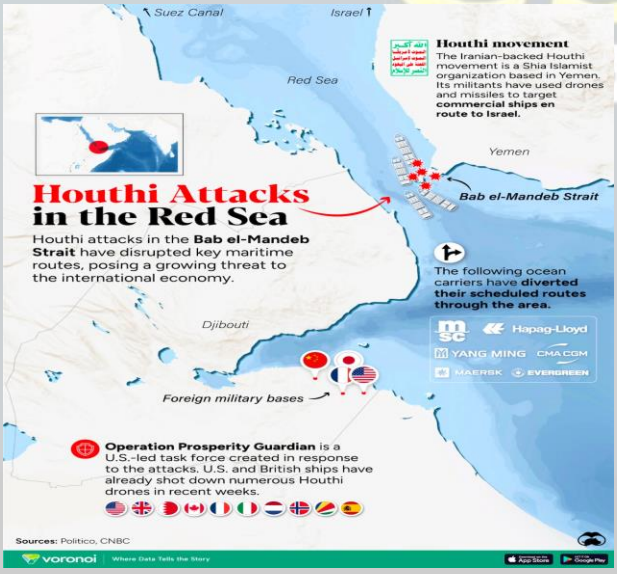
- The third is to double down on India's comparative advantage: India already plays host to the design houses of every major global semiconductor industry player and Indian chip design engineers are an indispensable part of the semiconductor GVC.
- These goals will help cement India's status as a semiconductor powerhouse.
- However, resources are limited.
- Therefore, priorities for industrial policy should ensure that we reap disproportionate benefits from our investments. Stimulating the design ecosystem is less capital-intensive than the foundry and assembly stages of the semiconductor GVC.
- Bolstering this stage can help establish strong forward linkages to an up-and-coming fabrication and assembly industry in India.

Issues with the scheme Prima facie

- The DLI scheme fares well with its focus on providing access to design infrastructure, such as electronic design automation (EDA) tools, alongside financial subsidies for different steps of the chip design process.
- But there has been lack lustre uptake of the scheme. First, the scheme mandates that beneficiary startups maintain their domestic status for at least three years after receiving incentives, and for this they cannot raise more than 50% of their requisite capital via foreign direct investment.
- This is a significant barrier. Costs for semiconductor design startups are also significant.
- Semiconductor R&D usually only pays off in the longer term, and the funding landscape for chip start-ups in India continues to be challenging.
- The primary aim of the DLI scheme should be to cultivate semiconductor design capabilities in India, with the understanding that homegrown IP will organically evolve as local talent fosters the creation of indigenous companies over time.
- The Centre for Development of Advanced Computing's role as the nodal agency appraising proposals by applicants under the DLI scheme merits a relook too.
- The Hindu

China maritime dominance and India





- **The Houthi terror attacks on MV Chem Pluto, an oil and chemical tanker, on its way to the New Mangalore port from the Al Jubail port in Saudi Arabia, and MV Sai Baba, a Gabon owned, Indian-flagged crude oil tanker, with predominantly Indian crew, forced India's External Affairs Minister S. Jaishankar to rush to Tehran to persuade the principal Houthi sponsor to help cease the attacks.**
- **India's military response to the Red Sea situation has also been swift: the Indian Navy deployed the guided missile destroyers, INS Mormugao, INS Kochi, and INS Kolkata in the broader region.**
- **A different 'new' two front situation India's new two front challenge is not Pakistan and China posing a nutcracker situation for India, but a combination of its continental and maritime challenges.**
- **Having an aggressive and rising China attempting to contain India on its continental and maritime fronts is a classic two-front situation.**
- **While India has been allowing itself to be obsessed with the Line of Control with Pakistan in the west, defending the Line of Actual Control with China in the north, and picking needless quarrels with its neighbours, Beijing was quietly building its empire of influence in**

the eastern, southern and western oceanic planks.

- **While the People's Liberation Army keeps up the pressure on the LAC, the People's Liberation Army Navy (PLAN) has been increasing its presence in the Indian Ocean Region (IOR) at an alarming rate.**
- **Beijing today has a military base in Djibouti. Growing Chinese activities in Pakistan's Gwadar and Sri Lanka's Hambantota should worry Indian strategists, even if they are not yet military bases.**
- **In Myanmar, the Kyaukpyu port which China is constructing will enable PLAN to inch closer to the Indian Navy in the Bay of Bengal a maritime space India hereto enjoyed unrivaled.**

  Beijing is reportedly expanding an artificial island in Maldives and the China-Maldives strategic partnership is bound to increase due to tensions between Male and New Delhi.
- **One had the visit of the anti-India Maldivian President to China recently.**
- **China is also exploring strategic investment options in the Seychelles and is also building a naval base in Ream, Cambodia.**
- **The small Indian Ocean island nation of Comoros is the latest to join China's fan club in the Indo-Pacific.**
- **The emerging picture is this: from the Horn of Africa (Djibouti) to Myanmar, Sri Lanka, the Seychelles, the Maldives in the Indian Ocean to Gwadar in the Arabian Sea, China's actions will amount to a containment of India in the Indo Pacific.**
- **Read these developments alongside China's expanding outreach to the global South, its port-building efforts around the world, and its strengthening of relations with West Asia and Africa.**
- **The Hindu**

India need to consider

- **The good news is that the Indian Ocean is too important for the rest of the world to let China take over.**
- **If China poses a challenge to India's regional security and interests in the broader IOR, it also poses a challenge to the commercial and security interests of the United States and its allies.**
- **Every major country is today interested in the Indo-Pacific and its future trajectory as is India, which provides an opportunity for New Delhi to make coalitions with like-minded countries, especially at a time when Beijing has little great**

power backing in the maritime theatre.

- **Second, India cannot balance against the growing Chinese power in the Indian Ocean all by itself.**
- **India occupies a pivotal location in the Indo-Pacific moment just as it is the heart of the Chinese attempts to create an empire of influence.**
- **Creating, and enhancing, partnerships with like minded countries is perhaps an important way forward.**

The Hindu

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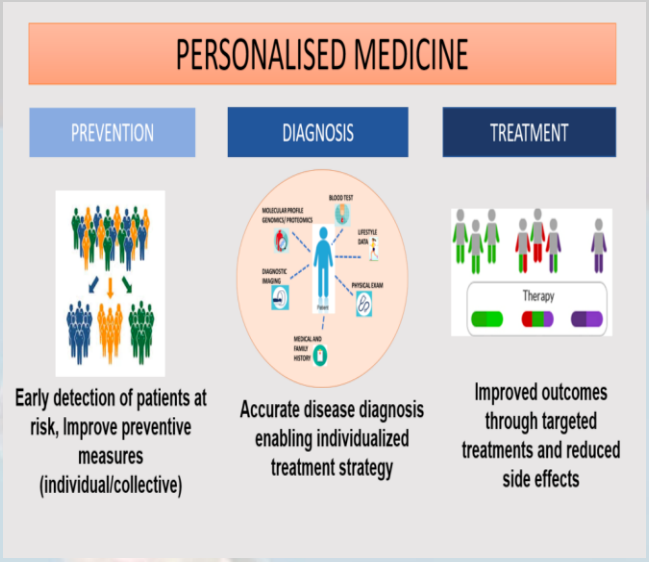
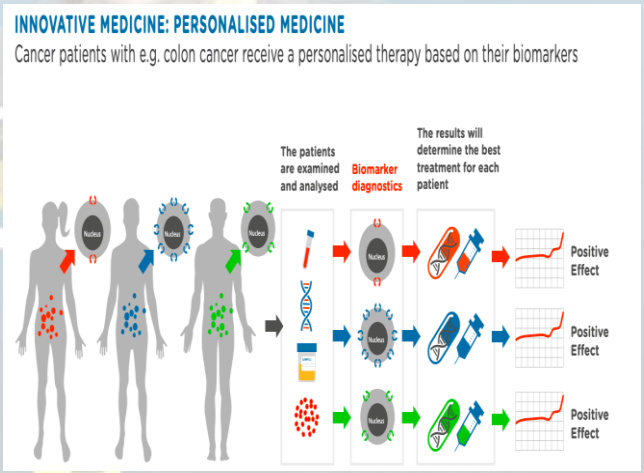
Personalised medicine

- **Warfarin is a powerful blood thinner and a leading drug for cardiovascular disease worldwide.**
- **But in South Africa, it is among the top four drug varieties leading to hospitalization from adverse drug reactions.**

Understudied populations

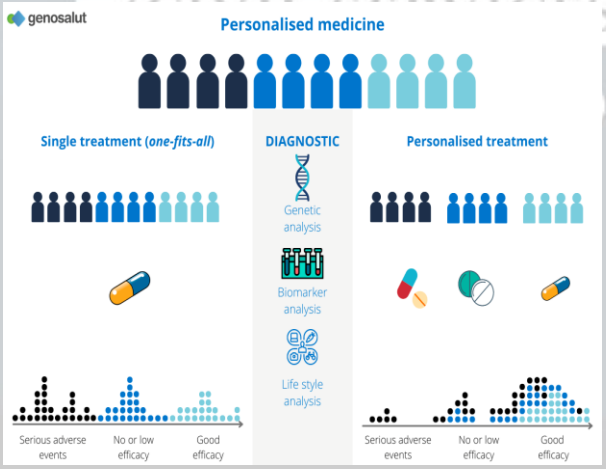
- **It's astonishing how powerful our genetics can be in mediating medicines.**
- **Take the gene CYP2D6, which is known to play a vital role in how fast humans metabolise 25% of all the pharmaceuticals on the market.**
- **If you have a genetic variant of CYP2D6 that makes you metabolise drugs more quickly, or less quickly, it can have a huge impact on how well those drugs work and the dangers you face from taking them.**





The Hindu

Quiet diplomacy



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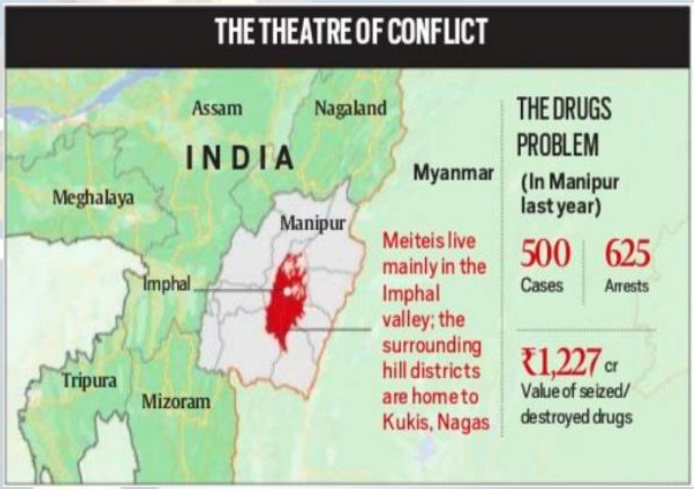
- **"Quiet diplomacy" refers to one state's efforts to influence the behavior of another state through discreet negotiations or actions.**
- **This means operating behind the scenes and may rely on back channeling rather than on public talks.**
- **It may also involve deal making and strategic partnerships, involving more carrots than sticks. Quiet diplomacy can also bring indirect influence sometimes called soft power to bear on a nation's leaders through meetings with members of civil society.**
- **Small nations often rely on quiet diplomacy, because they don't have the military or economic clout to intimidate other nations.**
- **But large, powerful countries like the United States also use quiet diplomacy.**
- **The Hindu**



