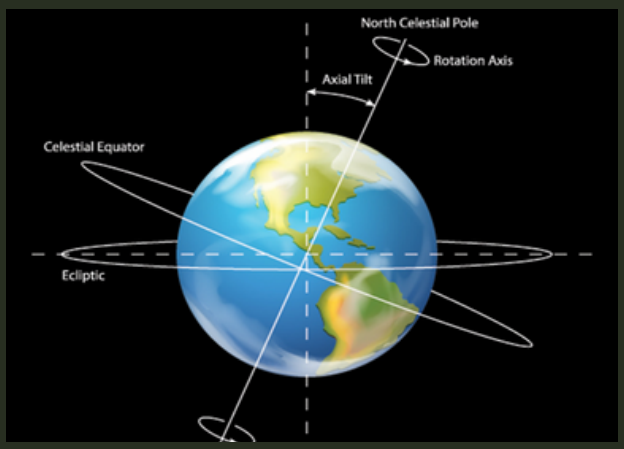
JUNE 2023

GES REPORTER



Best Geography, Science and ENvironment Magazine

June 2023

The Best Magazine for Geography, Environment, Science Technology

GES REPORTER

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China IN ASEAN

Due to its intensifying geopolitical competition with the U.S. and its own security interests in the region, China is expanding its military outreach to Southeast Asian countries.

What is the People's Liberation Army (PLA) currently undertaking?

- The PLA and the Laotian People's Armed Forces (LPAF) have recently concluded their bilateral military exercise, Friendship Shield 2023.
- In 2023, the PLA STC conducted the 'Golden Dragon' drills with Cambodia

- In late April, the PLA STC conducted a joint exercise with the Singaporean Navy.
- Firstly, Xi Jinping has put excessive emphasis on defence diplomacy under his flagship Global Security Initiative (GSI.
- Second, China's threat perception of expanding the United States military engagement with countries in the Asia-Pacific region, especially those countries that China has disputes with in the South and East China Seas region.
- China building a surveillance military base on Great Coco Islands in Myanmar.
- This also impacts India because the Great Coco Islands lie just 55 km north of the Andaman and Nicobar Islands, and their militarization by China poses a strategic threat to India's national security
- The increasing proximity of the U.S. with the Philippines, with whom China shares a disputed maritime border in the Luzon Strait in the South China Sea, is worrisome for China.
- What has perhaps recently irked China the most is the Philippines' decision to provide the U.S. with access to four military bases in addition to the five bases the U.S. already had access to, under the 2014 Enhanced Defence Cooperation Agreement between the two sides
- Despite China's military and economic inroads in the region, it needs to prove to ASEAN countries sitting on the fence that it has the capability to exercise restraint and act in accordance with the provisions of a Code of Conduct in the South China Sea (which is yet to come into force)

Graphene

Graphene is the world's thinnest, strongest, and most conductive material of both electricity and heat.

- It conducts electricity better than copper.
- It is 200 times stronger than steel but six times lighter. It is almost perfectly transparent as it absorbs only 2% of light.
- It is impermeable to gases, even those as light as hydrogen and helium. It has the potential to revolutionize electricity, conductivity, energy generation, batteries, sensors, and more.
- Also, when added to other materials, graphene even in small quantities produces composite materials with dramatically transformed qualities.
- Graphene composites are used in aerospace, automotive, sports equipment, and construction.
- It is used for high- performance batteries and super-capacitors, touchscreens, and conductive inks.
- Graphene- based sensors are used for environmental monitoring, healthcare and wearable devices.
- Graphene oxide membranes are used for water purification and desalination. Graphene- based masks were made during COVID.
- Graphene is important for defense and aerospace as well.
- Its exceptional strength makes it a promising material for armor and ballistic protection.

- Graphene has the potential to absorb and dissipate electromagnetic waves, making it valuable for developing stealth coatings and materials that reduce radar signatures and electromagnetic interference.
- Graphene is highly sensitive to environmental changes, which makes it an excellent candidate for sensing chemical and biological agents, explosives, radiation, and other hazardous substances.
- Besides, graphene -based materials can also protect us against chemical and biological attacks.
- Better energy storage and electronics properties make graphene attractive in defense and aerospace as well as in civil and commercial application
- Materials define an age the Stone Age, Iron Age, plastic Age, and silicon Age.
- There are reasons to believe that we are entering the graphene age
- China and Brazil are global leaders in the commercial production of graphene.
- At the Beijing Graphene Institute, set up in 2018, several companies produce industry-grade graphene products. India produces about one-twentieth compared to China and one-third compared to Brazil.

India's progress

- The Centre for Nano Science and Engineering at IISc Bangalore along with KAS Tech produced a graphene-based system several years ago.
- Some start-ups and foreign subsidiaries have started graphene or graphene derivatives in India
- It figured out how graphene oxide-based wrappers loaded with preservatives

can increase the shelf life of fruits and vegetables.

- The IIT Roorkee Incubated Log 9 has patented a technology for graphene-based ultra-capacitors, and the IIT Kanpur Incubated RF Nanocomposites has developed EMI shielding and stealth technology using graphene-based nanotubes

- Governments have a crucial role to play. China declared graphene a priority in its 13th Plan. Europe set up the Graphene Flagship, with a budget of €1 billion in 2013

- India missed the semiconductor bus in the mid-1990s. The time to step on the graphene pedal is now.

Lithium reserves ownership

What is the status of India's lithium industry?

- India's electric vehicle (EV) market was valued at $383.5 million in 2021, and is expected to expand to $152.21 billion in 2030.

- India imported 450 million units of lithium batteries valued at $929.26 million (₹6,600 crore) in 2019--2020, which makes the development of the country's domestic lithium reserves a matter of high stakes.

- Scholars have argued that the ongoing global transition to low carbon economies, the rapid expansion of artificial intelligence (AI), and 5G networks will greatly reshape global and regional geopolitics

Who should own these minerals?

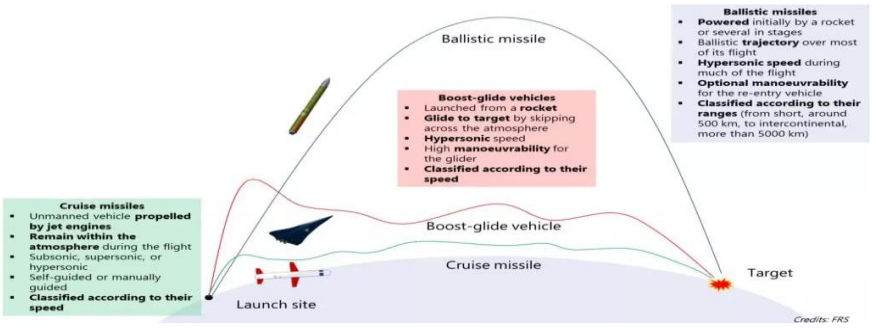
- In July 2013, a three-judge bench of the Supreme Court of India ruled that the

owner of the land has rights to everything beneath, "down to the center of the earth".

- Yet, large areas of land, including forests which make up more than 22% of India's landmass hills, mountains, and revenue wasteland are publicly owned.
- The Supreme Court also recalled that the Union government could always ban private actors from mining sensitive minerals, as is already the case with uranium under the Atomic Energy Act of 1962
- In Chile, the government has designated lithium as a strategic resource and its development has been made the exclusive prerogative of the state.
- Bolivia, gave the state "the control and direction over the exploration, exploitation, industrialization, transport, and commercialization of natural resources."
- Much of India's mineral wealth is mined from regions with very high levels of poverty, environmental degradation, and lax regulation.

Medium range ballistic missile, Agni-1

- Effective and careful management of the sector should be paramount if India's rare minerals development is to meet its multiple goals social wellbeing, environmental safety, and national energy security. Ballistic and cruise missiles
- A successful training launch of a medium range ballistic missile, Agni-1 was carried out by the Strategic Forces Command from APJ Abdul Kalam Island, Odisha



Law commission on sedition

- The Section 124A of the Indian Penal Code (IPC) dealing with sedition needs to be retained but certain amendments could be made for greater clarity regarding its usage, the 22nd Law Commission has said in its report to the government.

- The commission said sedition being a "colonial legacy" is not a valid ground for its repeal but in view of the misuse of Section 124A, the panel has recommended that the Centre issue model guidelines to curb any misuse

- The Law Commission said the existence of laws such as Unlawful Activities (Prevention) Act (UAPA) and the National Security Act (NSA) does not by implication cover all elements of the offence envisaged under Section 124A of the IPC. "

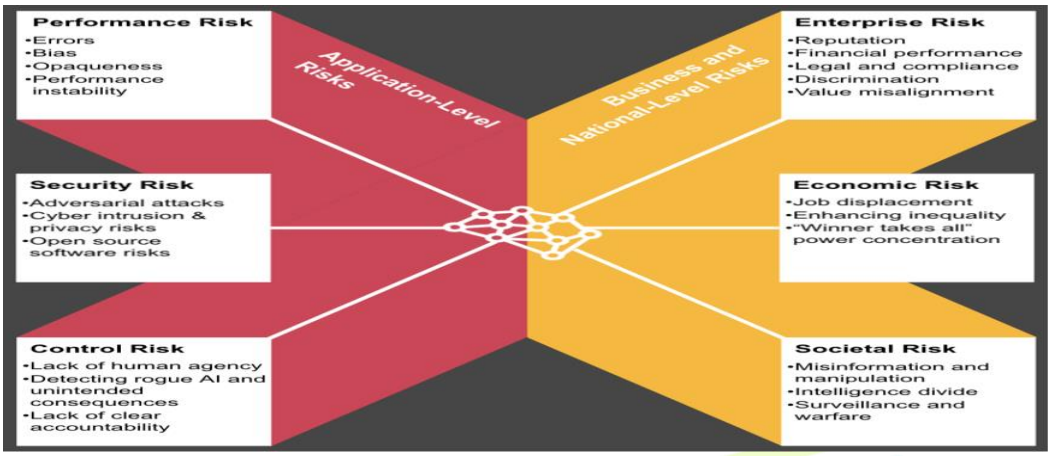
- Further, in the absence of a provision like Section 124A of IPC, any expression that incites violence against the government would invariably be tried under the special laws and counterterror legislation, which contain much more stringent provisions to deal with the accused.

- The mere fact that a particular legal provision is colonial in its origin does not ipso facto validate the case for its repeal.

- "Even though, in our considered opinion, it is imperative to lay down certain procedural guidelines for curbing any misuse of Section 124A of IPC by the law

enforcement authorities, any allegation of misuse of this provision does not by implication warrant a call for its repeal.

Risk of AI



- G generative artificial intelligence (AI) is AI that can create new data.
- AI models backed by neural networks trained on very large datasets and with access to sufficient computing power have been used to do well, such as finding new antibiotics and alloys, for clever entertainment and cultural activities, and for many banal tasks, but it has caught attention most notably with its ability to falsify data.
- The world is past being able to reliably differentiate between data that faithfully reflect reality and data made to look that way by bad -faith actors using AI.
- AI models, their use of copyrighted data, regard for human dignity and privacy, and protections from falsifying information
- At this time, the Indian government should proactively launch and maintain an open-source AI risk profile, set up sandboxed R&D environments to test potentially high-risk AI models, promote the development of explainable AI, define scenarios of intervention, and keep a watchful eye

CBAM

- The European Union's (EU) key climate law, the Carbon Border Adjustment Mechanism (CBAM), has spooked India
- While India's exports may be limited to aluminum, iron, and steel, and affect only 1.8% of its total exports to the EU, India has reportedly decried CBAM as being protectionist and discriminatory.
- There is also talk of challenging the CBAM at the World Trade Organization (WTO)'s dispute settlement body
- In 2005, the EU adopted an important climate change policy known as the Emissions Trading System (ETS).
- Now in its fourth stage, the ETS is a market-based mechanism that aims at reducing greenhouse gas (GHG) emissions by allowing bodies emitting GHG to buy and sell these emissions amongst themselves.
- However, the EU's concern is that while it has a mechanism for its domestic industries, emissions embedded in products imported from other countries may not be priced in a similar way due to a lack of stringent policies or due to less stringent policies in those countries
- Furthermore, the EU also apprehends the phenomenon of 'carbon leakage', that is, due to the application of ETS, European firms operating in carbon intensive sectors might possibly shift to those countries that have less stringent GHG emission norms.
- CBAM is aimed at addressing this quagmire, and, thus, leveling the playing field

for the EU industries.

- Under the CBAM, imports of certain carbon intensive products, namely cement, iron and steel, electricity, fertilizers, aluminum, and hydrogen, will have to bear the same economic costs borne by EU producers under the ETS.
- The price to be paid will be linked to the weekly average of the emissions priced under the ETS
- A cornerstone principle of WTO law is non-discrimination. Thus, countries are required to accord equal treatment to 'like' products irrespective of their country of origin (most-favoured nation treatment) and to treat foreign made 'like' products as they treat domestic ones (national treatment principle).
- While the CBAM's design is origin neutral in appearance, it may, in its application, discriminate between goods from different countries on account of an inadequate carbon pricing policy, or due to onerous reporting requirements that importers would be subject to.
- Even if the EU's CBAM is discriminatory, there could be a claim for justifying it under the General Exceptions clause given in Article XX of the General Agreement on Tariffs and Trade (GATT).
- Under Article XX, measures taken by countries that otherwise violate GATT obligations are permitted if, first, they fall under one of the listed policy grounds, and second, if they satisfy the requirements of the introductory clause of Article XX, known as the chapeau.
- One of the listed policy grounds in Article XX is 'conservation of exhaustible natural resources'. CBAM would fall under this category

H5N1

- A study published recently has found that the H5N1 virus (clade 2.3.4.4b), which spread among wild birds across 30 countries or territories across continents by February 2022 collected different combinations of genes through reassortment with viruses circulating in wild birds in North America.
- The reassortant A (H5N1) viruses are genotypic ally and phenotypically diverse, with many causing severe disease with dramatic neurologic involvement in mammals.
- The viruses have distinct in vitro characteristics including increased virus replication rates and ability to cause severe disease outcomes with dramatic neurologic involvement in mammalian animal models.
- In December 2021, A (H5N1) viruses were detected in poultry and a gull in Eastern Canada.
- Zoonotic transmission potential of these viruses. So far human- to- human transmission has not been reported.

