SCIENCE AND TECHNOLOGY

THE ARDUOUS QUEST TO FIND THE SHAPE OF THE ELECTRON'S CHARGE

CONTEXT: Physicists are using extreme precision tests to search for flaws in the Standard Model. A new study found no evidence of "new physics" by measuring the electric dipole moment of electrons in a molecule. This result precludes the existence of certain hypothetical particles.

The Standard Model of particle physics is a powerful but incomplete theory. It predicts the existence of different particles, but it cannot explain many things about nature and the universe. For example, the Standard Model does not say what dark matter is or can explain dark energy. It does not know why the Higgs boson is so heavy or why gravity is so much weaker than the other fundamental forces.

Where did the antimatter go?

The Standard Model predicts equal amounts of matter and antimatter at the universe's creation, leading to annihilation and abundant light. However, today, there is more matter and no antimatter, challenging the model. A study at the University of Colorado, Boulder, found no evidence of 'new physics' in an electron experiment, guiding physicists to refine alternative theories. Another experiment ruled out such evidence at the Large Hadron Collider in Europe.

The electron dipole moment

CP-symmetry is part of CPT symmetry, where T-symmetry ensures physics behaves the same forward and backward in time. A study checked if electrons have an electric dipole moment, indicating CP and T-symmetry violation. The experiment measured energy differences between electron states to find possible off-centre charge, with the Standard Model allowing a dipole moment up to 10^-38 e cm.

Electrons in an atom

- Electrons are subatomic particles with a negative charge that orbit the nucleus of an atom.
- They determine the atom's chemical properties and participate in chemical bonding.
- Electrons occupy discrete energy levels or orbitals, following the Pauli Exclusion Principle.
- Transitions between energy levels result in the emission or absorption of photons.
- The maximum number of electrons in an energy level is determined by the formula 2n^2, where n is the principal quantum number.

What is antimatter and its significance?

Antimatter is composed of antiparticles that have the same mass as regular particles but opposite electric charge. For example, the positron is the antimatter counterpart of the electron. When matter and antimatter collide, they annihilate each other, releasing immense energy in the form of gamma rays.

Significance in Physics: Antimatter plays a crucial role in understanding fundamental physics principles. It confirms the symmetry between matter and energy, as predicted by the laws of physics. The study of antimatter helps validate the CPT (Charge-Parity-Time) theorem, a fundamental principle in particle physics.

Potential Energy Source: Theoretically, antimatter could serve as a highly efficient energy source, as its annihilation with matter produces an enormous amount of energy. However, currently, antimatter production is challenging and costly, limiting its practical applications. Research into antimatter continues to explore its potential in propulsion systems and medical imaging.

ICMR-NIV SURVEY FINDS PROOF OF NIPAH VIRUS IN BATS ACROSS NINE STATES, ONE UT

NEWS IN GIST: The ICMR-NIV's ongoing nationwide survey detected Nipah virus circulation in bats across nine states and one Union Territory in India. Antibodies were found in bat populations in Kerala, Tamil Nadu, Karnataka, Goa, Maharashtra, Bihar, West Bengal, Assam, Meghalaya, and Pondicherry. Survey also conducted in other regions.

ON GOING FINDINGS: ICMR-NIV found Nipah virus in fruit bats in Assam, West Bengal, and Kerala in the past. An ongoing nationwide survey aims to assess virus prevalence and identify high-risk areas. Prompt detection through BSL-3 facility at ICMR-NIV Pune helped manage the second outbreak in West Bengal in 2007.

NIPAH VIRUS

- Nipah virus is a zoonotic virus that can cause severe respiratory and neurological disease in humans.
- It is primarily transmitted to humans from infected fruit bats or through contact with contaminated animals or their products.
- Nipah outbreaks have occurred in several countries, leading to fatalities and economic losses in the agricultural sector.

- There is no specific treatment for Nipah, and prevention relies on early detection, isolation of infected individuals, and controlling exposure to infected animals.
- Nipah poses a significant public health concern due to its high mortality rate and potential for person-to-person transmission, requiring close monitoring and preparedness measures.

Nipah Outbreak in India

Nipah Outbreak in Kerala, 2018

In May 2018, Kerala witnessed a Nipah virus outbreak, causing panic due to its high fatality rate. The virus, transmitted from fruit bats, infected humans and resulted in 17 deaths among 19 confirmed cases. Authorities implemented containment measures, contact tracing, and public awareness campaigns to prevent further spread.