Free movement regime to end

- **The Free Movement Regime (FMR) agreement with Myanmar would be reconsidered to stop border residents from moving into each other's country without any paperwork.**
- **What is the FMR?**
- **Much of India's present-day northeast was temporarily under Burmese occupation until the British pushed them out in the 1800s.**

- The victors and the vanquished signed the Treaty of Yandaboo in 1826, leading to the current alignment of the boundary between India and Burma, later renamed Myanmar.
- The border divided people of the same ethnicity and culture specifically the Nagas of Nagaland and Manipur and the Kuki Chin Mizo communities of Manipur and Mizoram without their consent.
- In some stretches, the border split a village or a house between the two countries.
- Wary of increasing Chinese influence in Myanmar, New Delhi began working on improving diplomatic ties with the Myanmar government a decade ago.
- After almost a year's delay, the FMR came about in 2018 as part of the Narendra Modi government's Act East policy.
- The Rohingya refugee crisis that began in August 2017 caused the delay.
- The FMR allows people living on either side of the border to travel up to 16 km inside each other's country without a visa.
- A border resident needs to have a border pass, valid for a year, to stay in the other country for about two weeks per visit.
- The FMR also envisaged the promotion of localised border trade through customs stations and designated markets apart from helping the people of Myanmar access better education and healthcare facilities on the Indian side of the border.

Why is the FMR being reconsidered?

- Apart from a 10 km stretch in Manipur, the India Myanmar border through hills and jungles is unfenced.
- The security forces have for decades grappled with members of extremist groups carrying out hit-and-run operations from their clandestine bases in the Chin and Sagaing regions of Myanmar.
- The ease of cross-border movement, even before the FMR was in place, was often flagged for inward trafficking of drugs and outward trafficking of wildlife body parts.

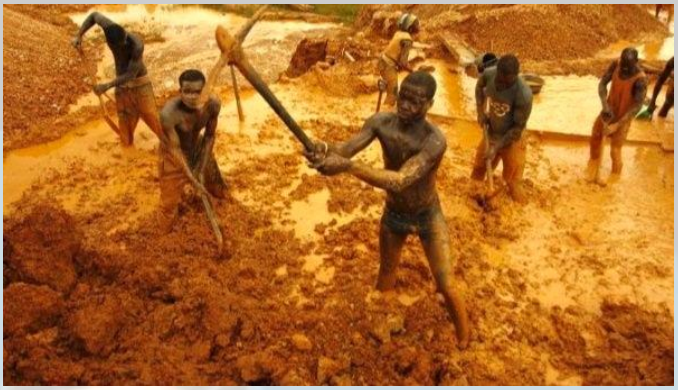
Why are Mizoram and Nagaland opposed to ending the FMR?

- Mizoram Chief Minister Lalduhoma said his government does not have the authority to stop the Centre from fencing the India-Myanmar border for perceived security threat and scrapping the FMR, but said he was opposed to the move.

- **According to him, the border was imposed by the British to divide the people belonging to the Zo ethnic stock. "We Mizos share ethnic ties with the Chin people across the border.**
- **The Hindu**

Sweden in NATO

- **More than 70 people have been killed after a tunnel collapsed at a Malian gold mining site last week,**
- **Mali, which is among the world's poorest countries, is one of Africa's leading gold producers.**
- **Gold mining sites are regularly the scene of deadly landslides and authorities struggle to control artisanal mining of the precious metal.**



- **The Hindu**

European Ports Alliance

- **Turkiye's Parliament on ratified Sweden's NATO membership after more than a year of delays that upset Western efforts to show resolve in the face of Russia's war on Ukraine.**

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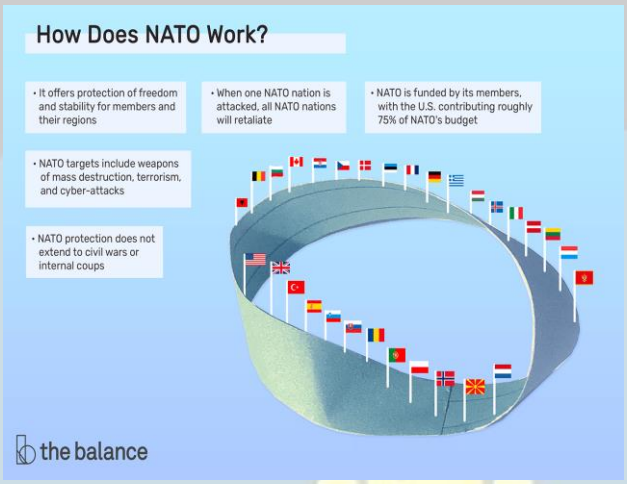

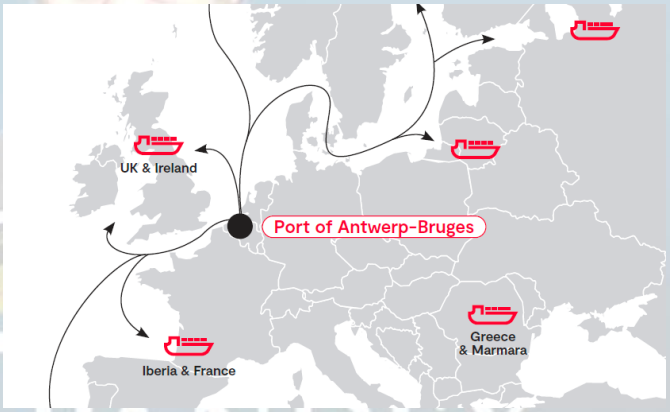

- **European Ports Alliance**
- **EU on launches a "European Ports Alliance" to harmonize methods in the fight against drug smuggling and to combat the hubs' infiltration by criminal groups.**
- **The initiative inaugurated at Belgium's Antwerp port, the main gateway for cocaine into Europe is attended by EU interior ministers and representatives from 16 of the bloc's ports and from the sea transport organization.**

The Hindu

Hydropower from glacial lake

- **High in the Himalayas, two villages near Nepal's border with Tibet are getting power from an unusual**

source: a threatening glacial lake. In this high altitude region, climate change is accelerating the melting of mountain ice, with villages located below fast filling glacial lakes facing a risk of catastrophic flooding.

- **But efforts to drain some of the excess water building up in the lakes, to lower disaster risk, also present an opportunity to boost clean power production, by installing small hydropower generators in the drainage channel.**

- 

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The Hindu

HYDROPOWER FROM GLACIAL LAKE

- 

- **Channeling water out of the lake to hydropower generating equipment could produce 50 megawatts (MW) of electricity year-round, he said, and lower the lake's water level by five to 10 meters. "When the water level is reduced, we don't have to worry about the lake bursting,**

The Hindu

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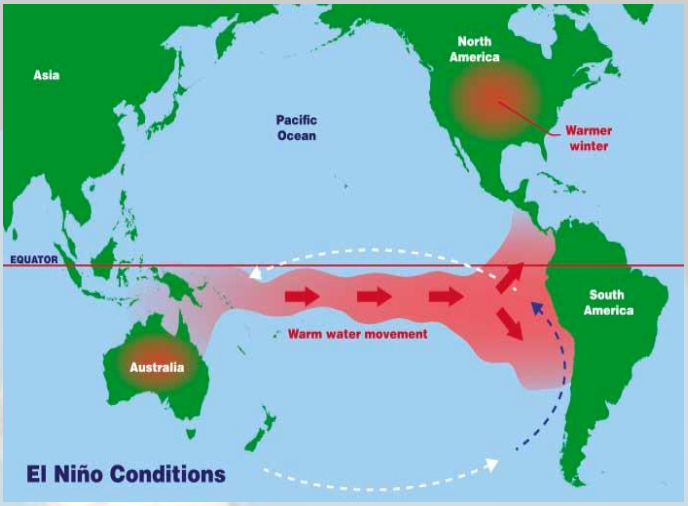
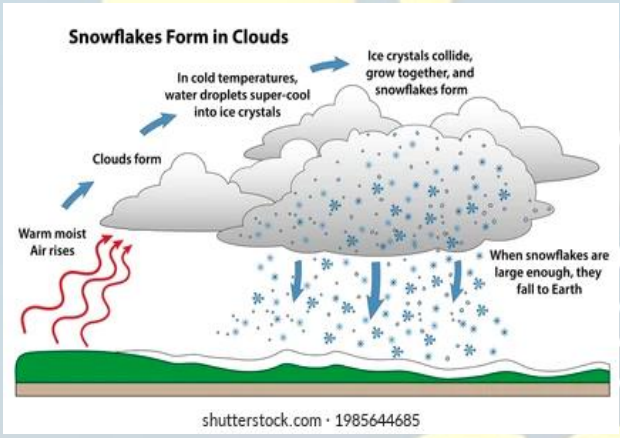
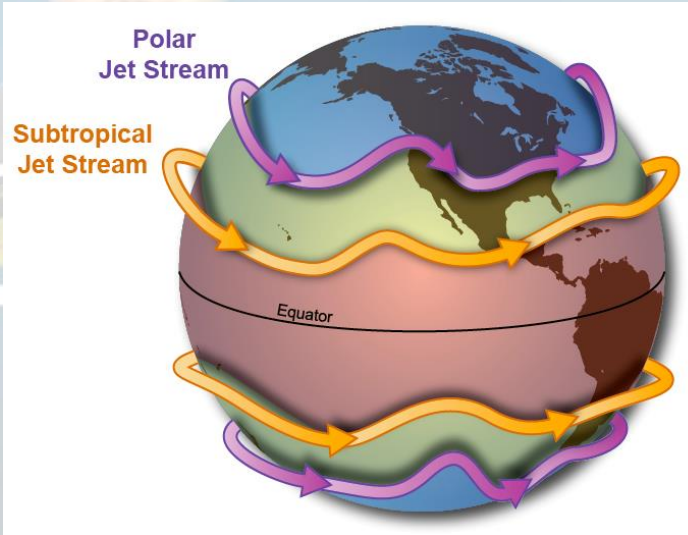
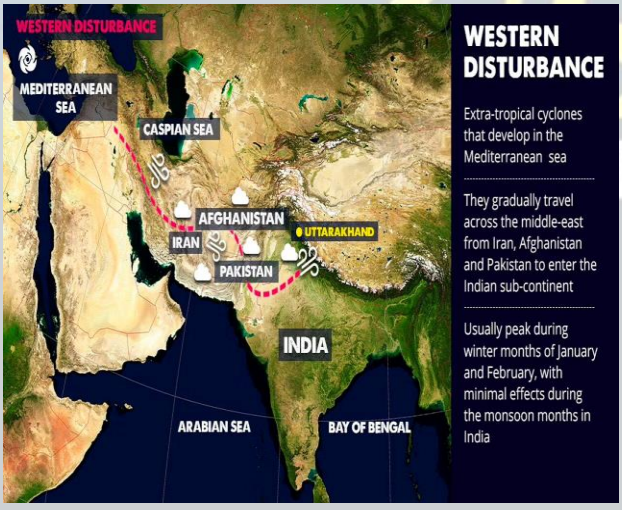
Why no snowfall in Kashmir?