Groundwater depletion

- Rapid depletion of groundwater in north India has become a norm during the last few decades. Between 2002 and 2022, about 95% of India's groundwater depletion occurred in north India.
- Groundwater use and summer monsoon rainfall variability are the two main drivers of groundwater storage. Climate change can throw new challenges for the sustainability of groundwater due to increased groundwater pumping to meet irrigation demands for crops.

- Also, a warming climate will increase the frequency of hydroclimate extremes floods, and droughts.
- A less discussed aspect is the role of increased evapotranspiration due to a warming climate, which will limit water availability for groundwater recovery.
- The projected increase in summer monsoon due to climate change notwithstanding, recovery of the depleted groundwater in north India will be insuffi-cient if there is continued use of groundwater at current levels for irrigation.
- Excessive pumping from non-renewable groundwater storage will aggravate groundwater loss.
- While most of the current observation wells are in the shallow aquifer, pumping of groundwater for irrigation in the Indo Gangetic Plain is predominantly from deeper aquifers.

Butterfly

- The work revealed that butterflies originated in the Americas in the late Cretaceous, about 100 million years after the origin of flowering plants.
- While butterflies dispersed from North America to Europe relatively quickly about 75 million years ago due to the landmass then being nearly contiguous, the dispersal from North America to Asia was through colder northern regions and happened around 60 million years ago
- Despite being its place of origin, North America largely being a temperate region has far less diversity compared with the tropical region in South America and Asia

AI Aisk - CAIS

What is CAIS and how is it funded?

- The CAIS is a not -for- profit based out of San Francisco, California.
- The Organisation is largely funded by Facebook co -founder Dustin Moskovitz's Open Philanthropy, a grant-making foundation.
- The Organisation makes grants based on the principles of effective altruism a philosophy that urges followers to channel their wealth to causes that are often backed by data.

What cause does CAIS support and how?

- The CAIS aims to mitigate existential risks arising from AI systems that could affect society at large.
- The Organisation does research and publishes papers on AI safety, and also provides funding and technical infrastructure to other researchers to run and train their LLMs in the field of AI safety
- Not just in the military, but AI and ML are used in diverse industries.
- Medical science is a major area where AI is used to train large datasets to diagnose health conditions.
- Car manufacturers deploy advanced driver assistance systems (ADAS) to give drivers automated driving experiences.

North Korea -spy satellite

- On May 31, a North Korean military reconnaissance satellite Malligyong-1 was launched through a new type of rocket named Chollima-1.

- The satellite is said to have flown for about 10 minutes before crashing into the Yellow Sea.
- The Korean Central News Agency (KCNA) reported the failure as the instability in the rocket's engine and fuel system.
- The launch, however, prompted evacuation warnings and emergency alerts in parts of South Korea and Japan
- Starting from 1998, North Korea successfully orbited its first satellite in 2012 after three failed attempts.
- The launch vehicle used was Unha-3, a likely variant of Taepodong-2 ICBM.
- The Unha-type launch vehicle was also used in the 2016 launch of Pyongyang's Earth Observation satellite

Why does it want assets in space?

- The North Korean spy satellites are expected to play a crucial role in providing advanced surveillance technology that covers a large portion of the region, to improve the ability to strike targets during conflict security anxiety in East Asia in response to the North Korean satellite launch reveals a sense of urgency among the regional powers.

Evapotranspiration

- Tectonic plates move to relieve and accumulate stress, ocean currents redistribute nutrients, and volcanoes pump minerals up, and trees fix minerals into the soil.
- Evapotranspiration is one kind of movement that is part of a larger planet -wide

rhythm called the water cycle.

- The term is an amalgam of evaporation which is how the soil loses water and transpiration which is how plants do it.
- In particular, transpiration accommodates both the movement of water up through the plant and its loss into the air from parts exposed to the atmosphere.
- Evapotranspiration is an amalgam of these terms conceptually, and it is the first part of the water cycle when water from terrestrial surfaces moves into the atmosphere.
- A number of factors affect the rate of evapotranspiration, including solar radiation, the length of day, the amount of soil moisture, the ambient temperature, the winds, and the amount of water vapor that the air already holds.

Higgs boson

- Last week, physicists working with the Large Hadron Collider (LHC) particle-smasher at CERN, in Europe, reported that they had detected a Higgs boson decaying into a Z boson particle and a photon.
- This is a very rare decay process that tells us important things about the Higgs boson

What is a Higgs boson?

- An electron is a subatomic particle that has mass
- The stronger a particle's interaction with the Higgs boson, the more mass it has. This is why electrons have a certain mass, protons have more of it, and neutrons

have just a little bit more than protons, and so on. A Higgs boson can also interact with another Higgs boson

- The Higgs boson is a type of boson, a force- carrying subatomic particle.
- It carries the force that a particle experiences when it moves through an energy field called the Higgs field, which is believed to be present throughout the universe.
- For example, when an electron interacts with the Higgs field, the effects it experiences are said to be due to its interaction with Higgs bosons.
- Since all the matter in the universe is made of these particles, working out how strongly each type couples to Higgs bosons, together with understanding the properties of Higgs bosons themselves, can tell us a lot about the universe itself
- This significance is even now not high enough for the teams to claim that a Higgs boson decayed to a Z boson and a photon with 100% certainty, reflecting the rarity of the decay pathway.

Now, why do physicists go to such lengths to spot the decay in the first place?

- This is because the Standard Model predicts that the Higgs boson will take this path 0.1% of the time if its mass is 125 billion eV/c2 (a unit of mass used for subatomic particles).
- The Standard Model has made many accurate predictions but it can't explain what dark matter is or, in fact, why the Higgs boson is so heavy

Technology and Sovereignty

- First, as defined by political theorists, a nation- state is a territorially -bounded

sovereign polity.

- However, this fundamental notion of a nation- state of a geographical unit in which citizens live is undergoing a massive change because of technology.
- While geographical boundaries are still essential to be safeguarded against physical aggression/invasion, there are now several externalities occurring across the borders of nation-states, i.e. cyber-attacks, which have a ripple effect on the physical boundaries to challenge their socio-economic and political existence
- The advent of Web3, massive peer- to- peer networks, and blockchains has allowed actors, both state and non-state, to influence areas such as trade, commerce, health, and education even while remaining outside of the financial and judicial scope.
- Second, geography- based rules are no longer easily enforceable simply because of the declining significance of conventional geographical borders in the era of high technology.
- Now, any form of "virtual activity" is not confined to the realms of the borders of a country; data travel on the chain of the world wide web and spread across the world at speed hitherto unimaginable
- Third, the emergence of newer technologies has exposed the incapacity and inability of the government of the nation- state to administer and regulate these technologies.
- On the economic side, "with a valuation of more than $4,100 billion, the five largest American tech companies (Google, Amazon, Facebook, Apple, and Microsoft) have symbolically surpassed Germany's GDP (the world's fourth

largest economy) in terms of valuation"

- This means that data "have become the most important raw material of our times, and only a handful of companies now hold unparalleled economic power and influence over it.
- These are the meta- platforms: their huge size allows them to constantly increase the amount of information they analyze and refine the algorithms they use to influence, if not control, us and our activities".

Energy transition

- India's global climate pledges 50% non-fossil electricity generation capacity by 2030 and net-zero emissions by 2070 are backed by domestic energy targets at the national level.
- States are critical actors in India's energy transition as there is multi-- tier governance of energy production and usage
- Moreover, about 80% of the current renewable energy capacity is confined to six states in the west and south of India.
- In a federal setting, States matter for four functions critical to the energy transition. First, States as spheres of implementation are critical to the realization of national targets
- Second, the legacy issues in the electricity sector, such as high losses, unreliable supply, and service quality, if left addressed, could be exacerbated by the transition.
- These are embedded in the State political economy and must be addressed at the State level.

- Third, States as laboratories of policy innovations have been instrumental to India's energy transition
- Fourth, States could also be roadblocks to national goals, particularly when the goals are perceived to be misaligned with State priorities.
- An effective transition requires multiscale planning and execution strategy, consideration of inter-linkages and implications, and cross-learning.
- Examples of such considerations include whether State targets add up to meet national goals, managing renewable energy- enabled load migration, the changing role of institutions, how these will affect legacy issues, and the resources required to deal with these implications.
- Central mandates to update the State Action Plans on Climate Change, recommendations to set up State level steering committees for energy transitions, and regular meetings of the Central and state energy ministers reinforce the importance of States.
- Central agencies have also developed multiple indexes that rank States on different aspects of energy transition
- There is a need for a State level framework to understand plans, actions, and governance processes toward an energy transition.
- First, it helps to broaden the transition discourse from a narrow set of outcomes and to include the processes that shape the outcomes.
- Second, it leads to greater transparency which could enable the participation of stakeholders in the processes and ensure public legitimacy and buy-in to complex decisions.

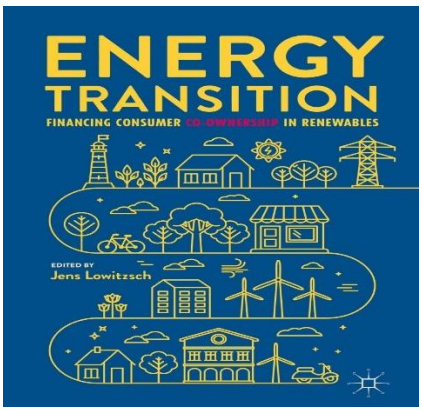
AMR and pandemic treaty

- In late May, the latest version of the draft Pandemic Instrument, also referred to as the "pandemic treaty," was shared with member states at the World Health Assembly
- Since the beginning of negotiations on the Pandemic Instrument, there have been calls from civil society and leading experts, including the Global Leaders Group on Antimicrobial Resistance, to include the so-called
- But not all pandemics in the past have been caused by viruses and not all pandemics in the future will be caused by viruses. Devastating past pandemics of bacterial diseases have included plague and cholera
- Antimicrobial resistance (AMR) is the process by which infections caused by microbes become resistant to the medicines developed to treat them.
- Microbes include bacteria, fungi, viruses and parasites. Bacterial infections alone cause one in eight deaths globally.
- AMR is fueling the rise of drug- resistant infections, including drug -resistant tuberculosis, drug -resistant pneumonia and drug -resistant Staph infections such as methicillin -resistant Staphylococcus aureus (MRSA)
- The Pandemic Instrument is the best option to mitigate AMR and safeguard lifesaving antimicrobials to treat secondary infections in pandemics.
- AMR exceeds the capacity of any single country or sector to solve.
- Global political action is needed to ensure the international community works together to collectively mitigate AMR and support the conservation, development, and equitable distribution of safe and effective antimicrobials.

- Treating these bacterial infections requires effective antibiotics, and with AMR increasing, effective antibiotics are becoming a scarce resource.
- Essentially, safeguarding the remaining effective antibiotics we have is critical to responding to any pandemic
- In 2020, cities dumped a whopping 29 trillion tonnes of carbon dioxide into the atmosphere
- An energy- system transition could reduce urban carbon dioxide emissions by around 74%.
- With rapid advancements in clean energy and related technologies and nosediving prices, we have crossed the economic and technological barriers to implementing low-carbon solutions.
- The transition must be implemented both on the demand and the supply side.
- Mitigation options on the supply side include phasing out fossil fuels and increasing the share of renewables in the energy mix, and using carbon capture and storage (CCS) technologies.
- On the demand side, using the 'avoid, shift, improve' framework would entail reducing the demand for materials and energy, and substituting the demand for fossil fuels with renewables.
- Secondly, in order to address residual emissions in the energy sector, we must implement carbon- dioxide removal (CDR) technologies
- An established city can retrofit and repurpose its infrastructure to increase energy efficiency and promote public as well as active transport like bicycling and walking.

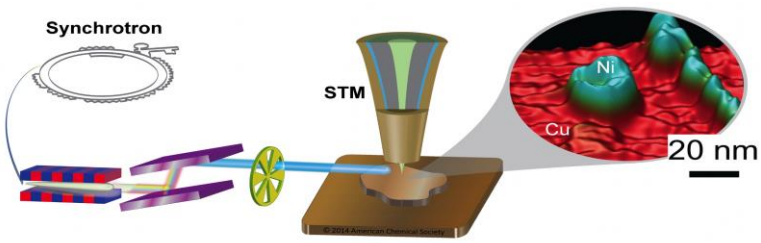
- In fact, walkable cities designed around people can significantly reduce energy demand, as can electrifying public transport and setting up renewable-based district cooling and heating networks.
- A rapidly growing city can try to collocate housing and jobs by planning the city in a way that brings places of work closer to residential complexes, thus reducing transport energy demand.
- Such cities can also leapfrog to low-carbon technologies, including renewables and CCS.
- Energy systems are directly and indirectly linked to livelihoods, local economic development, and the socio-economic well-being of people engaged in diverse sectors.
- The energy supply needs to be balanced against fast-growing energy demand (due to urbanization), the need for energy security, and exports.
- Additional justice concerns include land dispossession related to large-scale renewable energy projects, spatial concentration of poverty, the marginalization of certain communities, gendered impacts, and the reliance on coal for livelihoods.
- For instance, developing economies, including Nigeria, Angola, and Venezuela, owe a significant fraction of their gross domestic products (GDPs) to fossil fuel exports.
- Transitioning away from these industries could devastate their economies, with the consequences landing particularly heavily on the workers employed in the fossil fuel sector.