Case Study 2: Nipah Outbreak in West Bengal, 2001

The first Nipah outbreak in India occurred in West Bengal in January-February 2001. It led to 45 deaths among 66 reported cases. With limited diagnostic facilities at the time, it took several years to confirm the outbreak. The incident highlighted the need for advanced containment and diagnostic capabilities to combat future outbreaks.

INTERNATIONAL RELATIONS

INDIAN NSA MEETS TOP CHINESE DIPLOMAT

Context: National Security Advisor (NSA) Ajit Doval has met top Chinese diplomat Wang Yi and discussed bilateral ties with him. The meeting took place on the sidelines of the Friends of BRICS meeting in South Africa on July 24.

Background

- India has been locked in a military standoff with China for more than three years. India's foreign Minister Mr. Jaishankar described it to be the most complex challenge in his long diplomatic career.
- External Affairs Minister S Jaishankar's met with Wang just about 10 days ago — on the sidelines of the ASEAN Regional Forum (ARF) Ministerial Meeting in Jakarta.
- India has maintained that the bilateral relationship cannot be normal unless there is peace in the border area.
- As per the Chinese official statement, last year at a dinner for G-20 leaders in Bali, President Xi Jinping and Prime Minister Modi reached an important consensus on stabilizing China-India relations in Bali.

Discussions at the meeting

- During the meeting, the NSA conveyed that the situation along the LAC in the Western Sector of the India-China boundary since 2020 had eroded strategic trust and the public and political basis of the relationship.
- The NSA emphasised the importance of continuing efforts to fully resolve the situation and restore peace and tranquility in the border areas, so as to remove impediments to normalcy in bilateral relations.
- The two sides agreed that the India-China bilateral relationship is significant not only for the two countries but also for the region and world.

U.S. REENTRY INTO UNESCO

Context: U.S. first lady Jill Biden attended a flag-raising ceremony at UNESCO in Paris on Tuesday, marking Washington's official reentry into the U.N. agency after a controversial five-year hiatus.

Background

- The US decision to return to Paris-based UNESCO was based mainly on concerns that China has filled a leadership gap since Washington withdrew during the Trump administration. This development underscores the broader geopolitical dynamics at play, particularly the growing influence of China in international institutions.
- The US exited from UNESCO in 2017 citing an alleged anti-Israel bias within the organization. The decision followed a 2011 move by UNESCO to include Palestine as a member state, which led the US and Israel to cease financing the agency. The US withdrawal became official a year later in 2018.
- The United States had announced its intention to rejoin UNESCO in June, and the organisation's 193 member states earlier this month voted to approve the U.S. reentry making it the 194th member of UNESCO.
- This is the second time the US has returned to UNESCO after a period of withdrawal. The country previously left the organisation in 1984, citing mismanagement, corruption and perceived advancement of Soviet interests. It rejoined in 2003.

About UNESCO

The United Nations Educational, Scientific and Cultural Organization (UNESCO) is a specialized agency of the United Nations aimed at promoting world peace and security through international cooperation in education, arts, sciences and culture.

ECOLOGY

HIMACHAL FLOODS: A MAN-MADE DISASTER?

Context: Flash floods during this year's monsoon season have caused unprecedented damage to both lives and assets in Himachal Pradesh. The death toll has crossed 150, and the estimated total loss amounts to ₹10,000 crore.

Reasons for disaster

- Apart from climate change, anthropogenic factors have also significantly contributed to the disaster.
- The exploitation of natural resources, including forests, water, tourism, and cement production, became a major focus for development. This led to the rapid construction of hydropower

projects, often causing damage to rivers and their ecosystems, widening of roads without proper geological and engineering assessments, expansion of cement plants altering land use patters, and a shift in agricultural practices to cash crop economies that affected the landscape and river systems.

- The technology employed, known as "run of the river" dams, diverts water through tunnels burrowed into the mountains, and the excavated material (muck) is often disposed of along the riverbeds. During periods of higher precipitation or cloudbursts, the water returns to the river, carrying the dumped muck along with it. This destructive process is evident in rivers like Parvati, Beas and Sutlej, as well as many other small hydropower dams.
- The mountains have been cut vertically in four-lane projects in Manali and Shimla, leading to massive landslides and damage to existing roads.
- The cement plants alter the natural landscape, and the removal of vegetation leads to reduced capacity of land to absorb water.

ECONOMICS

FULL-RESERVE BANKING: WHERE BANKS ACT SOLELY AS CUSTODIANS OF CUSTOMERS' MONEY

"Also known as 100% reserve banking, this is a system of banking where banks are not allowed to lend out money that they receive from customers in the form of demand deposits."