What is the reason for the lack of snowfall?

- **Snowfall requires adequate moisture as well as atmospheric temperatures to be zero degrees or less.**
- **Temperatures have been fairly low since December.**
- **An analysis by the IMD in mid-January reported that maximum temperatures are running 5-8°C**

'below normal' over the plains of north India since December 29.

- Minimum temperatures were also below 4 degrees Celsius at many stations of northwest India for most of January.
- This also resulted in a very dense fog persisting over the plains of northwest India.
- While moisture and high aerosol loads contribute to fog, there were three major reasons behind the lack of snowfall and consequently intensifying cold waves over north India.
- These were a drastic fall in Western Disturbances (WDs) over northwest India; prevailing ElNino conditions; and the absence of a strong jet stream.

How do these three factors influence snowfall?

- Western Disturbances are storms that originate in a multitude regions and travel thousands of kilometres to bring rains to northern India.
- Such WDs in the winter dissipate fog and increase the sunshine incident on the ground raising temperatures.
- They also, when the temperatures are low, result in snowfall and water being available as snow melts.
- The melting glaciers contribute to the water available in the Ganga, Indus and Yamuna. On the other hand, they can also bring in hail, which is destructive to standing wheat crop.
- Usually, 57 WDs impact northwest India during December to January. But this winter there have been none.
- There were two WDs in this period, but their impact was mainly confined to Gujarat, north Maharashtra, east Rajasthan and Madhya Pradesh.
- As a result of the lack of these rains, the Western Himalayan Region got 80% less rain than normal.
- Prevailing El-Nino conditions over the equatorial Pacific Ocean, or warmer ocean temperatures, may also have had a role to play.
- However, irrespective of El Nino, or the converse, La Nina, the number of WDs in December and January have been on a decline.

What role do the jet streams play?

- Jet streams are powerful winds, ranging from 250320 kmph, travelling at about 12 km above mean sea level.
- They are carriers of the western disturbances but the lack of moisture means that so far, they have been

contributing to the subsidence of cold air thereby enhancing the cold over north India.

- The jet streams set in after the withdrawal of the monsoon are also able to draw in moisture from the Arabian Sea.
- In recent years, the jet stream has been shifting northwards.
- This, emerging research suggests, is a consequence of a warming in the Arctic seas that affects the natural gradient of temperature necessary to ensure the strength and direction of the jet streams.
- The Hindu

Minority status

What constitutes 'minority character'?

- Article 30(1) in Part III of the Constitution empowers all religious and linguistic minorities with a fundamental right to establish and administer educational institutions of their choice.
- Clause 2 ensures that the State maintains 'equality of treatment' in granting aid to all educational institutions, irrespective of their minority status.
- This includes educational institutions at all levels, from primary schools to professional education.
- Notably, these institutions enjoy exemptions from the implementation of SC, ST, and OBC reservations in both admissions and employment.
- Additionally, they can reserve up to 50% of seats for students from their community and exercise greater control over employees compared to other institutions.
- In the T.M.A Pai Foundation (2002) case, the SC clarified that a 'minority' is to be determined by the concerned State's demography, not the national population.
- In 1877, Sir Syed Ahmed Khan, a Muslim reformer, founded the Muhammadan Anglo Oriental College (MAO College) at Aligarh.
- The Aligarh Muslim University Act, 1920 (AMU Act) was passed to incorporate the MAO College and the Muslim University Association.

The Hindu

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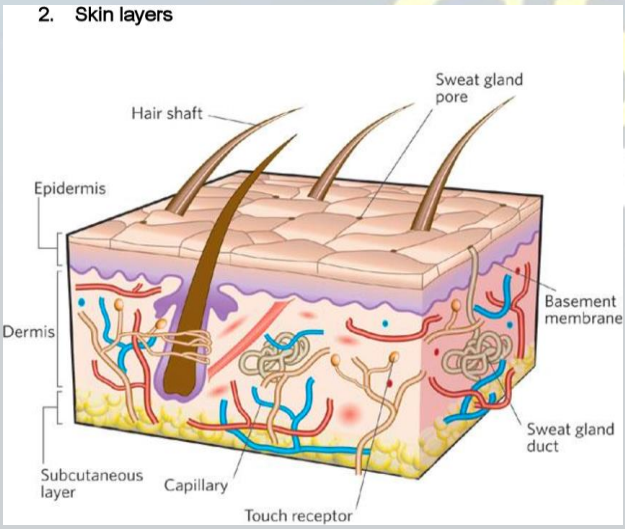
Artificial skin



- **Dr. Coclite and her team had succeeded in developing a three in one "smart skin" hybrid material, which closely resembles human skin by simultaneously sensing pressure, moisture, and temperature and converting them into electronic signals.**
- **With 2,000 individual sensors per square millimetre, the hybrid material is more sensitive than a human fingertip, giving it its reputation, and, at 0.006 millimeters thick, many times thinner than human skin.**
- **Artificial skins are a series of materials that try to emulate the functionality of our skin.**
- **. Artificial skin projects try to emulate at least some of the function.**
- **one is a piezoelectric material which when compressed or stretched, generates an electric current.**
- **This type of material for example, is the one that allows the artificial skin to sense force or pressure.**
- **The other material that is also very fundamental in this is the smart polymer that changes thickness depending on humidity and temperature, and in particular, these two materials have been combined in various nano rods.**
- **One area of practical application that really excites her and the team is prosthetics.**

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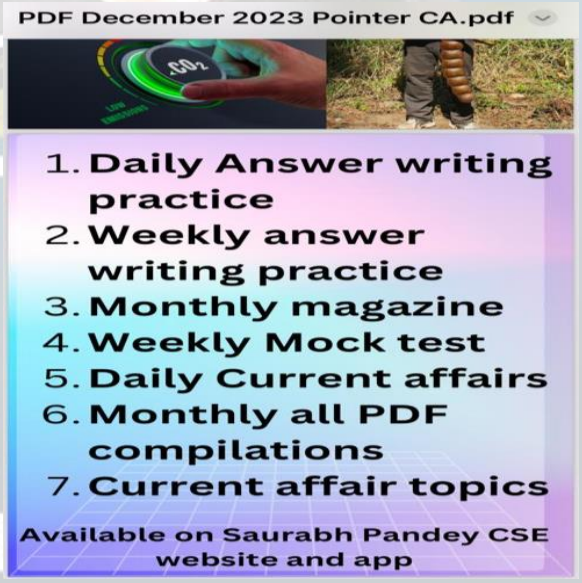
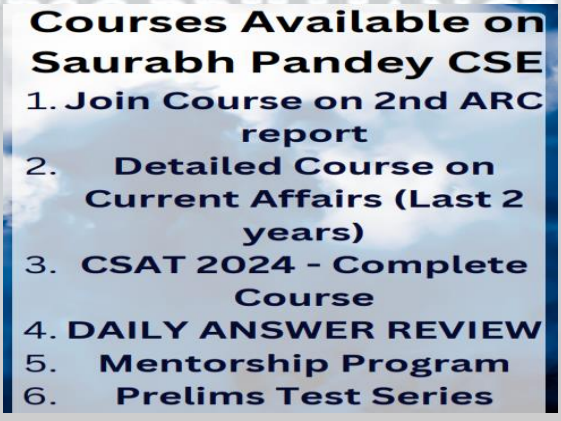
- **"The artificial skin could cover the prosthetics and help the patient with the amputation regain sensation.**
- **The Hindu**

Cold waves and community

- **With temperatures hitting record lows, communities grapple with a spectrum of physical health challenges.**
- **Prolonged exposure to extreme cold can lead to hypothermia, a condition where the body loses heat faster than it can generate it, resulting in shivering, confusion, and potentially life threatening consequences.**
- **Respiratory issues come to a head as cold air irritates the airways, worsening conditions like asthma and bronchitis.**
- **Cardiovascular health is not exempt, as the heart works overtime to maintain a stable internal temperature.**
- **Elevated blood pressure and heart rate become commonplace, posing additional risks for those with underlying cardiovascular issues.**
- **The convergence of cold waves and flu seasons heightens risks. The psychological toll is substantial. Reduced social interaction during cold spells affects psychological well being. Seasonal Affective Disorder (SAD) can set in when low visibility and weather related mobility restrictions lead to a lack of sunlight and limited movement.**
- **Sleep disruptions further compound the mental toll, as the discomfort of cold temperatures interferes with achieving restful sleep. The cumulative effects of physical discomfort and mental strain create a challenging environment for individuals during the winter season.**





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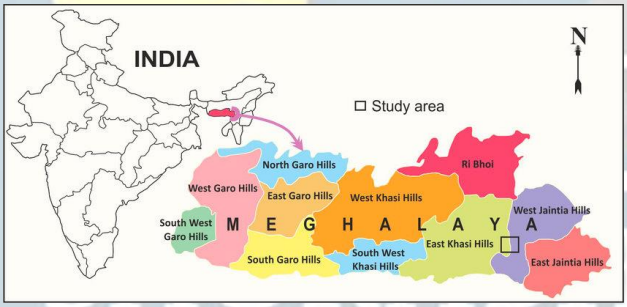
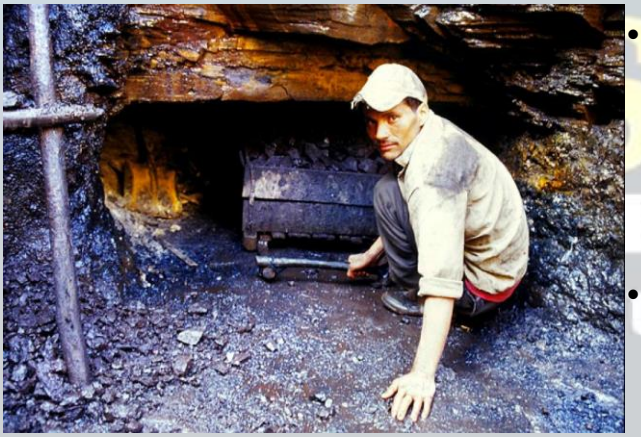
Rat hole mining

- A rat-hole mine is made by digging pits ranging from 5 to 100 meters into the ground to reach the coal seam.
- Thereafter, tunnels are made sideways into the seam to extract the coal.
- Coal seams are reached by excavating the side edge of the hill slopes after which, coal is extracted through a horizontal tunnel.