- Similarly, in developed countries, many communities suffer energy poverty and inequity due to high energy costs, low incomes, and inadequate infrastructure.



Synchrotron X-ray scanning tunneling microscopy or SX-STM

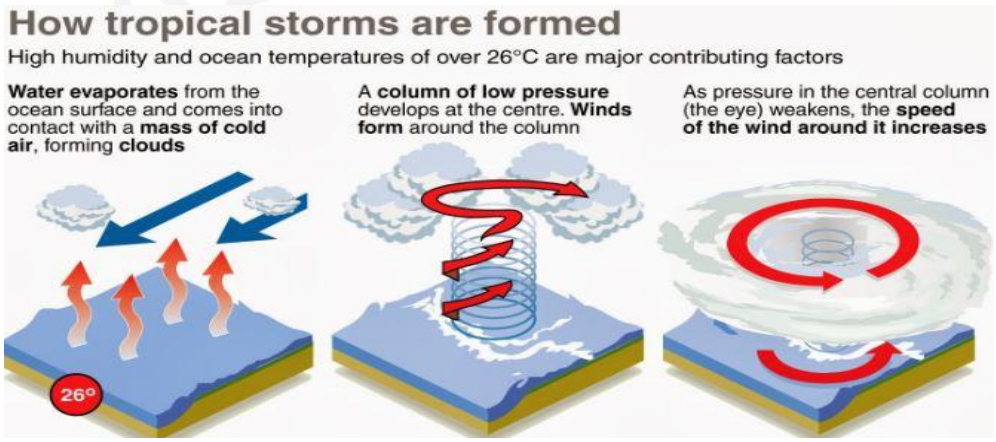
- X-rays are an important way to identify the type of material.
- Scientists have improved this technology through the years so that the quantity of a sample required for identification has become very small
- A method called synchrotron X-ray scanning tunneling microscopy or SX-STM.
- The atom was hit with X-ray photons. As expected, the electrons in the atom absorbed only photons of certain frequencies.
- Photons of the other frequencies passed through.
- Using a spectroscope, the team determined which frequencies had been absorbed.
- This absorption spectrum is unique to each element and can be used to identify it.



Synchrotron X-ray Scanning Tunneling Microscopy: Science-driven development of a next-generation instrumentation concept

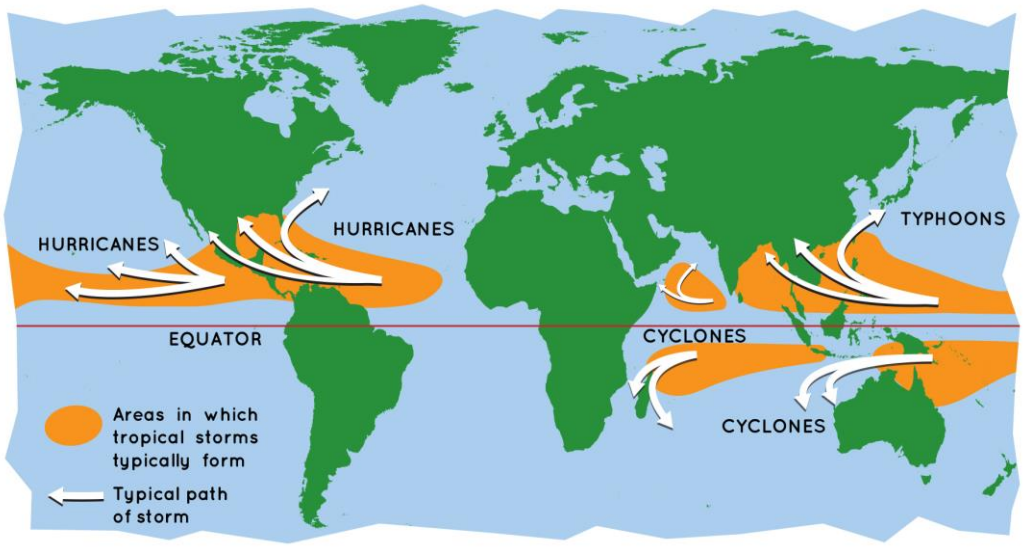
- When electrons absorb the X-ray photons, they become excited and tunnel their way to the metal tip of the detector.
- There, a small voltage allows the electron to create an electric current, which is recorded and measured.
- Being able to identify a material using only one atom could, according to the group, revolutionize research in material science, quantum mechanics, and other areas.

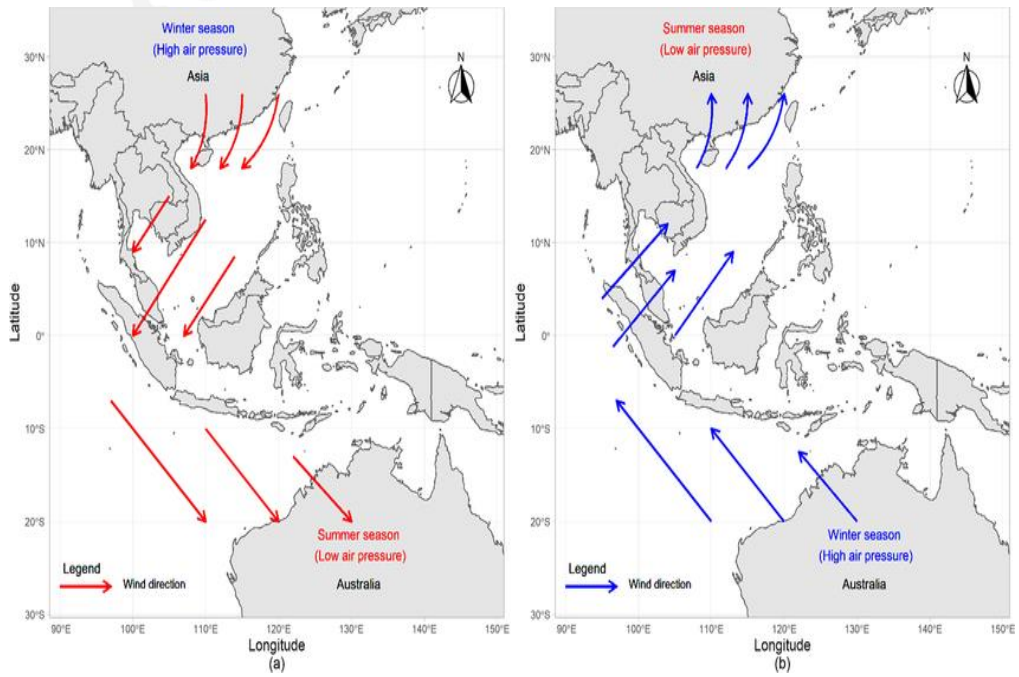
Cyclone affects monsoon



Cyclone Category	Wind Speed in Km/h	Damage Capacity
01	120-150	Minimal
02	150-180	Moderate
03	180-210	Extensive
04	210-250	Extreme
05	250 +	Catastrophic

Type of Disturbances	Wind Speed in Km/h
Low Pressure	Less than 31
Depression	31-49
Deep Depression	49-61
Cyclonic Storm	61-88
Severe Cyclonic Storm	88-117
Very Severe Cyclone	118-221
Super Cyclone	More than 221





- The monsoon is of course also affected by the three tropical oceans Indian, Atlantic, and Pacific; the 'atmospheric bridge' from the Arctic; and the oceanic tunnel as well as the atmospheric bridge from the Southern Ocean (a.k.a. the Antarctic Ocean).

- A 'bridge' refers to two faraway regions interacting in the atmosphere while a 'tunnel' refers to two remote oceanic regions connecting within the ocean.

Why does a cyclone's position matter?

- Some cyclones in the North Indian Ocean have had both positive and negative impacts on the onset of the monsoon. Since the circulation of winds around the cyclones is in the anticlockwise direction, the location of the cyclone is critical as far as the cyclone's impact on the transition of the monsoon trough is concerned.

- (The monsoon trough is a low-pressure region that is a characteristic feature of the monsoons.)

- For example, if a cyclone lies further north in the Bay of Bengal, the back-winds blowing from the southwest to the northeast can pull the monsoon trough forward, and assist in the monsoon's onset

- One severe consequence of the anomalous anticyclones since March is that both the Arabian Sea and the Bay of Bengal have warmed by more than 1o C in the pre -monsoon season.

- The late- season cyclone Biparjoy is still chugging along in the warm Arabian Sea and may well rapidly intensify i.e., have its wind speeds increase by 55 kmph within 24 hours before making landfall

- Mawar, Biparjoy, and Gaucho Cyclone Biparjoy are not interacting much with the monsoon trough at this time.
- However, its late birth, as well as the late onset of the monsoon, are both closely related to typhoons in the northwestern Pacific Ocean.
- On May 19, Typhoon Mawar was born and dissipated by June 3. Mawar qualified as a 'super typhoon' and is thus far the strongest typhoon to have taken shape in May.
- It is also the strongest cyclone of 2023 so far.
- Tropical storm Guchol is now active just to the east of the Philippines and is likely to continue northwest before veering off to the northeast.
- These powerful typhoons are thirsty beasts and demand moisture from far and wide.
- Mawar pulled winds across the equator into the North Indian Ocean, setting up southwesterly winds over parts of the Arabian Sea and the Bay of Bengal. 'Southwesterly' means blowing from the southwest.
- Winds were southwesterly over the entire Bay when Mawar was active.
- This continues to be the case now due to Guchol, which has become a 'severe tropical storm' now.
- Winds have been blowing strongly northeastward over the Bay, a key reason why the monsoon trough has been struggling to reach Kerala
- The strong southwesterly winds over the Bay of Bengal can be imagined to be a very large highway with heavy traffic heading from the southwest, over

southern peninsular India and Sri Lanka, towards the South China Sea and the northwestern Pacific Ocean, feeding the monstrous typhoons there.

- The monsoon trough in the meantime is like a little car trying to cross this busy and wide highway from the Andaman Nicobar Islands to India across the Bay of Bengal.
- This complicated dance of global warming affecting cyclogenesis over the Pacific and North Indian Oceans, the warming over the North Indian Ocean, and the late pre-monsoon cyclones and typhoons together is just another monkey wrench in the monsoons' dynamics and in the predictions of the monsoon's onset and its evolution through the season
- A late monsoon onset does not necessarily indicate a monsoon deficit.
- Then again, this year is unique, with an impending El Niño. So the nation waits and watches for the arrival of the monsoon as always hoping for the best and preparing for the worst

Genetic research

- The common ancestor that founded the evolutionary lines of flies and humans, half a billion years ago, appears to have been equipped with biology so well-designed that many of its aspects are still maintained, such as mechanisms of growth or neuronal function.
- Because we are so alike genetically, many aspects of human biology and disease have been explored first in Drosophila. Meanwhile, research on fruit flies is fast, cost-effective, and extremely versatile.
- It's ideal for scientific discoveries.

- Scientists can study mutant defects, even if the eggs never hatch, which can then inform us about the normal function of the affected gene.
- These kinds of genetic studies of Drosophila, combined with emerging technologies, such as gene cloning, helped us understand how gene networks can determine the development of a body and how they can sometimes cause inherited disorders.
- Gene networks are a set of genes, or parts of genes, that interact with each other to control a specific cell function. In 1995, three scientists won the Nobel Prize for their contribution to this new understanding.

Flies are not mini-humans

- They cannot be used to study personality loss seen in Alzheimer's disease, for example.
- But they can be used to study why neurons die in such diseases and bridge important gaps in our understanding of this type of disease.

Taurine

- Taurine deficiency may be a driver for aging, according to a new study, which evaluated the amino acid's effect on health and longevity across several animal models.
- Reversing age- associated taurine loss via supplementation improved the healthy lifespan in worms, rodents, and non-human primates findings (Science) that warrant further human trials to examine taurine's effect on healthy lifespan in humans and the potential risks involved.
- Taurine is one of the most abundant amino acids in animals.

- Covid 19 and Animal movement
- Reduced traffic and human mobility during the COVID-19 lockdown rapidly altered some mammals' movement behaviors (Science).
- The findings illustrate how human activities constrain animal movement and how they react when those activities cease.

Climate change and forest

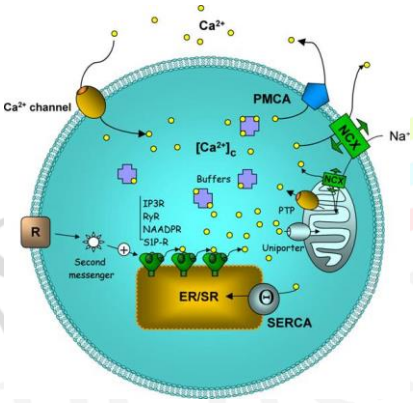
- Field observations and hydroclimatic modeling show that the distribution of African forest and savanna ecosystems are highly predictable by climate (Science).
- The effects of climate change on the distribution of African forests and savanna may be more easily forecasted than previously recognized.
- Spatial variation in climate is the dominant influence on ecosystems, challenging the view that climate alone cannot predict alternative ecosystem states across the Earth.