- Full Reserve Banking System

FULL RESERVE BANKING SYSTEM

Under a Full Reserve Banking System, banks are mandated to hold all money that they receive as demand deposits – Savings Account and Current Account from customers in their vaults at all times. Banks act as custodians to depositors' money and may charge a fee from depositors for the service of safekeeping that they offer to the depositors. This is to ensure that banks can successfully meet redemption demands from depositors, and thus avoid a run on the bank even if all depositors someday decide to come asking for their money at the same time. Under a Full Reserve Banking System, banks can only lend money that they receive as time deposits from their customers. Time deposits – Fixed Deposit and Recurring Deposit are deposits that customers can withdraw from the bank only after a certain period of time that is agreed upon between the bank and its customers.

Under a Full Reserve Banking System, banks are prohibited from creating loans without actual cash in their vaults to back these loans. Proponents of Full Reserve Banking argue that it as the only natural form of banking that could prevent the various crises that affect today's fractional Reserve banking. Since banks will be allowed to make loans to borrowers only out of their time deposits and since they will be legally forced to keep demand deposits in heir value. Since banks will not be able to create money out of thin air in a Full Reserve Banking system, their influence on the economy's money supply will become severely restricted.

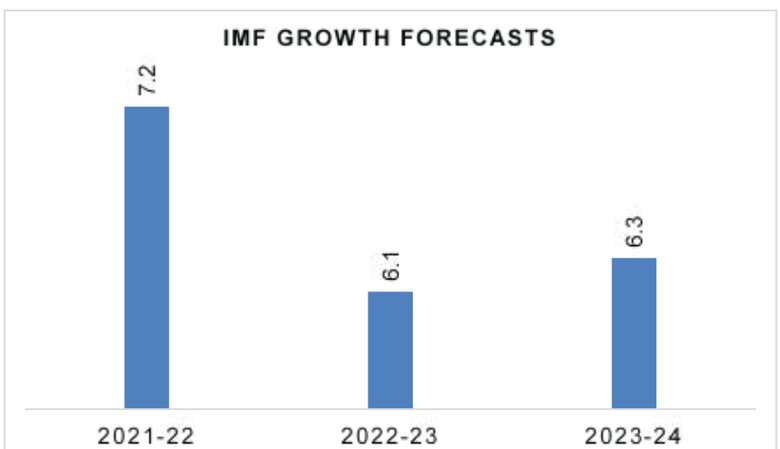
FRACTIONAL RESERVE BANKING SYSTEM

Fractional Reserve Banking System, banks predominantly do not lend money in the form of physical cash. The cash deposits that they receive from their customers, whether as demand deposits or as time deposits, mostly stay in their vaults. Banks lend more money than the cash they have in their vaults, made possible because most lending to various borrowers happens in the form of electronic money.

Fractional Reserve Banking frees the economy from having to rely on real savings from depositors to finance the huge investments required to fuel growth. Supporters of fractional reserve banking believe allowing banks to create loans without the necessary savings to back these loans can help spur investment and economic growth.

IMF LIFTS INDIA GROWTH FORECAST TO 6.1 %

CONTEXT: The International Monetary Fund (IMF) has raised its growth forecast for India's economy in 2023 to 6.1%, up from 5.9% in its previous forecast.



The IMF attributed the upward revision to stronger-than-expected growth in the fourth quarter of 2022, driven by robust domestic investment. The IMF also said that India's economic outlook is "subject to downside risks", including the possibility of a sharper-than-expected slowdown in global growth, rising inflation, and a potential escalation of the Russia-Ukraine war.

Overall, the IMF's latest forecast for India is positive, but it is important to note that there are some downside risks that could weigh on growth. The IMF will continue to monitor India's economic outlook and will adjust its forecast as needed.

INSTANT SETTLEMENT OF TRANSACTIONS: HOW WILL INVESTORS BENEFIT?

CONTEXT: India will become the second country in the world after China to start the 'trade-plus-one' (T+1) settlement cycle in top-listed securities.

"Transactions of securities will be reflected in the Demat account after a day. An investor buying a stock on Monday would be shown in the Demat account on Tuesday."

- T+1 SETTLEMENT CYCLE

BACKGROUND: Most international markets such as the US, Europe, and Japan are still under the 'T+2' settlement cycle. Since 2017, trade settlements in India used to take place on a 'T+2' basis, securities bought or sold by an investor will reflect in his/her Demat account after a period of 2 days.