- These rat-hole mines are spread throughout Meghalaya, but are mostly concentrated in the Jaintia Hills, the South Garo Hills around the towns of Baghamara and Nangalbibra, and the area around Nongjri and Shallang in the West Khasi Hills.
- On April 17, 2014, the National Green Tribunal (NGT) banned illegal rat-hole mining after the All Dimasa Students Union and the Dima Hasao District Committee filed a petition that highlighted the unscientific and unregulated rat-hole coal mining operations in the Jaintia Hills.
- However, following protests by the mining lobby, the tribunal allowed the transport of already-mined coal

Moon sniper

- The country became the fifth to put a spacecraft on the moon when its so-called “Moon Sniper” lander touched down on the lunar surface.
- The Japan Aerospace Exploration Agency [JAXA] said it had received all data about the landing of its Smart Lander for Investigating Moon (SLIM) probe.
- The mission aimed to land within 100 meters (328 feet) of its target, bettering the conventional accuracy figure of several kilometers.
- The target was a crater where the moon’s mantle, a deep inner layer, is believed to be exposed on the surface.

- JAXA also published its first colour images from the mission depicting the aircraft sitting at a slight angle on the moon's rocky grey surface, with rising slopes in the distance.

- JAXA said saying SLIM's solar panels have been unable to generate electricity likely because they were angled wrong, expressing hope that a change in the sunlight's direction could power it up again.
- Its probe is part of several new lunar missions launched by governments and private companies, five decades' years after the first human moon landing.
- Japan has been expanding its space activities, even forging partnerships with the US to address China's burgeoning military and technological influence.
- The country is an active participant in NASA's Artemis program and aims to send one of its astronauts to the moon.
- JAXA has faced multiple setbacks, including a launch failure in March of the new flagship rocket H3 that was meant to be competitive against others like SpaceX.

Viksit Bharat@2047

- Viksit Bharat@2047 represents the government of India's ambitious vision to transform the nation into a developed entity by the centenary of its independence in 2047.
- Encompassing diverse facets of development such as economic prosperity, social advancement, environmental sustainability, and effective governance.
- This vision underscores the critical juncture at which India currently stands.
- Realizing this vision demands unwavering dedication, a firm belief in India's destiny, and a profound recognition of the vast potential talent and capabilities of its people, particularly the youth.
- With the largest demographic share, the youth are positioned as the vanguard in leading India towards recessive Bharat by 2047.
- In response to the nation's call, the Prime Minister has extended an invitation for the youth to actively engage in a transformative agenda

through a youth movement called "Ideas from Youth for Viksit Bharat@2047".

- To encourage widespread student participation in providing suggestions for the vision of Viksit Bharat@2047, which aims to maximize engagement on the Viksit Bharat web page.

- The Hindu

Nitrogen hypoxia

What is nitrogen hypoxia?

- Prison officials strapped a mask to Smith's face and administered the pure nitrogen gas.
- The gas itself is not poisonous - nitrogen makes up more than three-quarters of the earth's atmosphere.
- But in pure concentrated form, breathing in the gas chokes off oxygen to the brain, a process called nitrogen hypoxia.
- The use of nitrogen gas in executions has been approved by three states, including Alabama in 2018, and has withstood various legal challenges since.

The Hindu

Liquefied natural gas

- What is liquefied natural gas?
- Liquefied natural gas (LNG) is natural gas that has been reduced to a liquid state, through a process of cooling.
- Natural gas is a 'traditional' source of energy that is already used for a range of functions, from heating our homes and businesses to cooking and transport.

How is LNG made?

- LNG is created by transforming natural gas into a liquid state, by cooling it to -161oC (-259F).
- The process reduces it to 1/600th of its original un-liquified volume and to half the weight of water.
- Why is LNG cleaner than other natural gases?
- LNG produces 40% less carbon dioxide (CO_2) than coal and 30% less than oil, which makes it the cleanest of the fossil fuels.
- It does not emit soot, dust, or particulates and produces insignificant amounts of sulphur dioxide, mercury, and other compounds considered harmful to the earth's atmosphere.
- Clear, odourless, and colourless, LNG is typically 85-95% methane, which contains less carbon than other forms of fossil fuels.

- It also contains tiny amounts of ethane, propane, butane and nitrogen; the exact composition varying depending on its source and processing.

- **Why is LNG important for the transition to net zero?**

- LNG helps with what's known as the 'energy trilemma', which refers to finding a balance between three key requirements in our energy choices: we want affordable energy; we want our energy supply to be secure; and, we want to drive down our carbon emissions to net zero.

LNG as part of our energy future

- Natural gas may be a fossil fuel, but it's making the transition to green energy possible – successfully helping renewables to become the UK's largest source of power.

- And LNG has other uses in the race to net zero. It can act as the 'feedstock' for low-carbon hydrogen a net zero process as it captures the carbon emissions during the manufacturing process meaning it has the potential to become part of a new hydrogen economy.

The Hindu

India-France defense ties

- Comprehensive defence industrial roadmap that was discussed aims to foster collaboration in cutting-edge technologies, including robotics, artificial intelligence (AI), autonomous vehicles, platforms, and cyber defence.

- The India-France defence roadmap's primary focus is to identify opportunities and collaboration in the defense-industrial sector, particularly in high-tech fields such as robotics, AI, and cyber defence.

- India and France have successfully agreed upon a robust defence-industrial roadmap, reflecting a shared commitment to enhancing strategic cooperation.

- Notably, Tata and Airbus Helicopters have entered into an industrial partnership for the production of H125 helicopters, fostering collaboration in the defense sector.

- Discussions between Prime Minister Modi and President Macron surrounded potential disruptions and actual developments in the maritime domain, with a specific reference to the Red Sea.

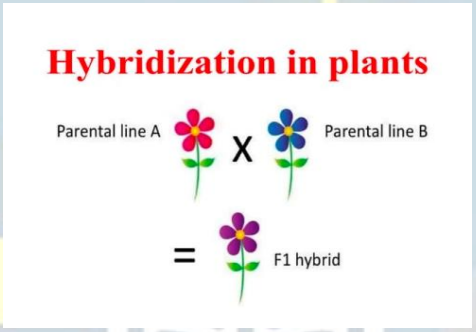
- An MoU was sealed between New Space India Ltd and France's Arianespace, signifying cooperation in satellite launches and advancing space exploration initiatives.

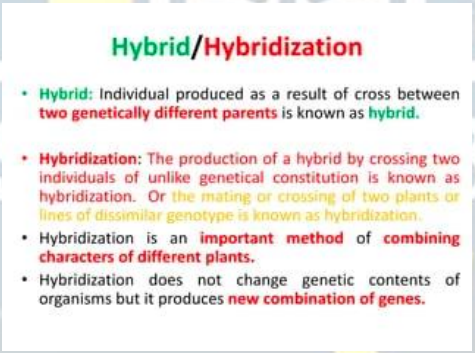
- **The comprehensive industrial roadmap extends beyond the defence sector, with agreements spanning science and technology, healthcare, education, training, research, public administration, and sustainable agriculture.**
- **Celebrating the spirit of innovation, 2026 has been designated as the "India France Year of Innovation".**
- **Other announcements include the introduction of the Young Professional Scheme, facilitating the exchange of individuals between 18-35 years of age, and the extension of visa validity to five years for Schengen visas for Indian students pursuing master's degrees in France.**

The Hindu

Current Affairs 28th January 2024 by Saurabh Pandey

Arabica coffee

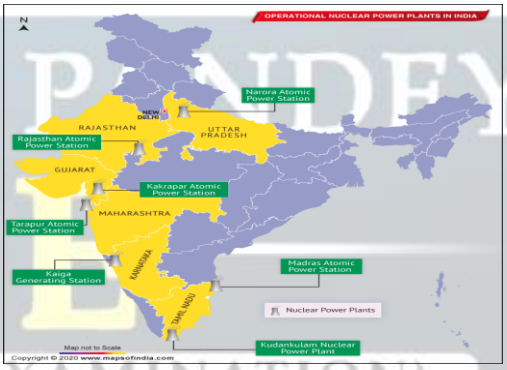


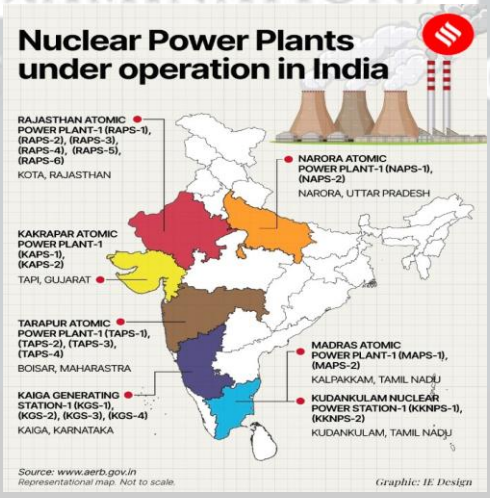


- **Based on a chromosome level assembly, a study published in Nature Communications reveals the sources of genetic diversity of Arabica coffee; the genetic diversity may contribute to its unique flavour and resistance to pathogens.**
- **About 60% of global coffee production is from the Arabica coffee species.**
- **Commercial coffee is mainly produced from Coffea canephora and Coffea arabica, known as Robusta and Arabica coffee, respectively.**
- **Arabica coffee is derived from the hybridization between the ancestors of present-day Robusta coffee and another closely related coffee species, Coffea eugeniodes.**
- **Diversity was found to increase in some Arabica coffee cultivars at specific genomic regions, due to two different sources of variation: chromosomal abnormalities and genetic segments donated by a Robusta Arabica hybrid, known as the Timor Hybrid.**
- **This hybrid has become the parental line of many modern cultivars that combine the disease-resistance trait of Robusta coffee and the unique flavour of Arabica coffee.**

The Hindu

Nuclear power plants and related issues





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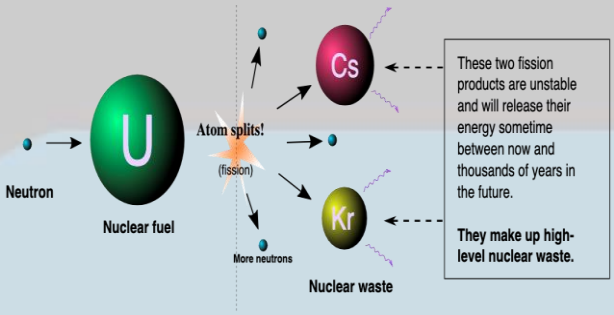
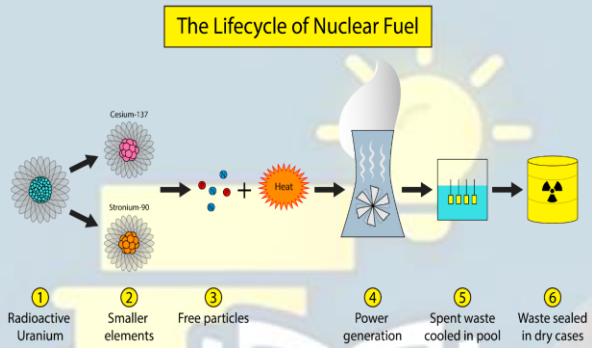
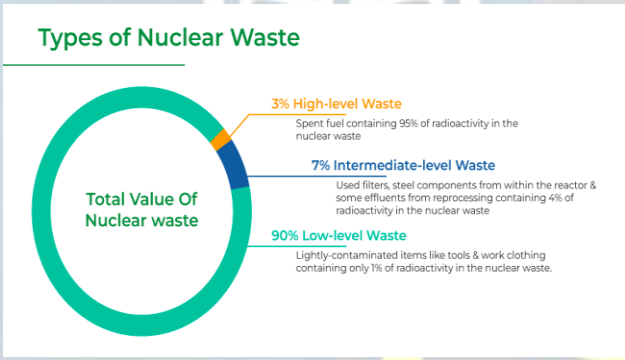