Cytosolic calcium

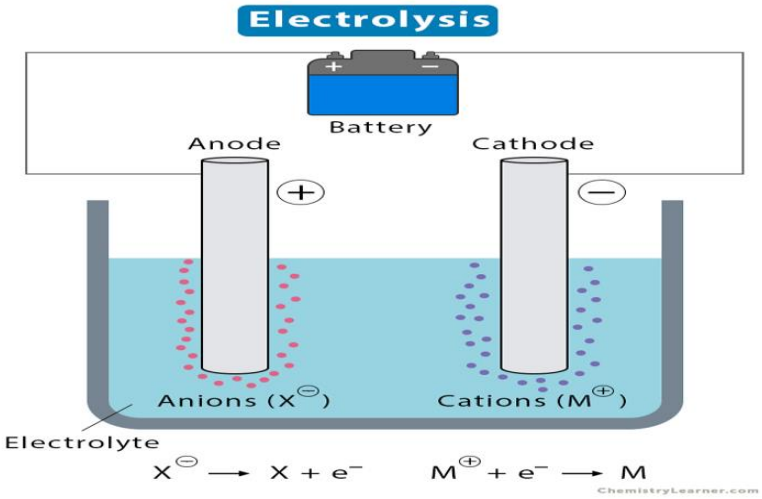
- Even without nerves, plants can sense when something touches them and when it lets go, a study has found.
- In a set of experiments, individual plant cells responded to the touch of a very fine glass rod by sending slow waves of calcium signals to other plant cells, and when that pressure was released, they sent much more rapid waves (Nature Plants).
- This study shows that plant cells send different signals when touch is initiated

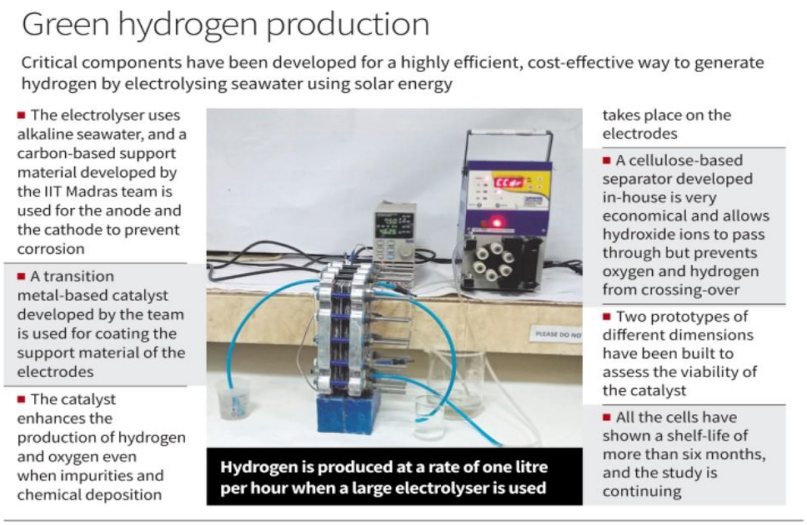
and ended.

- Within 30 seconds of the applied touch to a cell, the researchers saw slow waves of calcium ions, called cytosolic calcium, traveling from that cell through the adjacent plant cells, according to a release
- Removal of the touch showed an almost instant set of more rapid waves that dissipated within a minute.
- These waves are likely due to the change in pressure inside the cell.



Hydrogen from seawater





- Researchers from the Department of Physics at IIT Madras have developed critical components for a highly efficient, cost -effective way to electrolyze seawater to generate hydrogen
- State-of-the-art alkaline water electrolyzer technology is energy -intensive, requires an expensive oxide polymer separator, and uses fresh water for electrolysis
- Alkaline water electrolyzer consists of two half-reactions occurring at the anode and cathode. At the cathode, water dissociates into H+ and hydroxide ions, and the H+ ions get converted into hydrogen.
- The hydroxide ions produced at the cathode permeate through the separator and oxygen is generated at the anode.
- When seawater is used for electrolysis, hypochlorite formation occurs at the anode.
- Hypochlorite is responsible for corrosion of the electrode support material and competes with the oxygen evolution reaction thus reducing the amount of oxygen produced.

- At the cathode, the hydrogen evolution reaction is slowed down when several impurities get adsorbed on the electrode surface.

Himalayas and livelihood

- Village of Karzok in Ladakh, with a population of 1,300, is the highest settlement in our country at 4,570 meters above sea level.
- Lack of opportunities is the main reason why very few people settle down in places such as the Himalayas.
- Agriculture requires land to be first shaped into terraces along steep mountain slopes.
- Water for irrigation is a major challenge. Also, as you go higher, there are fewer organisms such as fungi and nematodes to enrich the health of the soil.
- Grazing of livestock like yaks in the Himalayas, and the llamas, alpacas, and vicunas in the Andes is feasible only for the warmer months of the year.
- Mining is done where resources are found.
- The world's highest settlement, La Revonda in Peru (5,100 msl), has attracted thousands of settlers after gold was discovered there.
- These days, adventure tourism provides sustenance to the village of Louche (4,950 msl) in Nepal and supports climbers trying to scale Mount Everest.
- High- altitude adapted Tibetans and Andeans have the same normal basal metabolic rate at high altitudes as other people on their home grounds.
- The forced vital capacity (FVC) is the maximum amount of air that you can exhale after filling your lungs

- The Quechua, who are an aboriginal people of South America (the Incas belonged to this group) have deep chests, and the FVC is higher in individuals born and brought up at high altitudes compared to their kith and kin who have grown up nearer to sea level.

Betelgeuse

- The bright red star Betelgeuse, called 'Thiruvathirai' or 'Ardra' in Indian astronomy, is easily spotted in the constellation Orion.
- By examining its pulsation the periodic contraction and expansion of the star researchers from Japan and Switzerland recently reported that the star is in its late carbon-burning stage.
- In massive stars like Betelgeuse, the carbon-burning stage lasts only up to a few hundred years, after which the star 'dies' and collapses into a supernova within a few months.
- Most stars, including the Sun, fuse the simplest element in the universe, hydrogen, to produce helium and some energy as a byproduct.
- This energy's outward push balances gravity's inward pull, and keeps the star from collapsing.
- Massive stars like Betelgeuse run out of hydrogen fuel in only a few crore years, after which they switch to using helium to make carbon.
- The energy released in the fusion of helium is less than that of hydrogen, so the star burns more helium to stay stable and not collapse.
- The helium runs out in about ten lakh years.

- At this time, red giants like Betelgeuse burn carbon, then silicon, and briskly consume one by one the elements of the periodic table, until finally their core brims with iron whose fusion requires more energy than it releases and some cobalt and nickel.
- Once the core is rich in iron, the temperature and pressure within the star drop.
- With nothing to stop it, gravity compresses the core and turns it into a neutron star or a black hole.
- Astronomers detect the expansion and contraction of a distant star by dispersing its starlight into its various colors and examining the resulting spectrum.
- This pulsation also corresponds roughly to periodic variations in the observed brightness of the star.
- For Betelgeuse, astronomers have observed four approximate semi-regular pulsations with periods of 2,190, 417, 230, and 185 days
- Homo naledi, of South Africa's Rising Star cave system and discovered the first evidence of an extraordinary assemblage of hominin fossils.
- The remains of more than 15 individuals belonging to a previously unknown species of extinct human, dubbed Homo naledi, have been found in the cave.
- These short- statured, small- brained ancient cousins are thought to have lived in Southern Africa between 335,000 and 241,000 years ago.
- Rising Star Cave is an exceptional resource for exploring the origins of our species
- Three new studies made available today (as pre-prints awaiting peer review)

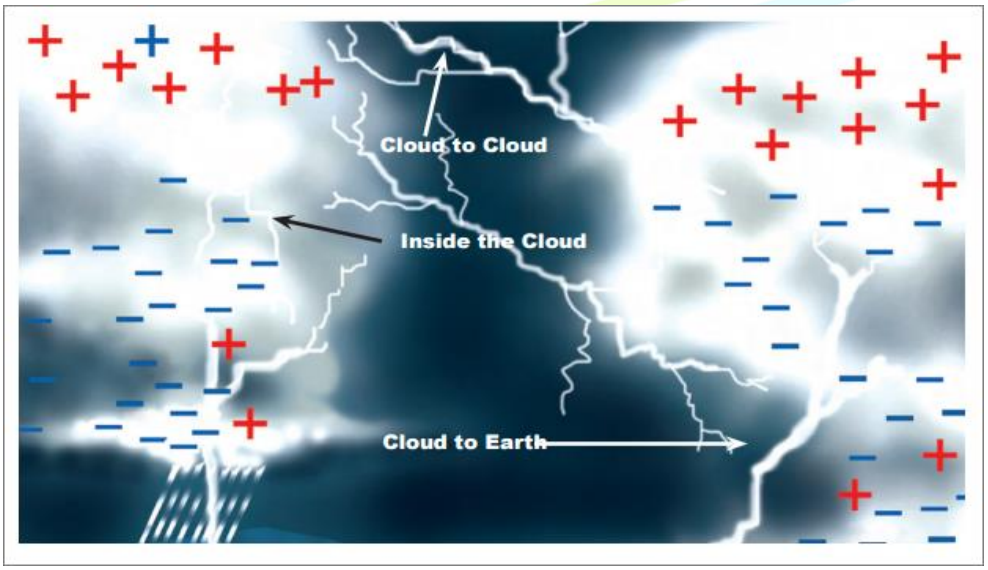
claim to have found evidence Homo naledi intentionally buried their dead (a sophisticated practice we usually associate with Homo sapiens) and made rock art, which suggests advanced cognitive abilities.

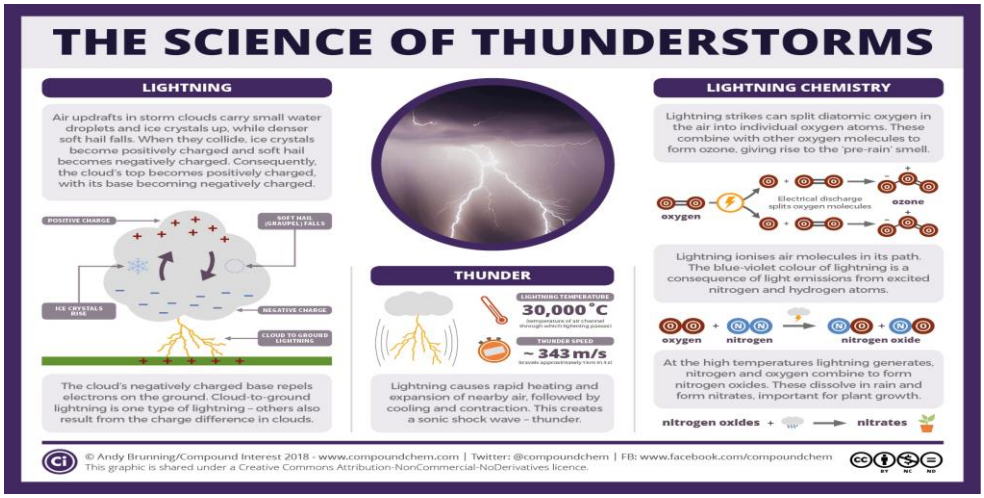
Lightning and forest fire

- Most of these blazes were caused by lightning, Reuters added.
- Human activities are also to be blamed for adding to the forest fires, reports have said.
- According to a study published in Nature on February 10, 2023, lightning is the main precursor of natural wildfires
- Laboratory experiments and field observations have together revealed that lightning electric currents that flow for more than some tens of milliseconds, the so- called long- continuing currents (LCC), are likely to produce fires.
- The study indicated an increase in the total global lightning activity and global LCCs by the 2090s.
- Study also found that LCC lightning activity increased by around 47% over land, implying a higher risk of lightning -ignited wildfires in the future.
- The trends face the other way in some other regions, including the western parts of North America, northern and southern South America, parts of Central Asia, and the Scandinavian Peninsula.
- Simulations have found that in these parts of the world, the total lightning activity could decrease but the amount of LCC lightning activity could increase, leading to an increase in wildfires

How does lightning work?

- During a storm, water droplets in warmer air and ice crystals that condensed in cooler air coalesce together to form thunderstorm clouds (usually cumulonimbus clouds).
- Contact between these droplets and crystals produces a static electrical charge in the clouds.
- The negative and positive charges in the clouds build up.
- Over time, the voltage difference becomes high enough to surmount the resistance presented by the air, leading to a rapid discharge of electric charge





- Of late, lightning strikes have been the deadliest natural disaster in India.
- There were 18.5 million lightning strikes in the country between April 2020 and March 2021 – 34% higher than the previous year-according to the Climate Resilient Observing Systems Promotion Council

EU ON AI

- EU lawmakers voted to adopt a key text forming the basis of a future law regulating artificial intelligence systems like ChatGPT while aiming to foster innovation in the technology.
- The law would regulate AI according to the level of risk: the higher the risk to individuals' rights or health, for example, the greater the systems' obligations.
- The EU's proposed high-risk list includes AI in critical infrastructure, education, human resources, public order, and migration management.
- EU Parliament has added extra conditions to that, before the high-risk classification would be met, including the potential to harm people's health, safety, rights, or the environment.
- There are also special requirements for generative AI systems such as ChatGPT and DALL-E capable of producing text, images, code, audio, and other media that include informing users that a machine, not a human, produced the content.
- Lawmakers also proposed bans on AI systems that use biometric surveillance, emotion recognition, and so-called predictive policing.

Status of transgenic crops

- The three States, Gujarat, Maharashtra, and Telangana, have deferred a proposal, approved by the Centre's Genetic Engineering Appraisal Committee (GEAC), to test a new kind of transgenic cotton seed that contains a gene, Cry2Ai, that purportedly makes cotton resistant to pink bollworm, a major pest

What is the status of transgenic crops in India?

- There is an array of crops brinjal, tomato, maize, and chickpea in various stages of trials that employ transgenic technology.

- However, cotton remains the only transgenic crop that is being commercially cultivated in India.

- After a long hiatus, the GEAC, the apex technical body charged with evaluating proposals for testing genetically modified (GM) seeds, approved the environmental release of Mustard hybrid DMH-11

- The GEAC, which is under the Union Environment Ministry, isn't the final arbiter in the case of GM crops. There is a long-standing litigation in the Supreme Court on the permissibility of allowing transgenic food crops in farmer fields

What is the process of regulating transgenic crops in India?

- There are multiple safety assessments done by committees before they are cleared for further tests in open plots of land, which are located at either agricultural universities or are plots controlled by the Indian Council for Agricultural Research (ICAR).