SIGNIFICANCE: Migration to a T+1 settlement cycle reduces the number of days for settlement facilitating more frequent circulation of money, leading to higher trading volumes and providing better liquidity to investors and thereby enhancing trade and participation.

BENEFITS OF INSTANT TRADE SETTLEMENT:

- Reduced risk of price volatility: There is a risk that the price of a security could change between the execution of the trade and credit of money to the account of the investor. This could lead to losses for investors if the price of the security falls.
- Improved liquidity: Instant settlement would make it easier for investors to buy and sell securities, as they would not have to wait for the money from a trade to clear before they could make another trade. This would improve liquidity in the markets, which would benefit all investors.
- Increased flexibility: Instant settlement would give investors more flexibility in how they manage their portfolios. For example, they could sell a security and immediately use the proceeds to buy another security. This would make it easier for investors to take advantage of market opportunities.

Overall, instant settlement of transactions would be a significant benefit for investors. It would reduce risk, improve liquidity, and increase flexibility. It is a welcome development that SEBI is working on this initiative.

ADDITIONAL BENEFITS FOR INVESTORS:

- 1. Reduced costs: Instant settlement would eliminate the need for investors to hold margin accounts, which can be costly.
- 2. Improved customer service: Investors would be able to get their money more quickly, which would improve their overall experience with the stock market.
- 3. Increased confidence in the markets: Instant settlement would send a signal that the markets are efficient and transparent. This would attract more investors to the markets, which would benefit everyone.

CONCERNS:

INFRASTRUCTURE ISSUES: A shift to shorter settlement cycle require upgradation of existing infrastructure of trading operations for brokers, and proper onboarding of Foreign Institutional Investors (FIIs), trading from different countries in different time zones.

INFRASTRUCTURE ISSUES: Higher volatility in capital markets could pose a contagion risk to the entire trading ecosystem.

FOREIGN INVESTORS: The United States, United Kingdom and Eurozone markets are yet to move to the T+1 system. Foreign investors operate from different geographies leading to time zone differences, information flow processes, and foreign exchange problems. Foreign investors would find it difficult to hedge their net India exposure in dollar terms at the end of the day under the T+1 system.

POLITY AND GOVERNANCE

LOK SABHA PASSES CONTENTIOUS BIOLOGICAL DIVERSITY BILL

The Lok Sabha on Tuesday passed the Biological Diversity (Amendment) Bill, 2021 , the Bill aims to amend the Biological Diversity Act, 2002.

What is Biodiversity?

Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain.

The term biodiversity was coined in 1985. It is important in natural as well as artificial ecosystems. It deals with nature's variety, the biosphere. It refers to variabilities among plants, animals and microorganism species.

Biodiversity includes the number of different organisms and their relative frequencies in an ecosystem. It also reflects the organization of organisms at different levels.

Biodiversity holds ecological and economic significance. It provides us with nourishment, housing, fuel, clothing and several other resources. It also extracts monetary benefits through tourism. Therefore, it is very important to have a good knowledge of biodiversity for a sustainable livelihood.

Types of Biodiversity

There are the following three different types of biodiversity:

1. Genetic Biodiversity
2. Species Biodiversity
3. Ecological Biodiversity

Species diversity

Species diversity refers to the variety of different types of species found in a particular area. It is the biodiversity at the most basic level. It includes all the species ranging from plants to different microorganisms.No two individuals of the same species are exactly similar. For example, humans show a lot of diversity among themselves.

Genetic diversity

It refers to the variations among the genetic resources of the organisms. Every individual of a particular species differs from each other in their genetic constitution. That is why every human looks different from each other. Similarly, there are different varieties in the same species of rice, wheat, maize, barley, etc.

Ecological diversity

An ecosystem is a collection of living and non-living organisms and their interaction with each other. Ecological biodiversity refers to the variations in the plant and animal species living together and connected by food chains and food webs.

It is the diversity observed among the different ecosystems in a region. Diversity in different ecosystems like deserts, rainforests, mangroves, etc., include ecological diversity.

- Importance of Biodiversity

Biodiversity and its maintenance are very important for sustaining life on earth. A few of the reasons explaining the importance of biodiversity are:

- Ecological Stability

Every species has a specific role in an ecosystem. They capture and store energy and also produce and decompose organic matter. The ecosystem supports the services without which humans cannot survive. A diverse ecosystem is more productive and can withstand environmental stress.