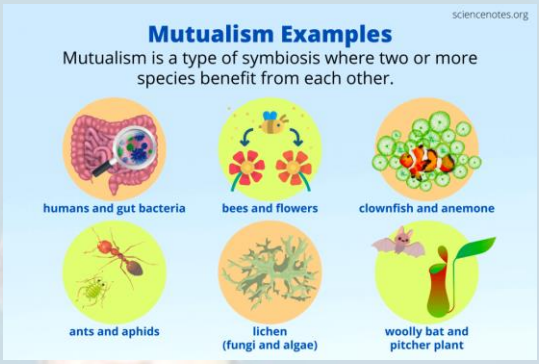




The Hindu

Mutualism

- **At a Kenyan conservancy, the invasive big-headed ant species disrupted a mutualism between native ants and acacia trees, in which the native ants protected trees from grazers in exchange for a place to live.**
- **When the invasive ants pushed out the native ants, the trees were left vulnerable to overgrazing by elephants, who browsed and broke trees at five to seven times the rate in areas with invasive ants.**
- **Due to a more open landscape, lions were left without hiding places stalk their preferred prey of zebras.**



The Hindu

Owl micro fringe

- **Owls' wings make no noise while flying, enabling them to accurately locate their prey while remaining undetected.**
- **While many studies have linked the micro fringes in owl wings to their silent flight, the exact mechanisms have been unclear.**
- **Now, a team of researchers has uncovered the effects of these micro fringes on the sound and aerodynamic performance of owl wings through computational fluid dynamic simulations.**
- **These trailing edge fringes play a crucial role in suppressing the noise produced by wing flap induced air movement.**

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- Simulations revealed that the trailing edge fringes reduced the noise levels of owl wing sand maintained aerodynamic performance comparable to owl wings without fringes.
- Researchers found that the fringes reduce the fluctuations in airflow by breaking up the trailing edge vortices, and they reduce the flow interactions between feathers at the wingtips, thereby suppressing the shedding of wingtip vortices.

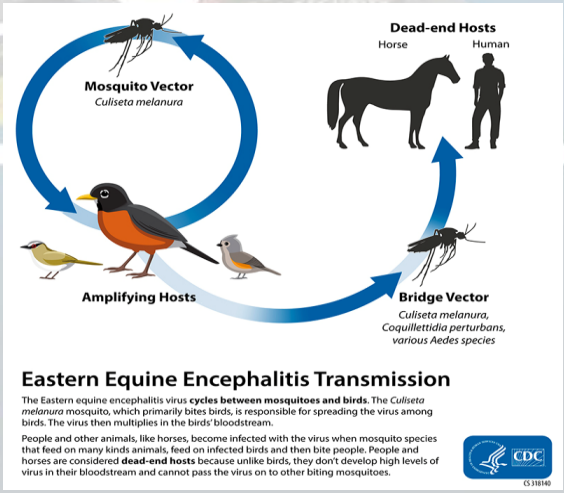
The Hindu

Western Equine Encephalitis Virus

- On December 20, 2023, the International Health Regulations National Focal Point (IHR NFP) in Argentina alerted the Pan American Health Organization/World Health Organization (PAHO/WHO) of a human case of Western Equine Encephalitis Virus (WEEV) infection.

About Western Equine Encephalitis Virus

- WEE is a rare mosquito-borne disease a used by a virus of the same name, which belongs to the genus *Alphavirus* of the *Togaviridae* family, to which the EEE and VEE viruses also belong.
- The main reservoir hosts of EEE and WEE viruses are passerine birds.
- In humans, the WEE virus can cause disease ranging from subclinical or moderate symptoms to severe forms of aseptic meningitis and encephalitis.
- The virus has the potential to spread to other areas through the migration of infected birds or even through the movement of people and animals carrying the virus.
- Given that birds act as a reservoir, they can act as amplifying hosts for viral dissemination to other countries.



WHO Risk Assessment

- The primary mode of WEE virus transmission is through the bites of infected mosquitoes, which act as vectors.
- The principal vector is *Culex tarsalis*; however, there are multiple vectors that contribute to transmission, including *Aedes melanimon, Aedes dorsalis*, and *Aedes campestris*.

- These vectors maintain the circulation of the virus in wild enzootic cycles where birds act as reservoirs of the virus.
- Humans and equines act as the final reservoirs of the virus, incapable of transmitting the virus to mosquitoes.

  People engaged in outside work or activities are at greater risk because of exposure to mosquitoes.
- Outbreaks of WEE in humans generally present as isolated cases with moderate symptoms and most infections are asymptomatic.
- Neurological manifestations include meningitis, encephalitis, or myelitis.
- Similar to other arboviral encephalitis, the encephalitis caused by WEE is characterized by fever accompanied by altered mental status, seizures, or focal neurological signs including movement disorders.
- The Hindu

- Punjab vs BSF power

- In 2021, the Government of India increased the jurisdiction of the Border Security Force (BSF) which chiefly focus on preventing transborder crimes from 15 kilometers up to 50 kilometers inside the international borders in the States of Punjab, West Bengal, and Assam.
- In Punjab, the move triggered sharp criticism from key political parties, with the State government ultimately moving the Supreme Court.

What is the allegation?

- A three judge Bench headed by the Chief Justice of India D.Y. Chandrachud will hear a complaint filed by Punjab accusing the Centre of stripping the State and its police of its powers.
- Police and law and order is a State subject under Schedule 7, List II Entries 1 and 2 of the Constitution.
- Punjab challenged the constitutional validity of the notification issued by the Centre in October 2021 extending the reach of the BSF to 50 km by invoking Section 139 of the Border Security Force Act, 1968.
- The provision authorizes the Centre to confer powers and duties on the BSF with respect to any Central Act like the Passport (Entry into India) Act, 1920, the Registration of Foreigners' Act, 1939, the Central Excises and Salt Act, 1944, the Foreigners Act, 1946, the Foreign Exchange Regulation Act, 1947, the Customs Act, 1962 or the Passports Act, 1967 or of any cognizable offence punishable under any other Central Act.

How has Punjab challenged the notification?

- Through the lawsuit filed under Article 131 of the Constitution of India, Punjab has challenged the notification issued by the Union of India, through the Ministry of Home Affairs under subsection (1) of Section 139 of the BSF.
- Punjab has submitted that the effect and the consequence of the notification amount to encroachment upon the powers of the State of Punjab by the Centre in as much as more than 80% area of the border districts.
- All major towns and cities including all the district headquarters of these border

districts of Punjab fall within the 50 km demarcation area from the India Pakistan International Border.

- The government contends that considering that more than 80% area of the major border area towns of Punjab are covered in the extended belt of 50 kms, the notification is ultra vires of the Constitution and encroaches upon Punjab's plenary authority to legislate on the issue which relates to or are necessary for the maintenance of public order and internal peace.

What are Punjab's concerns?

- The concerns of Punjab are distinguishable from the concerns of other States and Union Territories, as per the lawsuit.
- The geography of Punjab is such that the area which has been included in the extended jurisdiction of the BSF is densely populated.
- The State argues that this is not the case in Gujarat, where most of the area falls in the wastelands of Kutch and saline marshes; similarly, the extended jurisdiction in Rajasthan is desert land, permitting only sparse vegetation, and the density of population is low too.
- In the case of Punjab, the 50km area is highly fertile, heavily populated and covers most of the physical areas forming part of the border districts of Pathankot, Gurdaspur, Amritsar, Tarn Taran, Ferozepur, Fazilka etc.

The Hindu

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Laughing gull

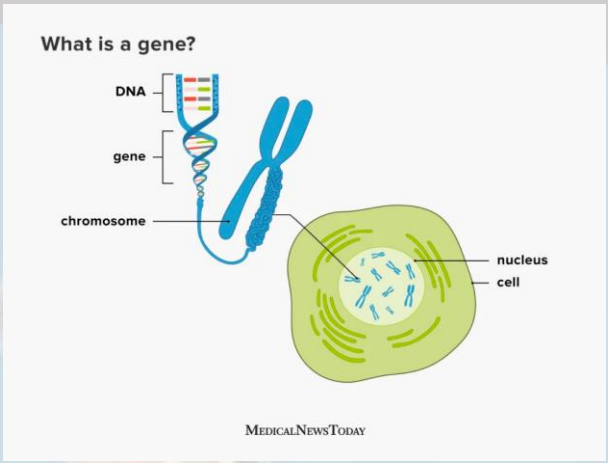
- **Laughing gull, a migratory bird from North America, has been sighted for the first time in the country at the Chittari estuary in Kasaragod district.**

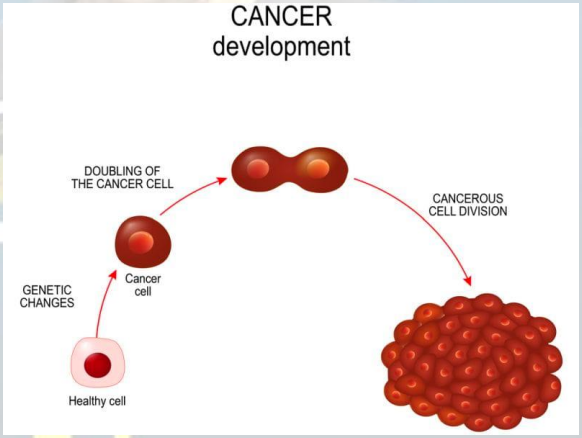
- **The laughing gull (*Leucophaeus atricilla*) is a medium-sized gull of North and South America.**
- **Named for its laugh-like call, it is an opportunistic omnivore and scavenger. It breeds in large colonies mostly along the Atlantic coast of North America, the Caribbean, and northern South America.**
- **The two subspecies are *L. a. megalopterus* which can be seen from southeast Canada down to Central America and *L. a. atricilla*, which appears from the West Indies to the Venezuelan islands.**

The Hindu

Genomic medicine

- **Cancer is a disease of the genome. It is caused by changes in genes that cause some cells to divide in an uncontrolled way.**
- **These changes can be inherited or acquired. Inherited genetic variants form the basis of many hereditary cancers, including breast and ovarian cancer.**





- **Advancements in genomic technologies have improved our understanding of the molecular underpinnings of cancer, which in turn have yielded a new generation of therapies that target molecular defects**
- **Such therapies are called precision oncology therapies. Their eligibility in a given setting is determined by molecular tests**
- **Of the 200 odd therapies the U.S. Food and Drug Administration has approved, almost a third have a DNA based test as a biomarker.**

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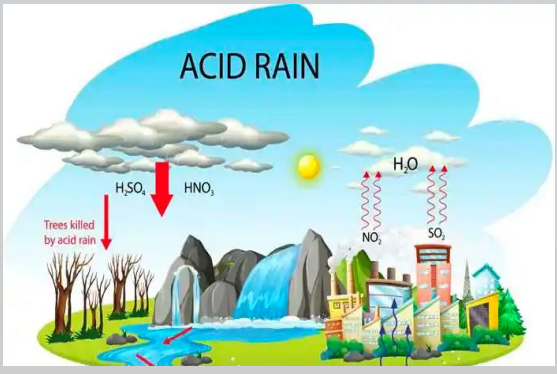
- And while scientists are discovering new biomarkers for cancers, the focus of late has been shifting to understanding how genomic tests could become the mainstay of cancer treatment in clinical settings.
- In the U.K. researchers sequenced and analysed the genomes of people with different types of cancers; the genomes came from blood and tumour tissues.
- Their analysis revealed details that the researchers have said can be applied in clinical settings to guide treatment strategies for cancer patients.