- A transgenic plant can apply for commercial clearance, only after it has proven to be demonstrably better than comparable non-GM variants on claimed

parameters (for instance, drought tolerance or insect resistance) without posing ecological harm to other species that may be being cultivated in the vicinity

Are there changes in the offing process of regulation of GM crops?

- The GEAC consists of a panel of plant biotechnologists and is headed by a senior official of the Environment Ministry and co--chaired by the scientist of the DBT.
- To resolve the issue of States not according to approvals on testing, because of differing attitudes to GM crops, the GEAC is considering a proposal by the DBT to declare some regions across India as 'notified testing sites'.
- There are 42 such proposed sites and, if it goes through, companies wanting to conduct trials of GM crops at these locations won't need the permission of States for trials.

AI friend or foe

- The performance and utility of AI systems improve as the task is narrowed, making them valuable assistants to humans.
- Speech recognition, translation, and even identifying common objects such as photographs, are just a few tasks that AI systems tackle today, even exceeding human performance in some instance
- Artificial General Intelligence (AGI) refers to intelligence that is not limited or narrow.
- Think of it as human "common sense" but absent in AI systems. Common sense will make a human save his life in a life- threatening situation while a robot may remain unmoved.

- There are no credible efforts toward building AGI yet.
- ChatGPT is a generative AI tool that uses a Large Language Model (LLM) to generate text.
- LLMs are large artificial neural networks that ingest large amounts of digital text to build a statistical “model”. Several LLMs have been built by Google, Meta, Amazon, and others
- LLMs merely predict the most probable or relevant word to follow a given sequence of words, based on the learned statistical model
- Even narrow AI tools can cause serious harm when matched with malicious intent.
- LLMs can generate believable untruths as fake news and create deep mental anguish leading to self-harm.
- Public opinion can be manipulated to affect democratic elections.
- AI tools work globally, taking little cognizance of boundaries and barriers.
- Individual malice can instantly impact the globe. Governments may approve or support such actions against “enemies”.
- We have no effective defense against malicious human behavior.
- Well-meaning people have expressed concern about AI-powered “smart” weapons in the military
- Privacy is a critical concern as algorithmic systems watch the world constantly. Every person can be tracked always, violating the fundamental right to privacy.

- Everything that affects humans significantly needs public oversight or regulation.
- AI systems can have a serious, long-lasting negative impact on individuals.
- We need a systematic evaluation of their efficacy and shortcomings in Indian situations.
- We need to establish mechanisms of checks and balances before large- scale deployment of AI systems.
- AI holds tremendous potential in different sectors such as public health, agriculture, transportation, and governance.
- As we exploit India's advantages in them, we need more discussions to make AI systems responsible, fair, and just for our society.

Cyclone in Arabian

- The India Meteorological Department (IMD) has over the years been largely accurate in forecasting the direction and intensity of cyclones in the country, data suggest that it takes more time for the agency to accurately forecast the trajectory of storms that originate in the Arabian Sea, than those in the Bay of Bengal.
- Historically, most cyclones around India tend to originate in the Bay of Bengal but global warming, as scientists have been pointing out for a while now, is causing the Arabian Sea to be heating up more than average and whetting greater and increasingly stronger cyclones like Biparjoy, which barreled into Gujarat.
- Cyclones in the Bay of Bengal, being far more frequent, were better understood.

- The Arabian Sea cyclones, historically have been fewer because of relatively colder sea surface temperatures
- "It is the winds in the upper reaches of the atmosphere, called steering winds, that influence the direction and recurving, whereas the heat within the ocean layers determine the strength and duration of cyclones
- The Arabian Sea has a much deeper up to 40 meters layer of warm water compared to the Bay of Bengal.
- Many times, these sub-surface values aren't captured in the prediction models and that's why the strength and speed of cyclones aren't accurately captured in advance.

Y chromosome

- The Y chromosome, often referred to as the "master of maleness.
- We have a pair of sex chromosomes called X and Y. Sex as a specification is determined by these sex chromosomes.
- They carry sex-determining genes. All biological males have X and Y chromosomes and all biological females have two X chromosomes
- Scientists published the complete genetic sequence of the Y chromosome in 2003.
- This sequence provided an outline of 23 million bases of the 60 million or so bases that together make up the Y chromosome
- Y chromosome possesses genes that are vital to biological functions, including those linked to aging and lifespan regulation (recent studies have shed light on

an intriguing connection between the human Y chromosome and longevity).

- In the animal kingdom (including mammals), scientists have noticed substantial differences in lifespan between the sexes: the females tend to live longer than the males.
- This phenomenon has been attributed largely to the absence of a second Y chromosome in males, exposing the deleterious mutations in the X chromosome.
- It is also well known that men lose the Y chromosome (LoY) with age and that this is associated with a higher frequency of cancers, Alzheimer's disease, and a shorter lifespan
- A recent study in fruit flies from France's National Centre for Scientific Research, published in the journal Nature Ecology and Evolution on June 12 attributed longevity to the phenotypic sex of the animal rather than the presence of a Y chromosome. Phenotypic sex refers to an individual's sex as deduced from their genitalia.

Reef shark extinction

- Five of the most common shark species living in coral reefs have declined 60-73%, according to a global study. Some individual shark species were not found at 34-47% of the reefs.
- The likely cause could be overfishing, which removed both the sharks themselves and the prey they depend on.
- As shark numbers decline, ray species are increasing on the reefs. Shark-
- Dominated reefs persist in protected marine sanctuaries, while rays dominate

the reef communities in areas of poverty and limited governance.

Phonons as qubits

RP PHOTONICS ENCYCLOPEDIA

https://www.rp-photonics.com/phonons.html

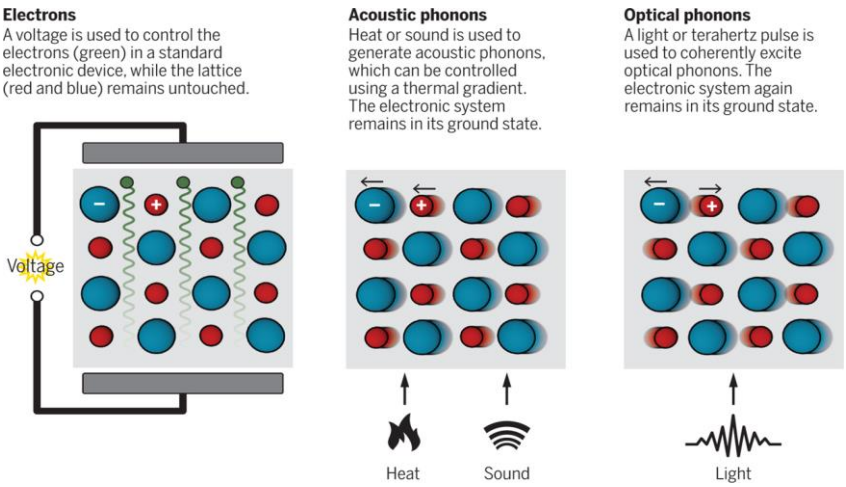
Phonons

by Dr. Rüdiger Paschotta

Phonons are quantized microscopic vibrations in solid media. They can interact with photons in some ways.

Comparison of Phonons & Photons

PHONONS	PHOTONS
• Quantized normal modes of lattice vibrations. The energies & momenta of phonons are quantized	• Quantized normal modes of electromagnetic waves. The energies & momenta of photons are quantized
$E_{phonon} = \frac{h\nu_s}{\lambda}$	$E_{photon} = \frac{hc}{\lambda}$
$p_{phonon} = \frac{h}{\lambda}$	$p_{photon} = \frac{h}{\lambda}$
Phonon wavelength: $\lambda_{phonon} \approx a_0 \approx 10^{-10}$ m	Photon wavelength (visible): $\lambda_{photon} \approx 10^{-6}$ m



What are qubits?

- Quantum computers use qubits as their basic units of information.
- A qubit can be a particle like an electron; a collection of particles; or a quantum system engineered to behave like a particle.
- Particles can do funky things that large objects, like the semiconductors of classical computers, can't because they are guided by the rules of quantum physics.
- For example, these rules allow each qubit to have the values 'on' and 'off' at the same time
- As a result, quantum computers are expected to perform complicated calculations that are out of reach of the best supercomputers of today.
- Other forms of quantum computing use other units of information.
- For example, linear optical quantum computing (LOQC) uses photons, the particles of light, as qubits
- LOQC offers to use optical equipment like mirrors, lenses, splitters, and wave plates with photons to process information.

Understanding phonons

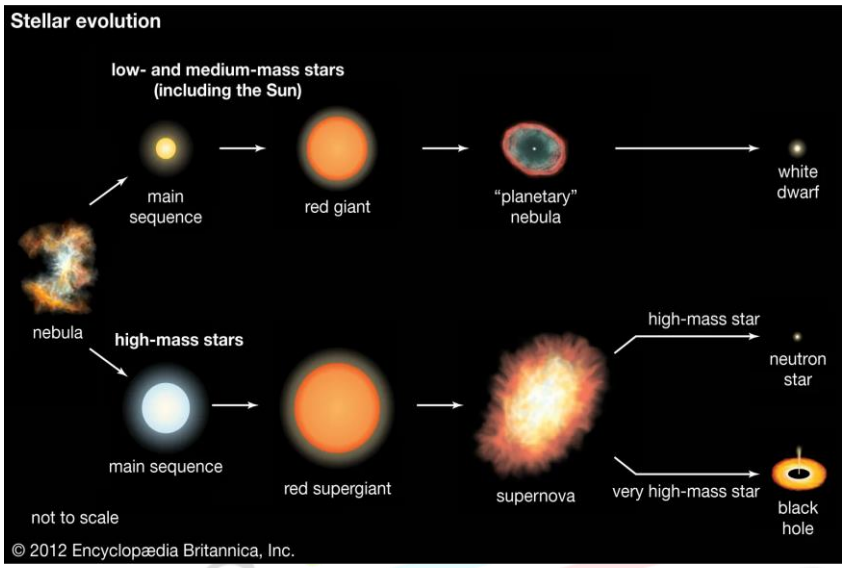
- Physicists thus wondered whether they can use phonons as qubits.
- Photons are packets of light energy; similarly, phonons are packets of vibrational energy
- While researchers can manipulate electrons using electric currents, magnetic fields, etc., and photons with mirrors, lenses, etc, they needed new tools to

manipulate phonons.

- To this end, in the new study, researchers from the University of Chicago have reported developing an acoustic beam splitter.
- Beam splitters are used widely in optics research. Imagine a torchlight shining light along a straight line.
- This is basically a stream of photons.
- When a beam splitter is placed in the light's path, it will split the beam into two, that is, it will reflect 50% of the photons to one side and let the other 50% pass straight through.
- While it seems simple, the working of a beam splitter actually draws on quantum physics.
- If you shine a million photons at it, it will create two beams, each of 5,00, 000 photons.
- We can then reflect these two beams to intersect each other, creating an interference pattern
- In the new study, the researchers developed an acoustic beam splitter a tiny device resembling a comb, with 16 metal bars jutting out of it.
- It was placed in the middle of a two- mm -long channel of lithium neonate.
- Each end of the channel had a superconducting qubit a qubit whose circuit components were superconducting that could both emit and detect individual phonons.
- The whole setup was maintained at an ultra-low temperature.

- If these phonons were converted to sound, their frequency would be too high for humans to hear.

Betelgeuse as a variable star

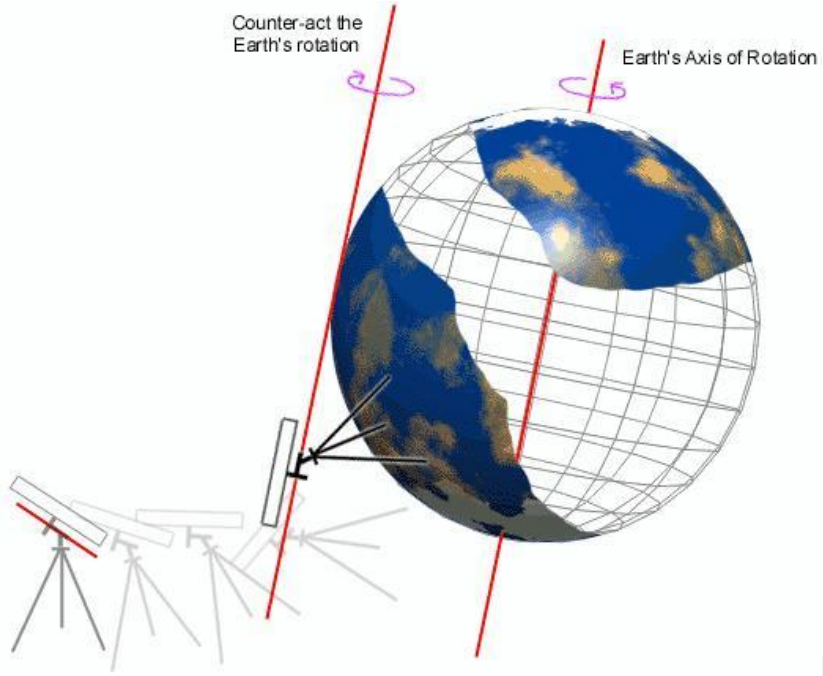


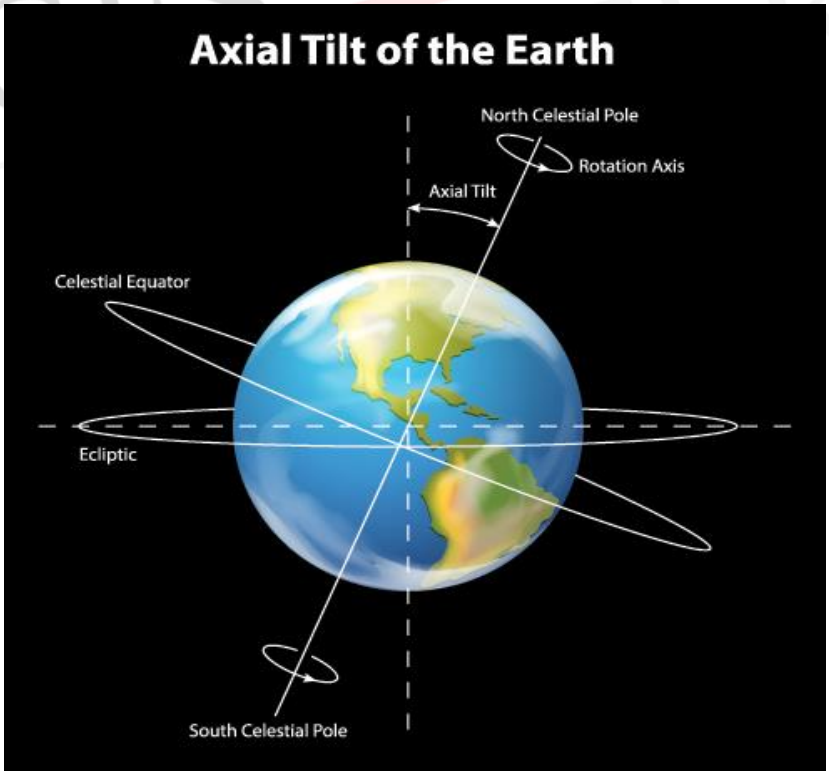
- The bright, red star Betelgeuse in the constellation Orion has shown some unexpected behaviour. In late 2019 and 2020 it became fainter than we had ever seen it at least in records going back more than a century.
- Briefly it became fainter (just about) than Bellatrix, the third brightest star of Orion.
- This event became known as the “great dimming”. But Betelgeuse has since become bright again. For a few days this year, it was the brightest star in Orion
- Stars are, by and large, remarkably stable.
- They shine with the same brightness year after year.
- But there are exceptions and some stars dubbed variable stars change in brightness.