- Economic Importance

Biodiversity is a reservoir of resources for the manufacture of food, cosmetic products and pharmaceuticals.Crops livestock, fishery, and forests are a rich sources of food.Wild plants such as Cinchona and Foxglove plant are used for medicinal purposes.Wood, fibres, perfumes, lubricants, rubber, resins, poison and cork are all derived from different plant species.The national parks and sanctuaries are a source of tourism. They are a source of beauty and joy for many people.

- Ethical Importance

All species have a right to exist. Humans should not cause their voluntary extinction. Biodiversity preserves different cultures and spiritual heritage. Therefore, it is very important to conserve biodiversity.

In the 20 years since the Act was brought into force by the Vajpayee government, we have seen that there were problems and it was necessary to address them," Bhupendra Yadav, Minister for Environment and Forests and Climate Change, said. "To ensure that tribes and vulnerable communities benefit from the proceeds of medicinal forest products, these amendments were necessary. By decriminalising certain activities, we are encouraging Ayurveda as well as ease of doing business.

The amended Bill was drafted in response to complaints by traditional Indian medicine practitioners, the seed sector, industry and researchers that the Act imposed a heavy "compliance burden".

The Bill sought to exempt registered AYUSH medical practitioners and people accessing codified traditional knowledge, among others, from giving prior intimation to State biodiversity Boards to access biological resources for certain purposes.

Environmental organisations such as Legal Initiative for Forests and Environment (LIFE) have said that the amendments were made to "solely benefit" AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy) firms and would pave the way for "bio piracy".

The Bill decriminalises a range of offences under the Act and substitutes them with monetary penalties.

An analysis by the Centre for Science and Environment and the Down To Earth magazine on how the Biodiversity Act was being practically implemented, showed serious shortcomings. There was no data — barring in a few States — on the money received from companies and traders for access and benefit-sharing from use of traditional knowledge and resources.

A Joint Parliamentary Committee was constituted in December 2021 to analyse the amendment Bill.

MULTI-STATE COOPERATIVE BILL PASSED BY LOK SABHA

- The Multi-State Cooperative Societies (Amendment) Bill, 2023, which seeks to strengthen cooperatives by making them transparent and introduces a system of regular elections was passed by the Lok Sabha.
- The Bill amends the Multi-State Co-operative Societies Act, 2002 to bring the Act in conformity with the 97th Constitutional Amendment. In 2011, through 97th Constitutional Amendment, the Constitution was amended (adding Part IXB) to specify guidelines for running co-operative societies.
- Co-operatives are voluntary, democratic, and autonomous organisations controlled by their members who actively participate in its policies and decision-making.

Key Provisions of the Bill

- It establishes the Co-operative Election Authority to conduct and supervise elections to the boards of multi-state co-operative societies.
- A Co-operative Rehabilitation, Reconstruction and Development Fund will be established for the revival of sick multi-state co-operative societies. The Fund will be financed through contributions by profitable multi-state co-operative societies.
- The Bill allows state co-operative societies to merge into an existing multi-state co-operative society, subject to the respective state laws.
- A multi-state co-operative society will require prior permission of government authorities before the redemption of their shareholding.

5 CR. NAMES OUT OF MGNREGS LIST IN 2022-23

Context: Rural Development Minister, in a written reply to the Lok Sabha, said that names of over five crore workers had been deleted under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) in the financial year 2022-23. This is a 247% increase from 2021-22 figure.

Details

- As per the Ministry, these deletions are a "regular exercise" conducted by the State governments. States have listed five reasons for the deletions — fake job card, duplicate job card, not willing to work, family shifted from gram panchayat permanently and single person in job card and the person is expired.
- Statistics maintained by the Rural Development Ministry say there are 10 reasons listed for deletions of workers and job cards — incorrect job card, fake applicant, duplicate applicant, family shifted, person shifted to a new family, single person in job card and expired, unwilling to work, person expired, non-existent panchayat and village becomes urban.
- Among the 34 States and Union Territories, between the financial years 2021-22 and 2022-23, West Bengal has reported the largest hike in deletion, a whopping 5,199%. The Centre has stopped all payments to the State under the MGNREGS for reportedly not following the programme's guidelines. It is followed by Telangana (2727%) and Andhra Pradesh (1147%). Uttar Pradesh has reported a deletion of 466% and Uttarakhand 427%.

About MGNREGS

The Government of India passed the Mahatma Gandhi National Rural Employment Guarantee Act, 2005 in September, 2005. The Act gives legal guarantee of a hundred days of wage employment in a financial year to adult members of a rural household who demand employment and are willing to do unskilled manual work.

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