Terms - personalised /Genomic medicine

- Personalized medicine, also referred to as precision medicine, is a medical model that separates people into different groups with medical decisions, practices, interventions and/or products being tailored to the individual patient based on their predicted response or risk of disease.
- Genomic medicine is an emerging medical discipline that involves using genomic information about an individual as part of their clinical care (e.g. for diagnostic or therapeutic decision-making) and the health outcomes and policy implications of that clinical use.
- The Hindu

Acid rain



- Acid rain is rain that is acidic. When fossil fuels that contain sulphur are combusted, their emissions include sulphur dioxide (SO2).
- When such combustion happens at a higher temperature, like inside the engine of a car, the combustion products also include nitrogen oxide and nitrogen dioxide (collectively called NOx).
- Both SO2 and NOx are also produced naturally, such as when volcanoes erupt or when lightning passes through the atmosphere, but in and around cities, their principal source is the use of fossil fuels for transport and power generation.
- Once SO2 and NOx rise into the air, they react with water and oxygen molecules to produce sulphuric acid (H2SO4) and nitric acid (HNO3), both of which are corrosive.
- When these molecules dissolve in water droplets and the droplets precipitate, we have acid rain, acid snow, and even acid fog.
- The typical pH of acid rain is around 4.2-4.4. When acid rain flows into rivers and lakes, it can render the water inhospitable to some species; in soil, it destroys some bacteria.
- These effects can in turn adversely affect forests and other large ecosystems in complex ways.
- To mitigate these effects, coal power plants have been able to reduce the SO, content in their atmospheric emissions by more than 90% using flue gas desulphurization.
- Many governments around the world have also been working together to minimise acid rain; an example in Asia is the Acid Deposition Monitoring Network in East Asia (EANET).

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RBI'S guidelines on state guarantees

- A working group constituted by the Reserve Bank of India (RBI) made certain recommendations to address issues relating to guarantees extended by State governments.

What constitutes a 'guarantee'?

- A 'guarantee' is contingent liability of a State, processed by an accessory contract, that protects the lender/investor from the risk of borrower defaulting.
- They promise to be answerable for the debt, default or miscarriage of the latter.
- The entity to whom the guarantee is given is the 'creditor', the defaulting entity on whose behalf the guarantee is given is called the 'principal debtor' and the entity giving the guarantee (State governments in this context) is called the 'surety'.
- If A delivers certain goods or services to B and B does not make the agreed upon payment, B is defaulting and at the risk of being sued for the debt. C steps in and promises that s/he will pay for the default of B. This is a guarantee.
- The RBI working group's report notes that while guarantees are innocuous in good times, it may lead to significant fiscal risks and burden the State at other times.
- This may result in unanticipated cash outflows and increased debt. State governments are often required to sanction, and issue guarantees, on behalf of State owned enterprises, cooperative institutions, urban local bodies and/or other State governed entities, to respective lenders.

What about the definition of a guarantee?

- The Working Group has suggested that the term 'guarantee' should be used in a broader sense and include all instruments, by whatever name they may be called, if they create obligation on the guarantor (State) to make a payment on behalf of the borrower at a future date.

What about risk determination?

- The Group suggested that States assign appropriate risk weights (indicative of the holding the lender should ideally have to adjust the associated risk) before extending guarantees.
- The categorizations could be high, medium, or low risk. These must also consider records of defaults.
- Additionally, it deemed a ceiling on the issuance of guarantees as "desirable."

The Hindu

Encryption

What is encryption?

- Fundamentally, encryption is the act of changing some consumable information into an inconsumable form based on some rule.

What is E2E encryption?

- E2E is encryption that refers to particular locations between which information moves. Say you are chatting with your friend on a messaging app.
- When you send a message, it first goes to a server maintained by the company that built the app; based on its instructions, the server routes the message to your friend.

- **In this setup, two important forms of encryption are encryption in transit and E2E encryption.**
- **Encryption in transit means before a message is relayed from the server to you (or vice versa), it is encrypted.**
- **This scheme is used to prevent an actor from being able to read the contents of the message by intercepting the relay.**
- **In E2E encryption, the message is encrypted both in transit and at rest.**
- **One broad distinction is between symmetric and asymmetric encryption.**
- **In symmetric encryption, the key used to encrypt some information is also the key required to decrypt it.**
- **DES is a famous example of a symmetric encryption protocol.**
- **In asymmetric encryption, if the message "ice cream" is encrypted using the key "motorcycle", it can be decrypted using a different key that corresponds to "motorcycle" in a predetermined way.**
- **Asymmetric encryption will work as long as the private key and the correspondence between the public key and the private key are kept secret.**

The Hindu

Humboldt's enigma

What is Humboldt's enigma?

- The world's tropical areas receive more energy from the Sun because of the earth's angle of inclination.
- So the tropics have greater primary productivity, which then facilitates greater diversity: more ecological niches become available, creating more complex ecosystems and greater biological diversity.
- The proponents of Humboldt's enigma have held that the earth's tropical areas by themselves don't contain all the biodiverse regions, and that many areas outside the tropics are highly biodiverse.
- These places are mountains. Indeed, while we expect diversity to decrease away from the tropics, mountains have been an important exception.
- A simple way to think of Humboldt's enigma in India is to consider the biodiversity in our tropical areas, south of the Tropic of Cancer passing through Madhya Pradesh and Chhattisgarh.
- These areas are supposed to be the most diverse in the country. The Western Ghats plus Sri Lanka biodiversity hotspot lies in this zone.
- However, the eastern Himalayas are much more diverse.

What drives biodiversity?

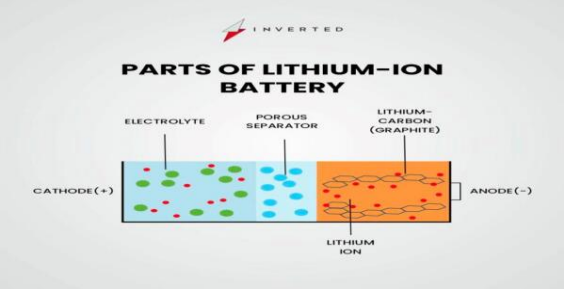
- The history of the earth, its geography, and the climate are the main drivers of mountain diversity.
- And different biodiversity at different locations is the result of changes in how these factors have intermingled over time and space. We know mountains host two processes that generate biodiversity.
- First: geological processes, like uplifts, result in new habitats where new species arise, so the habitats are 'cradles'.
- Second: species on some climatologically stable mountains persist there for a long time, so these spots are 'museums' that accumulate many such species over time. Coastal tropical sky islands (mountains surrounded by lowlands), like the Shola Sky Islands in the Western Ghats, are a good example.
- Here, old lineages have persisted on the mountain tops as climates and habitats fluctuated around them in the lower elevations.
- This is the reason some of the oldest bird species in the Western Ghats, such as the Sholicola and the Montecincla, are housed on the Shola Sky Islands.
- The northern Andes range including Chimborazo is considered the most biodiverse place in the world. Another critical force in biodiversity formation is geology.
- National programmes are trying to address these gaps, including the National Mission on Himalayan Studies, the National Mission for Sustaining the Himalayan Ecosystem, and the National Mission on Biodiversity and Human Wellbeing. They need to be strengthened, and bolstered by the will to support basic research on diversity.

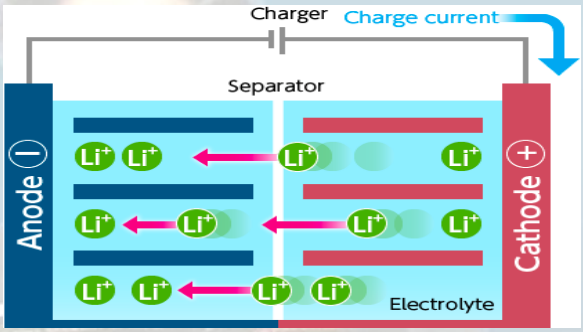
The Hindu

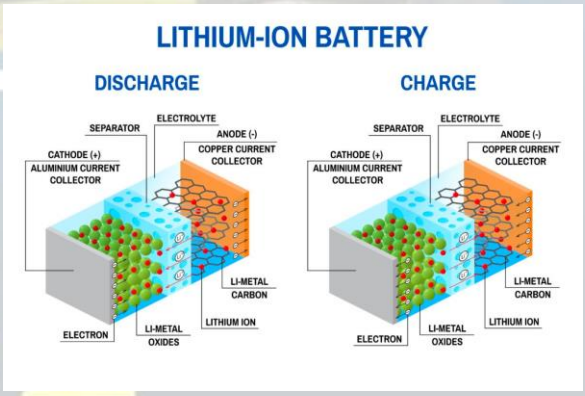
Child nutrition

- To markedly improve child nutrition and combat undernutrition in India, three key strategies can be the largest needle movers.
- First, promoting early breastfeeding, along with continued breastfeeding for two years, coupled with appropriate complementary feeding starting at six months, is essential.
- This not only prevents stunting but also fosters optimal child development. Government initiatives, such as the Mother's Absolute Affection Programme, need expansion to provide comprehensive lactation support and create breastfeeding-friendly environments. Leveraging mobile technology to educate mothers about the criticality of exclusive breastfeeding in the first six months is also vital.
- At the same time, improving maternal nutrition is crucial, as healthier mothers have healthier babies.
- Second as children grow, diversifying their diet becomes crucial. India should implement and scale up community-based complementary feeding programmes.
- These can educate parents about the importance of adding a variety of foods to their child's diet after six months of age, focusing on locally available, nutrient rich food options.
- Finally, adding an extra Anganwadi worker to each Anganwadi centre could help.
- The Hindu

Li battery

- 

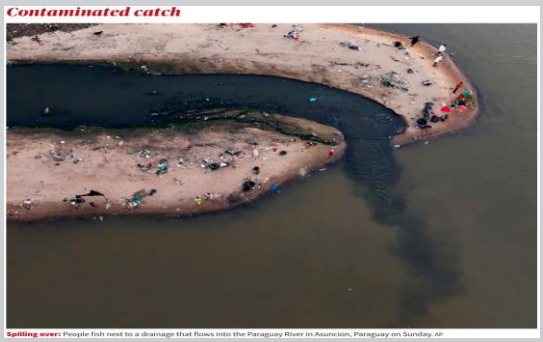
- 

- 

- All EVs on the road today are powered by lithium ion batteries.
- It consists of two electrodes (an anode and a cathode) separated by a liquid electrolyte.
- Lithium atoms in the anode give up electrons which travel to the cathode through an external wire this stream of electrons provides the current that powers the motor of the vehicle.