- Most famous is Mira, the “star of wonder”, which was discovered as a variable star by the German pastor David Fabrice in 1596 -it is a pulsating star that regularly expands and contracts.
- Algol is another well-known example
- Betelgeuse, the seventh brightest star in the sky (discounting the Sun), is the brightest of the variable stars.
- Sometimes Betelgeuse becomes nearly as bright as Rigel (the blue fourth brightest star in the constellation), while at other times it is notably fainter.
- The variation is caused by pulsations, similar to those of Mira although not as large or as a regulator
- We still don’t know what caused the sudden brightening it is now 50% brighter than usual.
- But an impending supernova doesn’t seem that likely. In these kinds of stars, a supernova explosion is triggered in the core
- The extreme brightening may in fact be due to the same dust cloud that caused the dimming, now reflecting light from the star towards us and making it appear brighter. But we can’t be sure, and astronomers are excited.
- Betelgeuse is about 15- to 20-times more massive than the Sun, and stars of this mass are expected to end their lives in a powerful explosion known as a supernova.
- Betelgeuse’s red color shows it is a red supergiant, meaning it’s already approaching the end of its life. But that end may still be a million years away.

- Stars like Betelgeuse can live in excess of 10 million years

Groundwater and earth axis





- Groundwater pumped up from the earth and moved elsewhere to quench the thirst of humans and their activities have caused the earth's axis to tilt nearly 80

cm to the east, a new study has found.

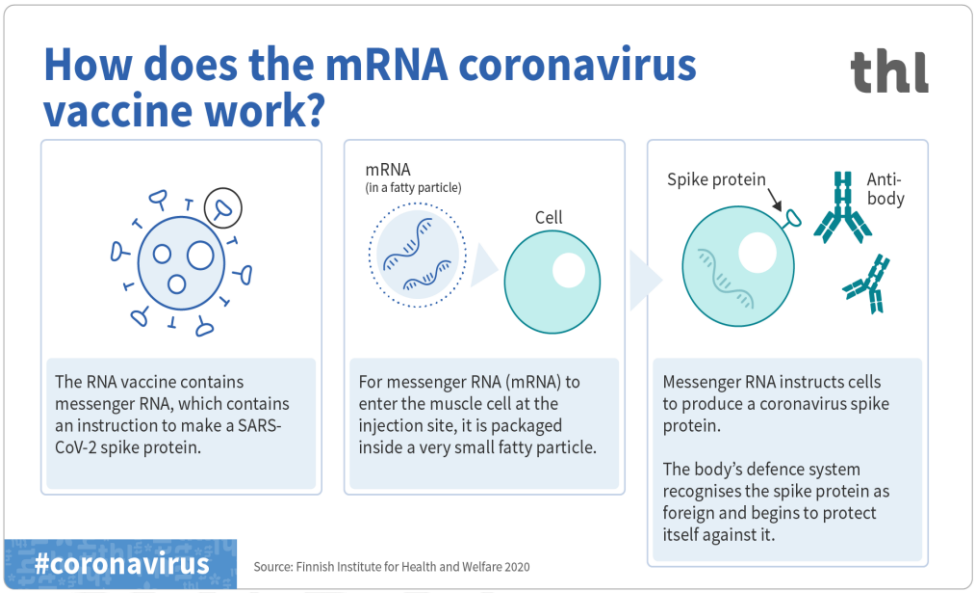
- Unlike a globe, which has a fixed axis and rotates stably the earth's axis wobbles.
- Scientists have also known for a long time that the movement of water can affect the earth's rotation.
- The study found that nearly 2,150 billion tonnes of groundwater have been pumped and drained into the oceans between 1993 and 2010, raising sea levels by 6.24 mm.
- The scientists also said that the location of groundwater depletion is important because that affects how much the axis wanders.
- With their model, they found that pumping groundwater from mid-latitude areas affected the drift the most

MRNA vaccines

- The company said GEMCOVAC-OM was stable in a 2-8 degrees Celsius range and hence could be stored in ordinary refrigerators.
- It could be administered into the skin via a "needle-free" Pharma Jet system.
- GEMCOVA COM, India's first indigenous mRNA vaccine for the Omicron variant of the novel coronavirus, was approved under emergency use guidelines by the Drug Controller General of India (DCGI).

What is jet injection??

- Pharma Jett's needle-free injection devices have the potential to rapidly improve the delivery of vaccines in emerging markets

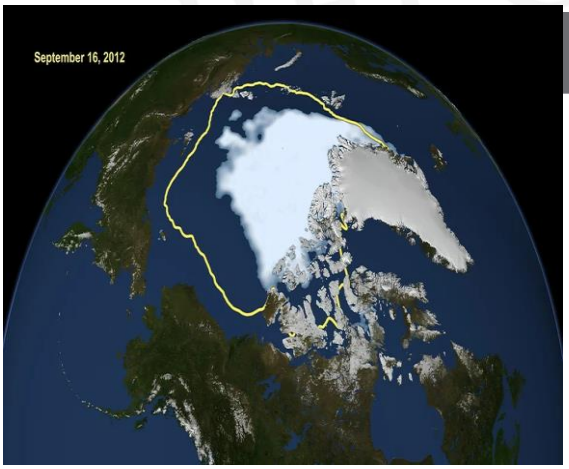


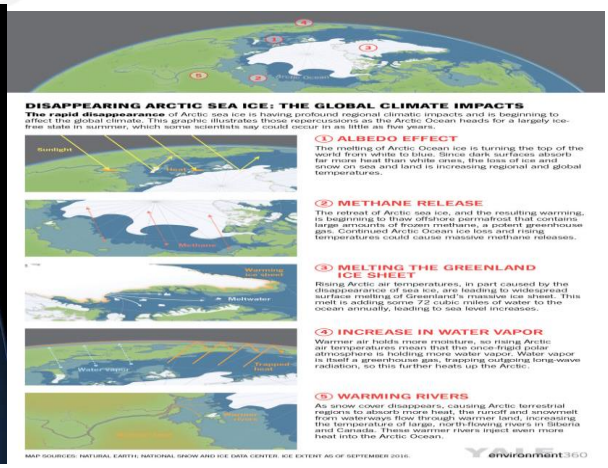
Titan

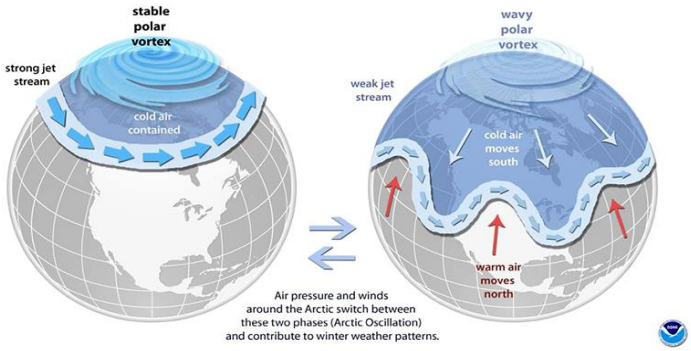
- A submersible taking wealthy tourists to visit the site of the Titanic wreckage in deep waters off the coast of Canada was missing, as U.S. and Canadian ships and planes swept a huge area trying to find the vessel the submersible called Titan,

Arctic melting

- The Arctic Ocean could be ice-free in summer by the 2030s,
- The ice which remains at the end of summer is called multiyear sea ice and is considerably thicker than its seasonal counterpart.
- It acts as a barrier to the transfer of both moisture and heat between the ocean and atmosphere.
- Over the past 40 years this multiyear sea ice has shrunk from around 7 million sq. km to 4 million.
- That is a loss equivalent to roughly the size of India or 12 UK
- When the Arctic Ocean might first become ice-free in summer, sometimes called a “blue ocean event” and defined as when the sea ice area drops below 1 million sq. km.

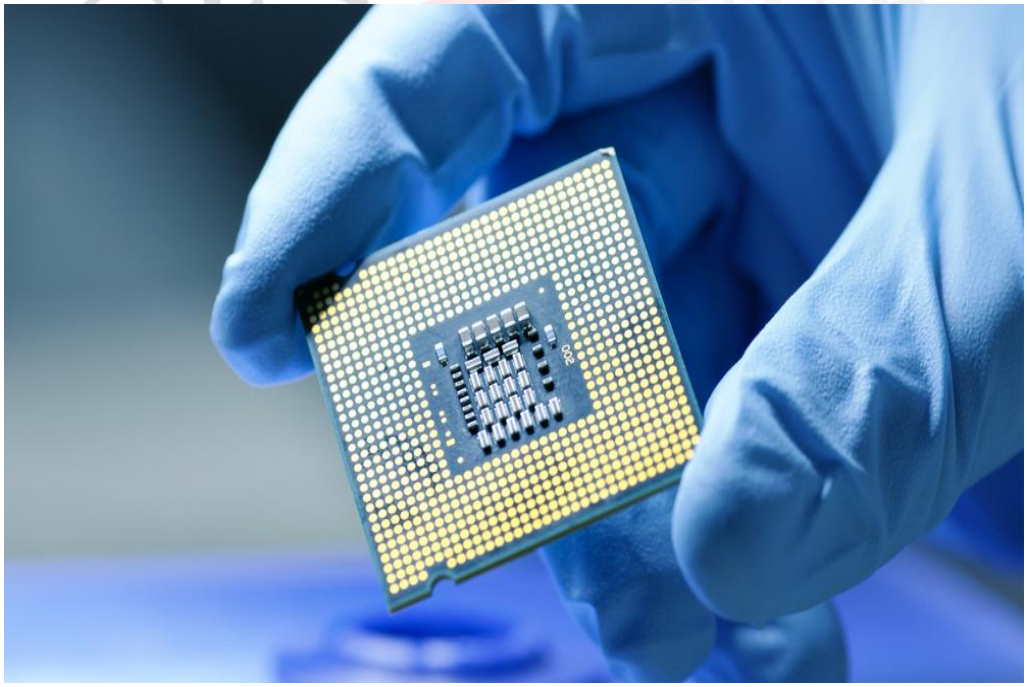






Semiconductor industry

- There are also strategic reasons: India's susceptibility to coercion increases due to its dependence on the import of semiconductors.
- Therefore, the government's 2022 Semiconductor Mission is laudable



- Semiconductor fabrication represents the ultimate frontier of human tech advancement.
- The frontier has been advancing adhering to Moore's law that the number of

transistors in a unit area doubles every 18 months.

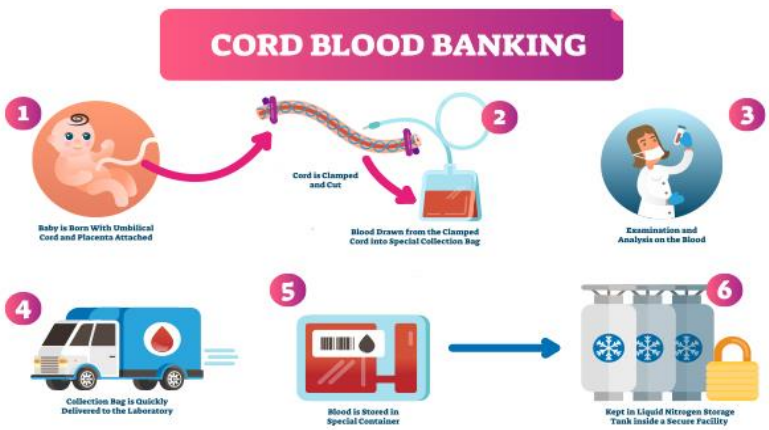
- But the progress of miniaturization is accompanied by higher complexity and costs
- China started late in the semiconductor fab industry.
- But backed by massive government financial support over the last two decades, it acquired hundreds of loss-making fabs from around the world and built its fab industry
- Investment in a semiconductor fab is one of the riskiest. Billions of dollars need to be recovered before the technology becomes obsolete
- The advantage of semiconductors having a small freight-to-price ratio and a zero custom duty regime under the Information Technology Agreement, 1996, facilitates production in a single location and global sales.
- This is why no company is interested in setting up a Greenfield fab.
- Developing an ecosystem for chip manufacturing in a greenfield location is a major challenge
- Hundreds of chemicals and gases are required for chip fabrication, people need to be trained, and abundant clean water be made available. But above all is the art of chip making.
- There are other issues, such as whether to set up a logic/processor, memory, or analog fab.
- Electronic equipment and its functionalities are characterized by their logic chips, which are therefore strategically important and generate the highest

profit.

- Acquiring existing fabs has many advantages: they are reasonably priced, have stabilized technology, a supply chain ecosystem, an established product line, and a market.
- They will enable India to build a fab ecosystem and train human resources.
- Much lower subsidies would be required, and the funds saved could be used for advanced R&D in fab technologies which will help build state-of-the-art fab in the next few years
- A relatively easier option is Assembly, Testing, Packaging, and Marking (ATMP), to get the fab ecosystem developed before the full-fledged fab is set up.

Cord blood And Regenerative medicine

- Cord blood is the blood that remains in the placenta and umbilical cord after the birth of your baby.
- Cord blood is rich in stem cells, which can be used to treat many different cancers, immune deficiencies and genetic disorders.



What is regenerative medicine?

- Regenerative medicine seeks to replace tissue or organs that have been damaged by disease, trauma, or congenital issues, vs. the current clinical strategy that focuses primarily on treating the symptoms.
- The tools used to realize these outcomes are tissue engineering, cellular therapies, and medical devices and artificial organs.
- Combinations of these approaches can amplify our natural healing process in the places it is needed most, or take over the function of a permanently damaged organ.

Submersible VS Submarine

What is the Titan submersible?

- Titan is a submersible or an underwater vehicle.
- It is operated by the privately owned U.S. Company Ocean Gate which organizes underwater expeditions for both research and tourism.
- The company claims that Titan, which it said was built with “off-the-shelf” components, is lighter and more cost-efficient than other deep-diving submersibles.
- The 6.7-metre-long manned submersible is intended for “site survey and inspection, research and data collection, film and media production, and deep sea testing of hardware and software
- The UNESCO guidelines stress on the long-term preservation of “underwater

cultural heritage" and the need to protect the surrounding waters by ensuring "responsible non-intrusive access."

- The NOAA guidelines are similar and insist that recovered material and artifacts must be managed as per professional standards.
- In other words, taking souvenirs from the wreckage site is strongly discouraged.

What is the difference between a submarine and a submersible?

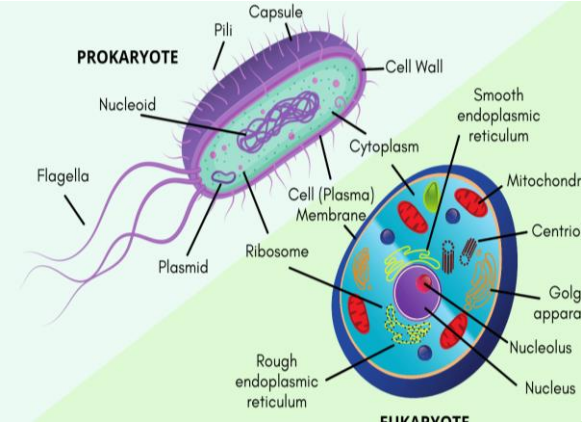
- While the two categories can overlap, a submarine refers to an underwater vehicle that is largely independent and has power reserves to help it depart from a port or come back to the port after an expedition.
- Meanwhile, a submersible is generally smaller in size and has less power, so it needs to work with a ship in order to be launched and recovered.
- Titan was working with a vessel named Polar Prince.

Y chromosome in Cancer

- Two studies have shed light on the role of the Y chromosome in cancer outcomes, in which males are often more adversely affected than females.
- Sex is known to affect cancer incidence, clinical outcomes, and tumor biology, with most cancers causing worse outcomes in males than in females.
- Some studies have suggested that the function of the Y chromosome may have a role.
- Colorectal cancer is the second most common cause of cancer- related deaths, which is more aggressive and metastatic in males.

- The model is a specific form of the disease, driven by a known oncogene called KRAS

Prokaryotes and Eukaryotes



Prokaryotic cell	Eukaryotic Cell
prokaryotes' genetic information is indeed not membrane-bound	eukaryotes have "real" nuclei that house their DNA
Prokaryotic cell walls are often made of various chemicals than eukaryotes.	Eukaryotes are substantially larger than prokaryotic cells.
Prokaryotic cells differ from eukaryotic in that they have only one loop of secure genetic material contained in the nucleoid	eukaryotic DNA found on securely bonded and organised chromosomes.
Though plasmids are found in certain eukaryotes, they are typically considered a prokaryote trait, and many critical genes in prokaryotic organisms are kept on plasmids.	Several chromosomes, made up of DNA and protein, are common in eukaryotic organisms. Most eukaryotic organisms have only a few chromosomes, whereas others have hundreds or even thousands. Within the nucleus, these chromosomes are safeguarded.
The DNA, or genetic information, in prokaryotic cells forms a single big circle, which spirals upon itself. The DNA is found in the cell's main body.	Eukaryotic cells have various membrane-bound components termed organelles in addition to a nucleus. Eukaryotic cells are often larger and more complicated than prokaryotic cells. They lack a nucleus as well as many other membrane-bound organelles.

What is cell-cultivated chicken?

- To make cell-cultivated meat, the two companies isolate the cells that make up the meat (the meat that we consume) and put them in a setting where they have all the resources they need to grow and make more copies of themselves.
- These resources are typically nutrients, fats, carbohydrates, amino acids, the right temperature, etc.
- The 'setting' in which this process transpires is often a bioreactor (also known as a 'cultivator'), a sensor- fit device like a container that has been designed to support a particular biological environment.
- Once there are enough of these cells, which takes around two to three weeks in Upside's process, they resemble a mass of minced meat.
- They are collected and processed with additives to improve texture

Fibonacci spirals in plants

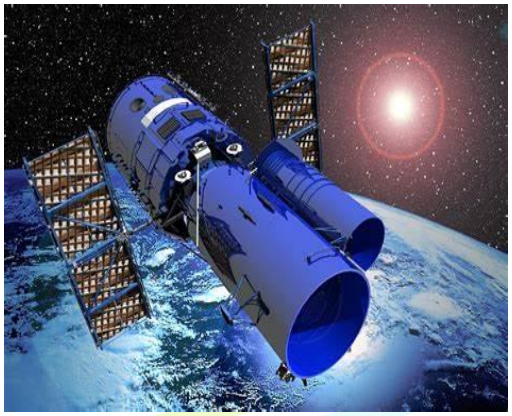
- Spirals, referred to as Fibonacci spirals for simplicity, are extremely widespread in plants and have fascinated scientists from Leonardo da Vinci to Charles Darwin.
- Such is the prevalence of Fibonacci spirals in plants today that they are believed to represent an ancient and highly conserved feature, dating back to the earliest stages of plant evolution and persisting in their present forms.

What are Fibonacci spirals?

- Spirals occur frequently in nature and can be seen in plant leaves, animal shells, and even in the double helix of our DNA.
- In most cases, these spirals relate to the Fibonacci sequence a set of numbers where each is the sum of the two numbers that precede it (1, 1, 2, 3, 5, 8, 13, 21, and so on).
- These patterns are particularly widespread in plants and can even be recognized with the naked eye.

- The discovery of non -Fibonacci spirals in such an early fossil is surprising as they are very rare in living plant species today.

Hubble telescope captures galaxy clusters merging

The Hubble Space Telescope (HST) has recently captured an image of a minimum of two galaxy clusters in the act of merging together to create what the European space agency (ESA) calls a “gargantuan cluster”

The ESA/NASA report was published on the NASA website earlier this month.

“HST observation as witnessing the formation of a single gargantuan cluster acting as a gravitational lens.” The gravitational lens is a phenomenon that “can occur when a huge amount of matter, like a cluster of galaxies, creates a gravitational field that distorts and magnifies the light from distant galaxies that are behind it but in the same line of sight.”

It has the practical effect of a magnifying glass, microscope, or binoculars, and enables scientists to observe celestial bodies that would otherwise be too distant to discern.

India to launch satellites from Singapore

India would launch PSLV-C56 carrying DS-SAR satellite from Singapore, along with six co-passenger satellites from ISRO Sri Harikota spaceport on July 30. The Satellite would launched from the first launch pad at 6:30 am.

Once deployed and operational it will be used to support the satellite imagery requirements of various agencies within the government of Singapore. ST Engineering will use it for multi-modal and higher responsiveness imagery and geospatial services for their commercial customers.

DS-SAR carries a synthetic aperture radar (SAR) payload developed by Israel aerospace industries (IAI0.

This allows the DS-SAR to provide for all weather day and night coverage and is capable of imaging at one-meter resolution at full polarimetry. The new Space India Limited (NSIL), a central public sector undertaking under the Department

of Space, procured the PSLV-C56 to deploy the 360-kg DS-SAR satellite from DSTA and ST Engineering, Singapore, the Indian space research organization (ISRO)

AI throws patent system into turmoil especially in drug discovery

Artificial intelligence is overturning the conventional idea of intellectual property rights.

Artificial intelligence, or AI, has been shaking up the established system of intellectual property rights (IPR).The modern patent system has taken its time to evolve, the milestone development being the first Patent Statute passed by the US Congress in 1790, which was followed a year later by France's patent system, created during the Revolution.

However, the AI revolution has thrown into a flap both policymakers and judges who are struggling to understand the wider implications of the new technology on the modern patent system that was established more than a century ago.

The case that has grabbed attention is the suit filed in February this year by stock photography giant Getty Images in the US against London-based Stability AI, the startup that created open-source AI art generator Stable Diffusion.

The photo company accused Stability AI of "brazen infringement of Getty Images' intellectual property on a staggering scale" by copying more than 12 million images from its database "without permission...or compensation...as part of its efforts to build a competing business". Getty charges Stability AI with infringing its copyright and trademark protections.

AI art tools require illustrations, artwork and photographs to use as training data, which are taken from the web, usually without the creator's consent. The

startup, which describes itself as the world's leading open-source generative AI firm, is also facing a class action suit by artists in the US.

These artists have filed lawsuits against Stability AI and two other companies, alleging that their AI tools were "trained on billions of copyrighted images scraped from the internet" and contained in a dataset that was downloaded and used by the companies without compensation for or consent from the artists.

This may sound like the familiar old battle between artists and corporations on copyrights, but the new technology gives it a complex twist that will not be easy to unravel. It is not just the judges who will be grappling with the implications of AI in diverse fields, from art to medicine, but a host of others who will be drawn into the dispute. The fact that Getty has sought a jury trial makes the outcome of the case even more unpredictable.

Stability AI contends its "goal is to maximize the accessibility of modern AI to inspire global creativity and innovation". That goal may be a long way off if the courts order, as Getty has sought, the withdrawal of the startup's Stable Diffusion the system for generating images from text inputs, and the image generator Dream Studio that was launched in August 2022.

However, the disruptive force of AI is beginning to be felt more strikingly in another field of medicine. As the legal drama over AI art tool generators escalates, the US Congress is wrestling with a more fundamental and vexing question: Can AI systems involved in inventive processes like drug discovery be awarded patents?

This is a critical issue because the US patent law, like those of Europe's, recognizes only humans as inventors and not machine-based or AI systems even though science and technology are demonstrating otherwise.

AI has been able to invent new molecules within a short span, a feat that promises to upend the pharmaceutical market, healthcare, and the patent system.

Although not the first AI-assisted breakthrough, a spectacular success came just a few weeks ago, with the announcement of the discovery of a new antibiotic that can kill deadly hospital bacteria.

A study published on May 25 in the journal *Nature Chemical Biology*, by scientists from Canada's McMaster University's department of biomedicine and biochemistry and from the Massachusetts Institute of Technology, reported the discovery of a new antibiotic that can be used to kill a superbug. The study focused on Acinetobacter baumannii, which heads the World Health Organization's list of "priority pathogens", a group of bacteria that pose the greatest threat to human life.

Uranium series dating

- The backbone of the timeline must be established by the dating of the sediment itself, using techniques such as luminescence dating.
- Uranium series dating works by measuring uranium, and the elements into which it transforms via radioactive decay, within the tooth.
- Electron spin resonance dating relies on measuring the number of electrons in tooth enamel.

Luminescence Dating

- Luminescence dating is a form of geochronology that measures the energy of photons being released.
- In natural settings, ionizing radiation (U, Th, Rb, & K) is absorbed and stored by sediments in the crystal lattice.