- Simultaneously, lithium ions (now positively charged from the loss of an electron) travel through the electrolyte to reach the cathode.
- During charging, the process is reversed with lithium ions being forced to travel back through the electrolyte to the anode.
- There is a good reason why lithium is the material of choice for EV batteries. Lithium, the lightest solid element known to man, has a high propensity to give up its electron. Its small size enables the lithium ion to efficiently travel between electrodes through the electrolyte.
- This translates to lighter and smaller batteries with an ability to store large amounts of energy.
- However, today's Li ion batteries still leave a lot to be desired.
- Its energy density while high compared to earlier battery technologies, pales in comparison to petrol. Batteries are still slow to charge (compared to the few minutes it takes to fill petrol at a pump).
- There is a need to make batteries more affordable and increase their lifespan.
- The Hindu

Paraguay river

- 

- The Paraguay River is a major river in south-central South America, running through Brazil, Bolivia, Paraguay, and Argentina.
- It flows about 2,695 kilometers (1,675 mi) from its headwaters in the Brazilian state of Mato Grosso to its confluence with the Paraná River north of Corrientes and Resistencia.
- 

Pros and cons of simultaneous election

- A High-Level Committee (HLC) headed by Ramnath Kovind, former President of India, was constituted in September 2023 to examine the issue of holding simultaneous elections for the Lok Sabha, State Legislative Assemblies, and local bodies of all States. T.

What is the background?

- During the first four general election cycles in 1952, 1957, 1962, and 1967, the elections to the Lok Sabha and State legislative assemblies were held simultaneously.
- However, due to the subsequent premature dissolution of the Lok Sabha on seven occasions and the premature dissolution of legislative assemblies on various occasions, the elections to the Lok Sabha and various State assemblies are held at different times.

What is the case for simultaneous elections?

- The desirability of simultaneous elections can be discussed from the perspectives of cost, governance, administrative convenience and social cohesion.
- Firstly, it is estimated that the cost of holding general elections to the Lok Sabha is around ₹4,000 crore for the Central government.
- Each State assembly election would also cost considerable amount of money according to the size of the State.
- While this is the official expenditure of the government, the expenditure by parties and candidates are manifold times higher.
- Simultaneous elections would entail a reduction in these costs.
- Secondly, there are at least 56 State elections that happen every year. This results in political parties, including Ministers, being in 'permanent campaign' mode, which acts as a hindrance to policy making and governance.
- Further, the Model Code of Conduct that is enforced during the election process ranges usually from 45-60 days where no new schemes or projects can be announced by the Centre and concerned State governments.
- Third, administrative machinery in the districts slow down during the election period with the primary focus being the conduct of elections.
- There are also paramilitary forces that are withdrawn from the locations in which they are posted and deployed to the concerned State for the smooth conduct of elections.

What are the challenges involved?

- Conducting elections simultaneously to the Lok Sabha and all State assemblies would result in national issues overshadowing regional and State specific issues.
- National political parties would have a significant advantage over regional parties on account of this mechanism.
- This would be detrimental to the federal spirit of our country which has been declared as a basic structure of the Constitution.
- Elections also serve as an effective feedback mechanism for governments in power.
- Apart from the federal and democratic issues discussed above, simultaneous polls will also require constitutional amendments. India is a parliamentary democracy where the governments at the Centre and the State need to enjoy majority in the Lok Sabha and the Legislative Assembly respectively.
- The duration of these houses is five years but it may be dissolved earlier if the party or coalition in power loses majority, and no alternative government can be formed.
- It may also be dissolved prematurely by the council of ministers in power to seek an early election.
- Further, State legislative assemblies can also be dissolved by imposing President's rule under Article 356 of the Constitution.
- Having a fixed tenure of five years for the Lok Sabha and State assemblies will

therefore require constitutional amendments to Articles 83, 85, 172 and 174 that deal with the duration and dissolution of Lok Sabha and Legislative assemblies.

- It will also require the amendment of Article 356.

- What are the various recommendations? The reports of the Law Commission (1999), and the Parliamentary Standing Committee on Personnel, Public Grievances, Law and Justice (2015), have dealt with the issue of simultaneous elections. The Law Commission had also submitted a draft report in 2018. The highlights of these discussions and recommendations can be summarized as follows (a) the elections to the Lok Sabha and nearly half of the State assemblies may be clubbed together in one cycle, while the rest of the State assembly elections can be held in another cycle after two and half years.

- This will require curtailing or extending the tenures of existing assemblies that will entail amendments to the Constitution and the Representation of the People Act, 1951;

- (b) any 'no confidence motion' in the Lok Sabha or Legislative Assembly should be mandatorily accompanied by a 'confidence motion' for the formation of an alternate government.

- If for any unavoidable reason, the Lok Sabha or State Assembly is to be dissolved prematurely, the duration of the newly constituted House should be only for the remainder period of the original House.

- This would act as a deterrent for MPs and MLAs pushing for premature dissolution of the House. It would instead encourage the members to explore the possibility of forming an alternate government through feasible realignments; .

- (c) the by-e elections necessitated by death, resignation, or disqualification of members can be clubbed together and conducted once a year.

- It may be noted that Parliamentary democracies like South Africa, Sweden and Germany have fixed tenures for their legislatures.

- The elections to the National Assembly and provincial legislatures happen simultaneously in South Africa every five years, with the President of the country being elected by the National Assembly.

What can be an ideal solution?

- There is a lack of consensus among various political parties about the conduct of simultaneous elections. The ideal middle ground may be to conduct the Lok Sabha election in one cycle and all State assembly elections in another cycle after two and a half years.

The Hindu

Current Affairs 31st January 2024 by Saurabh Pandey

Northern kangaroo lizard

- The biodiverse forests of the Western Ghats have thrown up yet another marvel of evolution a new species of tiny lizards, which researchers have described as “diminutive dragon”.
- Agasthyagama edge or northern kangaroo lizard, which belongs to the Agamidae family, is known to have a maximum snout-vent length of 4.3 cm.
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- The species is the second one of the Agasthya Gama genus after A. beddomii or Indian kangaroo lizard that has been previously reported from the Sivagiri hills in Tamil Nadu.
- A reduced fifth toe makes these reptiles poor climbers and hence do not climb trees like other lizards.
- Instead, they are mostly terrestrial and found in areas with dense leaf litter cover.
- While they feed on small insects, this variety of kangaroo lizard runs fast and hides within dry leaves to evade predators.
- The findings have been reported in Vertebrate Zoology, a scientific journal published by the Senckenberg Museum in Germany.

Snow Leopard

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- India has an estimated 718 snow leopards in the wild, according to a first of its kind, four yearlong estimation exercise, the results of which were made public.
- The snow leopard is known to be an elusive cat and located in mountainous terrain that is hard to access, and the exercise for the first time marks a base threshold for the animal’s numbers in India.
- The highest number of cats was estimated to be in Ladakh (477), followed by Uttarakhand (124), Himachal Pradesh (51), Arunachal Pradesh (36), Sikkim (21), and Jammu and Kashmir (nine).

Current Affairs 31st January 2024 by Saurabh Pandey

- The current estimate puts the number of Indian snow leopards between 10% and 15% of the global population.

About snow leopard

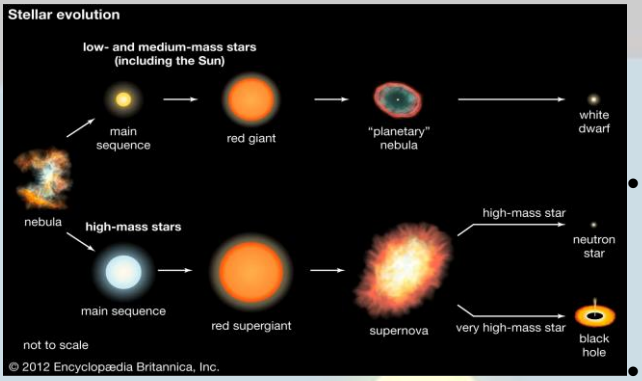
- The snow leopard's powerful build allows it to scale great steep slopes with ease. Its hind legs give the snow leopard the ability to leap six times the length of its body.
- A long tail enables agility, provides balance and wraps around the resting snow leopard as protection from the cold.
- For millennia, this magnificent cat was the king of the mountains. The mountains were rich with their prey such as blue sheep, Argali wild sheep, ibex, marmots, pikas, and hares.
- The snow leopard's habitat range extends across the mountainous regions of 12 countries across Asia: Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyz Republic, Mongolia, Nepal, Pakistan, Russia, Tajikistan, and Uzbekistan.
- The total range covers an area of close to 772,204 square miles, with 60% of the habitat found in China. It is listed as Vulnerable on the IUCN Red List .
- The Hindu

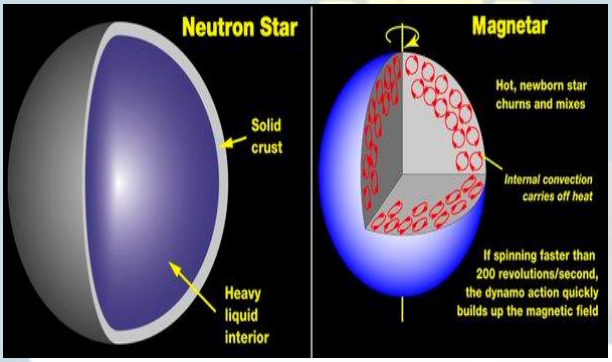
Maratha Military Landscapes

- India has nominated the "Maratha Military Landscapes", a network of forts that showcase the strategic military powers of Maratha rule, for inclusion on the UNESCO World Heritage List for 202425.
- The 12 forts included in this nomination are the forts of Salher, Shivneri, Lohagad, Khanderi, Raigad, Rajgad, Pratapgad, Suvarnadurg, Panhala, Vijaydurg and Sindhudurg in Maharashtra and Gingee in Tamil Nadu.
- The "Maratha Military Landscapes", which developed between the 17th and 19th centuries, represent an extraordinary fortification and military system envisioned by the Maratha rulers.
- This extraordinary network of forts, varying in hierarchies, scales and typological features, is a result of integrating the landscape, terrain and physiographic characteristics distinctive to the Sahyadri mountain ranges, Konkan Coast, Deccan Plateau and Eastern Ghats in the Indian Peninsula.
- They are distributed across diverse geographical and physiographic regions and showcase the strategic military powers of the Maratha rule, the Union Culture Ministry said on Monday.
- The inception of the Maratha military ideology dates back to 17th century during the reign of the Shivaji Maharaj from 1670 and continued through subsequent rules until the Peshwa rule till 1818 CE.

The Hindu

Mass gap

- 

- 

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- **Star cluster NGC 1851 that spotted what appears to be a pair of stars offering a new view into the extremes of matter in the universe.**

- **The system is composed of a millisecond pulsar, a type of rapidly spinning neutron star that sweeps beams of radio light across the cosmos as it spins, and a massive, hidden object of unknown nature.**

- **The massive object is dark, meaning it is invisible at all frequencies of light from the radio to the optical, X ray and gamma ray bands.**

- **In other circumstances this would make it impossible to study, but it is here that the millisecond pulsar comes to our aid. Millisecond pulsars are akin to cosmic atomic clocks.**

- **Their spins are incredibly stable and can be precisely measured by detecting the regular radio pulse they create.**

- **Although intrinsically stable, the observed spin changes when the pulsar is in motion or when its signal is affected by a strong gravitational field.**

- **By observing these changes, we can measure the properties of bodies in orbits with pulsars.**

- **The NGC 1851E system weighs almost four times as much as our Sun, and that the dark companion was, like the pulsar, a compact object much denser than a normal star.**

- **The most massive neutron stars weigh in at around two solar masses, so if this were a double neutron star system (systems that are well known and studied) then it would have to contain two of the heaviest neutron stars ever found.**

- **To uncover the nature of the companion, we would need to understand how the**

mass in the system was distributed between the stars.

- Again using Einstein's general relativity, we could model the system in detail, finding the mass of the companion to lie between 2.09 and 2.71 times the mass of the Sun.
- The companion's mass falls within the "black hole mass gap" that lies between heaviest possible neutron stars, thought to be around 2.2 solar masses, and the lightest black holes that can be formed from stellar collapse, around 5 solar masses.
- At the boundary between neutron stars and black holes there is always the possibility that some new, as yet unknown, astrophysical object might exist.

The Hindu

Water drops formation

- Many windblown drops can be forced together to form what weather reporters call 'sheeting rain', but rain is always born as minuscule drops of condensed water vapour, according to the book Clouds and Weather by John A. Day and Vincent J. Schaefer.
- The formation of these droplets depends on the right amount of water vapor at the right pressure and temperature, but it also requires the presence of tiny solid particles of matter in the air on which the water vapour can gather and condense.
- These bits of dust and salt are called cloud condensation nuclei.
- Salt starts collecting vapor at about 80% relative humidity, while bits of clay begin to take on water molecules at 100% relative humidity.
- As the water molecules slowly collect and condense on the particles, cloud droplets form.
- They are a million times the volume of the original particle but are still very tiny.
- It takes perhaps 3,000 droplets to form a small raindrop.
- The drops in a heavy shower are the size of around 6,000 droplets, according to The New York Times.
- The droplets can grow into drops by several processes.
- First, they can slowly continue to attract vapour. Second, larger droplets fall faster than small ones and collide with them, sometimes joining into larger drops.
- Finally, evaporating droplets may collect on ice crystals in clouds.
- The crystals may warm and melt into rain drops or they may grow 'branches' and fall as snowflakes.

BIG SHOT

The spiral galaxy NGC 1512, located 30 million light-years away from the earth, is seen in this image captured by the James Webb Space Telescope. The images were made public on Monday by scientists in a project called Physics at High Angular resolution in Nearby GalaxieS (PHANGS). The new images came from Webb's Near-Infrared Camera and Mid-infrared Instrument. They show roughly 100,000 star-clusters and millions of individual stars. NASA, ESA, CSA, STScI, PHANGS

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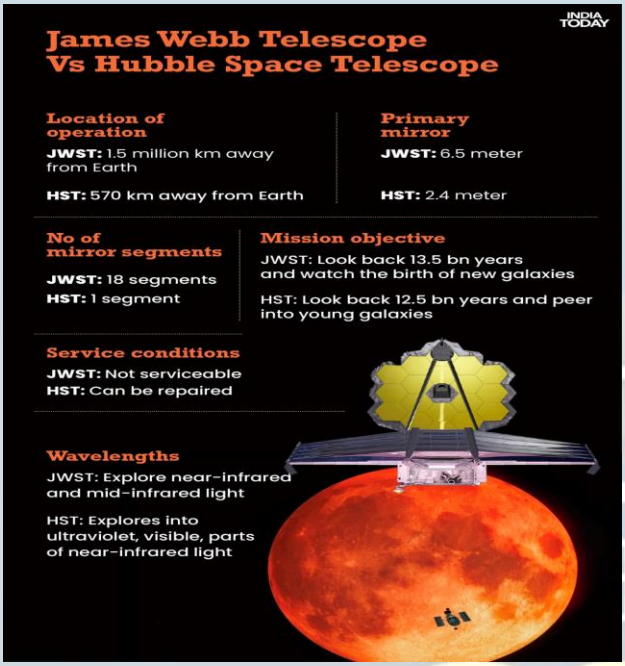

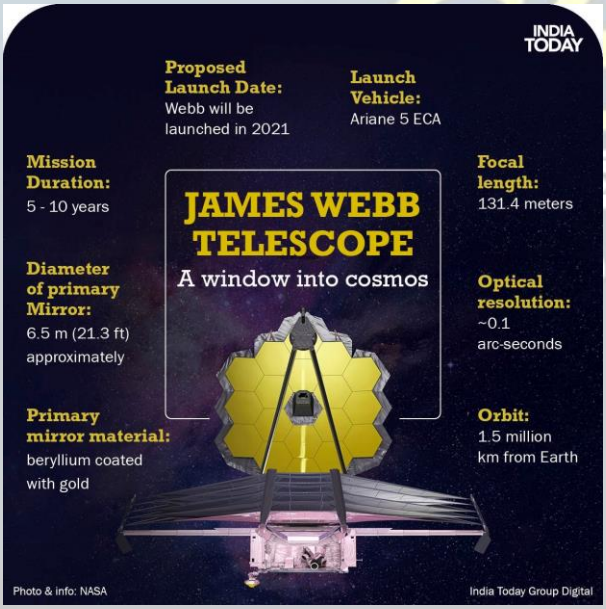

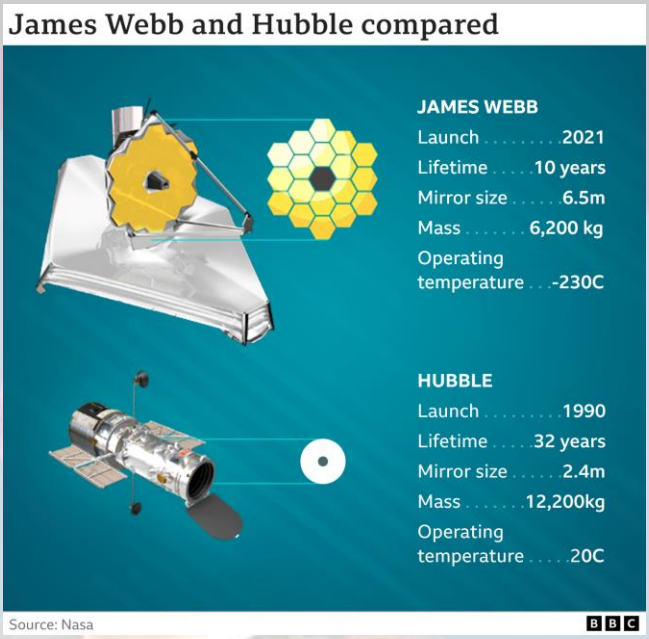

- **The Hindu**

Kangla fort

- **The *Kangla*, officially known as the Kangla Fort, is an old fortified palace at Imphal in the Manipur state of India.**
- **It was formerly situated on both sides (western and eastern) of the bank of the Imphal River, now remaining only on the western side in ruined conditions.**
- **Kangla means "the prominent part of the dry land" in old Meetei.**
- **It was the traditional seat of the past Meetei rulers of Manipur.**
- **Kangla (Imphal) was the ancient capital of pre-modern Manipur.**
- **The Kangla is a revered spot for the people of Manipur, reminding them of the days of their independence. It is a sacred place to the Meiteis.**

The Hindu

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Iran vs Pakistan

- Sri Lanka needs sustained economic growth of 5-6% in the medium term to escape from indebtedness.
- But its outlook is vulnerable to external and internal risks.
- The first is geopolitical competition between the U.S. and China.
- For instance, an intensified U.S. China trade war following the possible victory of Donald Trump in the U.S. presidential elections could be devastating for inward FDI and trade in Sri Lanka.
- The second is debt restructuring.
- In November 2023, Sri Lanka concluded an initial agreement with key bilateral creditors, including India and the Paris Club, to restructure $5.9 billion in external debt.
- This was important for reducing interest payments and unlocking IMF financing in 2024.
- This deal followed China's separate debt restructuring agreement with Sri Lanka.
- These agreements are on similar terms, extending deadlines and lowering interest rates.

The Hindu

Tigray region

- On 16 January, a day after its strikes in Iraq and Syria, Iran targeted Pakistan's Balochistan province, with missiles, killing two.
- On 17 January, condemning the attacks as "unprovoked" and a breach of sovereignty, Pakistan recalled its Ambassador from Tehran and expelled the Iranian Ambassador. Pakistan also suspended all high profile bilateral visits ongoing and planned.
- On 18 January, Pakistan retaliated by targeting "individuals" and "terrorist groups" in Iran's Sistan Baluchestan province, killing nine.
- Pakistan's Foreign Ministry claimed Iran as a close friend, with great respect and affection for the Iranian people.
- On 19 January, the National Security Council meeting decided to "address each other's security concerns in the larger interest of regional peace and stability" as Iran is a "neighborly and brotherly Muslim country."
- On 22 January, a joint statement issued by the two Foreign Ministries agreed on the return of ambassadors.
- Subsequently, on 26 January, the Ambassadors returned to their offices in Tehran and Islamabad.
- On 28 January, Iran's Foreign Minister arrived in Islamabad to discuss economic and security issues between the two countries.

What challenges lie ahead for Pakistan and Iran?

- Though Tehran was one of the first to recognise Pakistan, since the 1979 Iranian revolution, the two countries had a troubled relationship.

- **Iran's revolution in 1979 and Muhammad ZiaulHaq's regime in Pakistan during the 1980s brought the SunniShia sectarian divide to the fore between the two.**
- **Though both refer to the "brotherly Muslim countries" rhetoric, the sectarian factor was too strong to patch the divide.**
- **Globally, Iran saw Pakistan under the American sphere of influence during the Cold War and post 9/11, especially in Afghanistan. Pakistan and Iran remained in opposite groups; only in recent years has China tried to bring Islamabad and Tehran together.**
- **And regionally, the struggle for supremacy, within the West Asia, pitches Iran and Saudi Arabia on opposite camps, with Pakistan aligned with the latter.**
- **On Afghanistan and the Taliban, both countries have differed on objectives and strategies.**
- **Until recently, Pakistan viewed Tehran as closer to New Delhi than Islamabad.**
- **Pakistan's nuclear bomb is seen as a Sunni one, pushing Tehran to have its own for the Shia world.**

The Hindu