- This stored radiation dose can be evicted with stimulation and released as luminescence

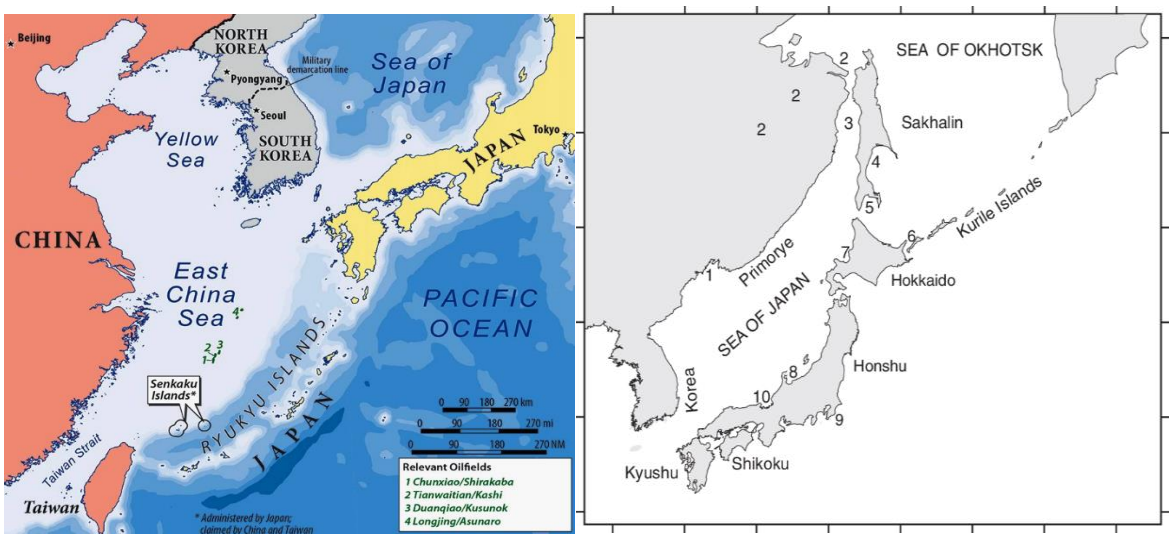
- U-Th dating is based on the activity ratios of parent (Uranium) and product (Thorium) isotopes, by calculating the disintegration of the parent to the daughter over time.
- This is done by the detection (mass spectrometry) of both the parent (234U) and daughter (230Th) products of decay.
- Humans were present in the vicinity of Tam Pà Ling Cave for roughly 56,000 years.
- It also confirmed that, far from reflecting a rapid dump of sediments, the site contains sediments that accumulated steadily over some 86,000 years.
- Tam Pà Ling Cave in northern Laos.

Fattah missile

- Iran claimed on Tuesday that it had created a hypersonic missile capable of traveling at 15 times the speed of sound.
- The new missile called 'Fattah,' or 'Conqueror' in Farsi

Kakhovka dam and hydroelectric power station

- Ukraine accused Russian forces of blowing up the Kakhovka dam and hydroelectric power station on the Dnipro river in an area that Moscow controls, while Russian officials blamed Ukrainian bombardment in the contested area
- Officials raced to check cooling systems at the Zaporizhzhia Nuclear Power Plan



National Mobile Monitoring Software (NMMS)

- In May 2021, the Ministry of Rural Development (MoRD) launched the National Mobile Monitoring Software (NMMS) app, a new application meant for “improving citizen oversight and increasing transparency” in National Rural Employment Guarantee Act (NREGA) works.

- It is to be deployed by NREGA Mates, local women at the panchayat level who are selected and trained to monitor NREGA worksites.

  The main feature of the app is the real-time, photographed, geo-tagged attendance of every worker to be taken once in each half of the day.

- Conditions affecting workers While such an app may be useful in monitoring the attendance of workers who have fixed work timings, in most States, NREGA wages are calculated based on the amount of work done each day, and workers do not need to commit to fixed hours

- The conditions for registering NREGA attendance on the app put Women in a dilemma where they may end up foregoing NREGA work.
- A stable network is a must for realtime monitoring; unfortunately, it remains patchy in much of rural India.
- This could lead to workers not being able to mark their attendance, and consequently lose a day of wages
- The app claims to "increase citizen oversight" by "bringing more transparency and ensuring proper monitoring of the schemes, besides potentially enabling processing payments faster.
- Corruption has been a rising problem in NREGA, with funds being siphoned off by faking attendance records.
- While ostensibly the NMMS's focus on real-time, geo-tagged attendance could be one way of addressing this corruption.

Types of AI

- Nasscom has introduced "AI Adoption Index" in a bid to assess trends of AI adoption in India.
- The index was the first detailed assessment of AI adoption, beginning with four key sectors of banking, financial services and insurance (BFSI), consumer packaged goods (CPG), retail, healthcare and industrials and automotive.
- These sectors could cumulatively contribute more than 60% of AI's potential value-add of $450 to $500 billion to the country's GDP by 2025
- The apex body said global investments in AI had more than doubled over the last couple of years, from $36 billion in 2020 to a high of $77 billion in 2021

About AI

- Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems.

- Specific applications of AI include expert systems, natural language processing, and speech recognition and machine vision.

Strong AI vs. weak AI

AI can be categorized as either weak or strong.

- Weak AI, also known as narrow AI, is an AI system that is designed and trained to complete a specific task. Industrial robots and virtual personal assistants, such as Apple's Siri, use weak AI. Strong AI, also known as artificial general intelligence (AGI), describes programming that can replicate the cognitive abilities of the human brain. When presented with an unfamiliar task, a strong AI system can use fuzzy logic to apply knowledge from one domain to another and find a solution autonomously. In theory, a strong AI program should be able to pass both a Turing Test and the Chinese room test.

What are the 4 types of artificial intelligence?

- **Type 1: Reactive machines.** These AI systems have no memory and are task specific. An example is Deep Blue, the IBM chess program that beat Garry Kasparov in the 1990s. Deep Blue can identify pieces on the chessboard and make predictions, but because it has no memory, it cannot use past experiences to inform future ones.

- **Type 2: Limited memory.** These AI systems have memory, so they can use past experiences to inform future decisions. Some of the decision-making functions in self-driving cars are designed this way.
- **Type 3: Theory of mind.** Theory of mind is a psychological term. When applied to AI, it means that the system would have the social intelligence to understand emotions. This type of AI will be able to infer human intentions and predict behavior, a necessary skill for AI systems to become integral members of human teams.
- **Type 4: Self-awareness.** In this category, AI systems have a sense of self, which gives them consciousness. Machines with self-awareness understand their own current state. This type of AI does not yet exist.

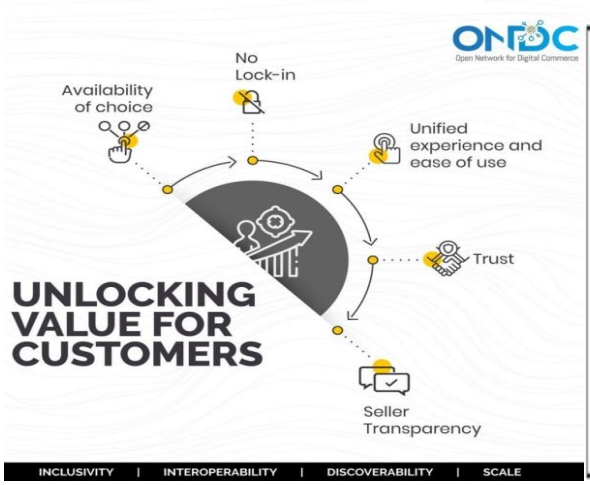
Open network for digital commerce (ONDC)

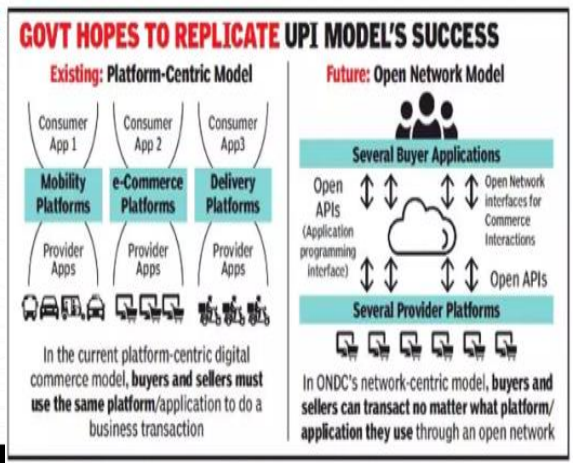
The government of India announced the launch of the pilot phase of an open network for digital commerce (ONDC) in five cities in late April with an aim to "democratize" the country's fast-growing digital e-commerce space that is currently dominated by the two U.S.-headquartered firms Amazon and Walmart

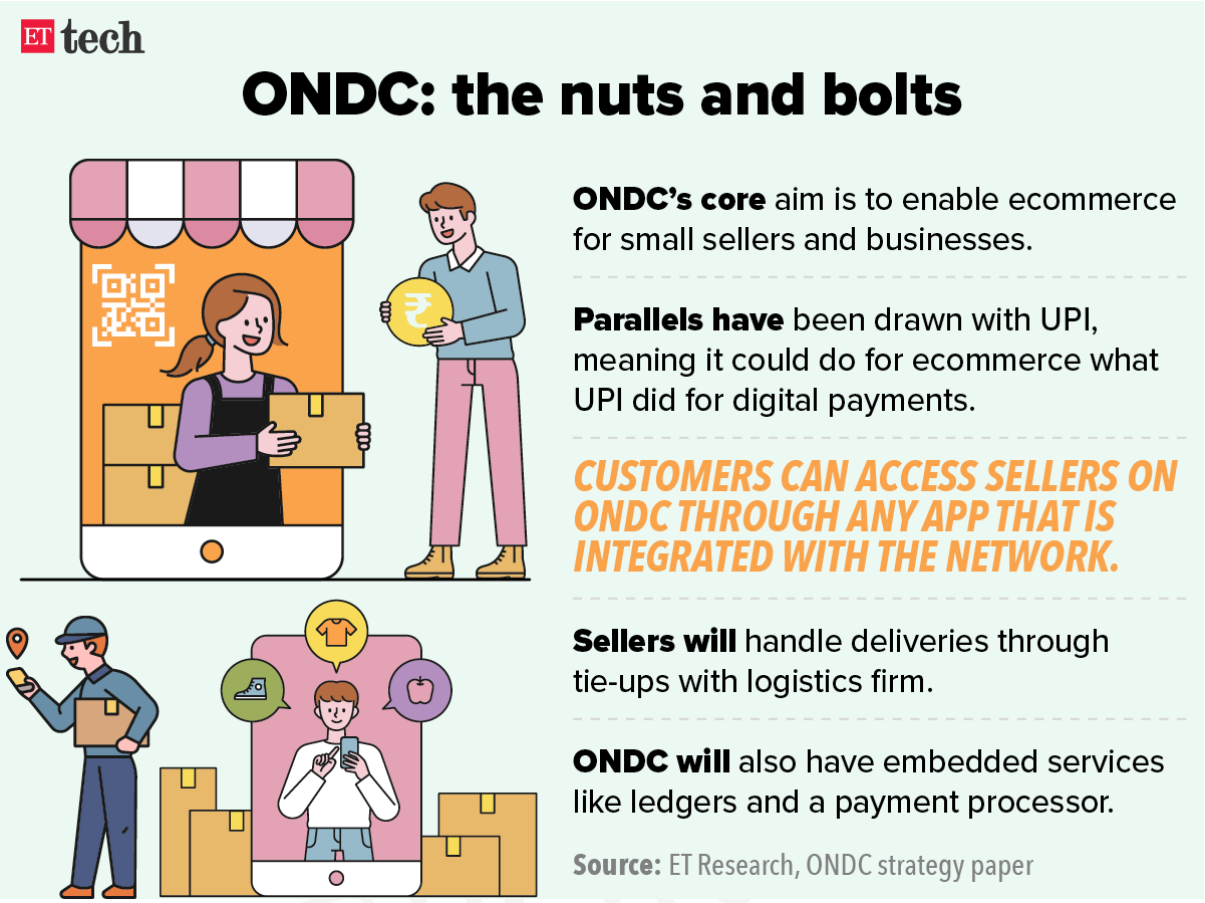
What is ONDC?

As per the strategy paper on ONDC, it is a not-for-profit organization that will offer a network to enable local digital commerce stores across industries to be discovered and engaged by any network-enabled applications.

- It is neither an aggregator application nor a hosting platform, and all existing digital commerce applications and platforms can voluntarily choose to adopt and be a part of the ONDC network.
- The ONDC aims to enable buying of products from all participating e-commerce platforms by consumers through a single platform. Currently, a buyer needs to go to Amazon, for example, to buy a product from a seller on Amazon.
- Under ONDC, it is envisaged that a buyer registered on one participating e-commerce site (for example, Amazon) may purchase goods from a seller on another participating e-commerce site (for example, Flipkart).
- The ONDC model is trying to replicate the success of the Unified Payments Interface (UPI) in the field of digital payments.
- UPI allows people to send or receive money irrespective of the payment platforms they are registered on.
- The open network concept also extends beyond the retail sector, to any digital commerce domains including wholesale, mobility, food delivery, logistics, travel, urban services, etc







What are the likely benefits of ONDC?

The ONDC will standardize operations like cataloging, inventory management, order management, and order fulfilment, hence making it simpler and easier for small businesses to be discoverable over network and conduct business. However, experts have pointed out some likely potential issues such as getting enough number of e-commerce platforms to sign up, along with issues related to customer service and payment integration.

New coral species

- **Scientists have recorded four species of corals for the first time from Indian waters.**

- These new species of azooxanthellate corals were found in the waters off the Andaman and Nicobar Islands.
- The azooxanthellate corals are a group of corals that do not contain zooxanthellae and derive nourishment not from the sun but from capturing different forms of planktons.
- They are deep-sea representatives with the majority of species being reported from depths between 200 metres and 1,000 metres.
- They are also reported from shallow waters unlike zooxanthellate corals that are restricted to shallow waters
- The Zoological Survey of India (ZSI) scientist behind these new findings, Tamal Mondal, said all the four groups of corals are from the same family, Flabellidae.
- Truncatoflabellum crassum (Milne Edwards and Haime, 1848), T. incrustatum (Cairns, 1989), T. aculeatum (Milne Edwards and Haime, 1848), and T. irregulare (Semper, 1872) under the family Flabellidae were previously found in Japan, the Philippines and Australian waters, while only T. crassum was reported with the range of Indo-West Pacific distribution
- Azooxanthellate corals are a group of hard corals and the four new species recorded are not only solitary but have a highly compressed skeletal structure.
- “Most studies of hard corals in India have been concentrated on reef-building corals while much is not known about non-reef-building corals.
- These new species enhance our knowledge about non-reef-building solitary corals